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The Graduate School
for 1937-38

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THE GRADUATE SCHOOL

ADMINISTRATION

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SECRETARY OF THE FACULTY OF THE GRADUATE SCHOOL

Professor BENTON SULLIVAN MONROE, Ph.D.

GENERAL COMMITTEE OF THE GRADUATE SCHOOL

1936–37

Professor G. H. SABINE, *at large, term expires 1938.*
Professor J. R. JOHNSON, *at large, 1938.*
Professor W. A. HURWITZ, *at large, 1937.*
Professor O. F. CURTIS, *at large,* 1939.
Professor C. L. DURHAM, *Group A (Languages and Literatures),* 1939.
Professor J. P. BRETZ, *Group B (History, Political Science, Philosophy, Psychology, Agricultural Economics, Farm Management, Rural Sociology), 1938.*
Professor C. C. MURDOCK, *Group C (Mathematics, Astronomy, Physics, Chemistry, Geology, Physical Geography, Geodesy), 1938.*
Professor L. M. MASSEY, *Group D (Biological Sciences),* 1937.
Professor G. B. UPTON, *Group E (Engineering, Architecture, Applied Physical Sciences, Rural Engineering, Landscape Design), 1939.*
Professor C. V. MORRILL, *Group F (Science Departments of the Cornell University Medical College in New York City), 1937.*
Professor P. F. SHARP, *Group G (Agricultural Sciences), 1937.*
Professor G. J. THOMPSON, *Group H (Law), 1938.*
Professor T. H. EATON, *Group I (Education), 1939.*
THE SECRETARY OF THE FACULTY.
THE DEAN, *Chairman ex officio.*

CALENDAR OF THE GRADUATE SCHOOL FOR 1937–38

FIRST TERM

1937

Sept. 27 Registration of new students.
Sept. 28 Registration of old students.
Sept. 30 Instruction begins.
Oct. 14 Last day for filing candidacy blanks in order to receive residence credit for the term.
Oct. 21 Last day for payment of tuition for the first term.
Nov. 24 Instruction ends at 6 P.M. } Thanksgiving Recess
Nov. 29 Instruction resumed at 8 A.M. }
Dec. 15 Last day for announcing titles of thesis by candidates for advanced degrees to be conferred in June, 1938.
Dec. 18 Instruction ends at 1 P. M. } Christmas Recess
1938
Jan. 3 Instruction resumed at 8 A. M.) }
Jan. 25 Last day for filing applications for admission to the Graduate School for the second term.
Feb. 8 Last day for completing requirements for advanced degrees to be conferred in February.
Feb. 9 Term ends.
Feb. 10 A holiday.

SECOND TERM

Feb. 11 } Registration.
Feb. 12 }
Feb. 14 Instruction begins.
Feb. 26 Last day for filing candidacy blanks in order to receive residence credit for the term.
March 1 Last day for filing applications for fellowships and scholarships for 1938–39.
March 7 Last day for payment of tuition for the second term.
April 2 Instruction ends at 1 P. M. } Spring Recess
April 11 Instruction resumed at 8 A. M. }
May 1 Last day for making application for June, 1938, degrees.
May 23 } Examination period for June degrees.
June 14 }
June 14 Last day for completing requirements for advanced degrees to be conferred at Commencement.
June 20 Commencement.

SUMMER SESSION, 1938

June 25 Last day for filing applications for admission to the Graduate School for the summer session.
July 11 Summer Session Registration.
July 15 Last day for payment of tuition.
July 16 Last day for filing candidacy blanks in order to receive residence credit for the summer session.
August 19 Summer Session ends.

August 10 Last day for filing applications for admission to the Graduate School for first term of 1938–39.
Sept. 25 Last day for completing requirements for advanced degrees to be conferred in September.

CONTENTS

GENERAL INFORMATION

THE FACULTY OF THE GRADUATE SCHOOL

The Faculty of the Graduate School has exclusive jurisdiction over all graduate work and advanced degrees and consists of three groups: (1) an *ex-officio* group, including the President of the University who is the presiding officer; the Provost of the University, who in the absence of the President is the presiding officer; the Deans of the several Faculties of the University; and the Directors of the New York State Experiment Stations; (2) a variable academic group consisting of those professors, assistant professors, and instructors who, as members of special committees, are actively engaged in supervising the work of graduate students; (3) a permanent academic group including those members of the University Faculty who, during five consecutive years, have been members of group (2).

Professors, assistant professors, instructors who hold the Doctor's degree, and such other members of the teaching staff of the University as the Faculty may authorize, are eligible for membership on the Special Committees in charge of the work of graduate students.

THE PURPOSE OF THE GRADUATE SCHOOL; DEGREES

It is the purpose of the Graduate School to offer to adequately trained students facilities for advanced study and for research, with the two-fold purpose (1) of providing each such student with a comprehensive view of a field of knowledge and (2) of training him for independent investigation in that field. A high grade of scholarly work, as distinguished from the fulfillment of routine requirements, is expected of every student.

A candidate for an advanced degree is expected to develop ability to meet new situations, at least in his own field, and to solve them by his own ingenuity. A candidate for the Doctor's degree should, in addition, acquire a feeling of responsibility to add to the sum total of human knowledge and should develop qualities of leadership, particularly in his special field of study.

The following degrees are offered:

Doctor of Philosophy (Ph.D.)
Doctor of the Science of Law[1] (J.S.D.)
Master of Arts (A.M.)
Master of Science (M.S.)
Master of Architecture[2] (M.Arch.)
Master of Landscape Architecture[2] (M.L.A.)
Master of Fine Arts[2] (M.F.A.)
Master of Science in Agriculture (M.S. in Agr.)

[1]Under the special jurisdiction of the Division of Law.
[2]Under the special jurisdiction of the Division of Architecture and Fine Arts.

Master of Chemistry[3] (M.Chem.)
Master of Science in Education[4] (M.S. in Ed.)
Master of Civil Engineering[5] (M.C.E.)
Master of Mechanical Engineering[5] (M.M.E.)
Master of Electrical Engineering[5] (M.E.E.)
Master of Science in Engineering[5] (M.S. in Eng.)
Master of Laws[1] (LL.M.)

Correspondence about admission to the Graduate School, or registration for any of the degrees listed above, should be addressed to *The Graduate School, Cornell University, Ithaca, New York.* Inquiries about facilities for advanced study and research may also be addressed to the Department in which such work is done, or to the Division or School under whose jurisdiction the advanced technical degree in question is granted.

ADMISSION

To be admitted to the Graduate School, an applicant (1) must have received his baccalaureate degree from a college or university of recognized standing, or have done work equivalent to that required for such degree; (2) as judged by his previous scholastic record, or otherwise, must show promise of ability satisfactorily to pursue advanced study and research; and (3) must have had adequate previous preparation in his chosen field of study to enter at once upon graduate study in that field.

Seniors in the colleges of Cornell University who have completed the academic requirements for the Bachelor's degree, and who qualify under (2) and (3), may, subject to the approval of the deans of their respective colleges, be admitted to the Graduate School.

Candidates for advanced professional degrees, given under the jurisdiction of the several special divisions of the Graduate School, should examine the special requirements for these degrees printed below at the beginning of the announcement for each division.

Students admitted to the Graduate School are usually expected to pursue a course leading to one of the advanced degrees; but a properly qualified person who, for special reasons, does not wish to meet the requirements for a degree may arrange a program of graduate study suitable to his purposes.

An applicant who is not a graduate of Cornell University must submit complete official transcripts of all previous college studies.

Applications for admission, made on the proper forms, should be filed in the office of the Graduate School at the earliest possible date and, ordinarily, not later than August 10 and January 25 for entrance

[3]Under the special jurisdiction of the Division of Chemistry.
[4]Under the special jurisdiction of the Graduate School of Education.
[5]Under the special jurisdiction of the Division of Engineering.
[1]Under the special jurisdiction of the Division of Law.

to the first and second terms, respectively; and not later than June 25 for entrance to the summer session.

Students may be admitted to the Graduate School in one of the following three classes:

(1) Candidates for degrees;
(2) Graduate students not candidates for degrees: "non-candidates";
(3) Resident Doctors.

Candidates for degrees:

Language requirements for admission. To be admitted to candidacy for any of the degrees A.M., M.S., M.Arch., M.L.A., M.F.A., M.Chem., M.M.E., M.C.E., or M.E.E., a student must have had training in a foreign language equivalent to three units of entrance in one language or two in each of two languages, except that candidates for M.M.E., M.C.E., or M.E.E., may make up a shortage of one entrance unit in course.

For admission to candidacy for M.S. in Eng. two entrance units in one foreign language are required.

Candidates for the Doctor's degree are expected to possess a reading knowledge of two foreign languages at the beginning of their candidacy at Cornell for that degree. For further details regarding the language requirement for Ph.D., see page 15.

Major and Minor Subjects. A candidate for an advanced degree must select within his field of study a branch to which he intends to devote the larger part of his time and which is called his Major Subject. In addition, a candidate for the doctorate must select two other subjects, called Minor Subjects, properly related to his Major Subject. Except in the case of the degree of Master of Laws[1] and Master of Science in Education,[2] a candidate for a Master's degree must select one such Minor Subject. A list of approved Major and Minor Subjects in each of the several fields of graduate study will be found below in the announcement of each department of instruction.

Special Committees. The work of each graduate student is in charge of a Special Committee. After the student has chosen his Major and Minor Subjects, he must select one or more members of the Faculty, to represent each subject and to serve as the members of his Special Committee, the representative of his Major Subject being the chairman. Their consent so to serve, together with a statement of the student's Major and Minor Subjects, approved by the members of his Special Committee, must be filed with the Dean of the Graduate School on the proper blank not later than two weeks after first registration in the Graduate School.

Changes in Special Committees. A student may change the membership of his Special Committee with the approval of all the members of the newly constituted Committee. Notice of such change

[1]See p. 157. [2]See p. 118.

must be filed *immediately* with the Dean of the Graduate School. A vacancy on a Special Committee, caused by the absence of a member from the University, may be filled by the Dean on joint recommendation of the absent member and the student.

Graduate Students not Candidates for Degrees: A student admitted to the Graduate School as a non-candidate is required to select one or more advisers to direct his work. He must present to the Dean not later than two weeks after registration for each term a statement of the studies which he intends to pursue, approved by his adviser(s) and by each of the members of the Faculty under whom the work is to be done. Non-candidates are expected to pursue a coordinated program of graduate work.

Resident Doctors: Persons who hold the Doctor's degree or who have equivalent standing may, subject to permission from the Dean, register in the Graduate School as Resident Doctors, for the purpose of engaging in advanced study and research in a field in which they have had adequate previous preparation. On the recommendation of the Dean, Resident Doctors are exempt from the payment of tuition and all fees except laboratory charges.

REQUIREMENTS FOR DEGREES

The requirements for advanced degrees, with the exception of the professional degrees in Law[1] and in Education,[2] include (1) the satisfactory completion of a minimum period of residence, (2) the presentation of an acceptable thesis or essay, and (3) the passing of a "final" examination. No student may present himself for his final examination until he has satisfied (1) and (2).

Residence

No student will be awarded any degree by Cornell University unless he has spent at least one full academic year, or the equivalent, in residence and study at the University as candidate for that degree. To receive credit for residence a student must be regularly enrolled in the Graduate School as a candidate for the degree in question; and the satisfactory completion of his work, term by term, must be attested by the members of his Special Committee.

For J.S.D. and for each of the Master's degrees a minimum of two terms of residence is required. All work for these degrees must be completed at Cornell University.

For the Ph.D. degree a minimum of six terms of residence is required. (See, however, Examination in Languages for the Doctor's degree, p. 15.) To obtain credit toward this degree for work done elsewhere, see under B and C below.

A. **Work done in Cornell University.**

Residence credit may be received for work done in Cornell University in the following ways:

[1]See p. 157. [2]See p. 118.

(1) For the satisfactory completion of a term, or portion thereof, in a regular session of the University. A graduate student who holds an appointment either as an instructor or as a teaching or research assistant may, upon recommendation of his Special Committee, receive a maximum of three-fourths residence credit for graduate work carried on during the period of such appointment.

Residence during the Summer Session may be counted at the rate of two summer sessions per term of residence. The credit that may be earned toward the doctor's degree by work in Summer Sessions is limited to two terms. Students who have demonstrated unusual ability in their graduate studies may, upon recommendation of their Special Committees and upon approval by the General Committee, earn a maximum of two more terms by work in the summer under personal direction. But the last year of candidacy for Ph.D. must be spent in residence at the University.

To obtain residence credit in the Graduate School for Summer Session work the student must register both in the Summer Session and in the Graduate School. A statement of the graduate work offered during the summer will be found in the Announcement of the Summer Session.

(2) For the satisfactory completion of work done during the summer under the personal direction of a member of the Faculty of the Graduate School. To secure credit for such work the student must register *in advance* at the office of the Graduate School.

Work done under personal direction may be undertaken only with the approval, obtained in advance, of the student's Special Committee and of the Dean, and upon the latter's receipt from the member of the Faculty concerned of a statement with respect to the number of weeks during which he is prepared to supervise the work of the student. A student may not ordinarily register for work under personal direction until he has completed a full year of graduate work.

Except on permission from the Dean in special cases, no student may earn more than two terms of residence credit in any given calendar year.

B. **Work done in other universities.**

Upon the recommendation of the student's Special Committee residence up to a maximum of four terms may be credited toward the doctor's degree for work done in other universities. Application for such credit should be made by the student as soon as possible after registration, and ordinarily not later than the end of the first term of residence at Cornell.

Work done elsewhere may not be credited toward either a master's degree or J.S.D.

C. **Work in absentia.**

Under the following conditions a candidate for the doctor's degree may be credited with residence for work done away from the university.

(a) An applicant for this privilege must be regularly registered in the Graduate School as a candidate for the doctorate, and while not in residence shall receive no compensation except from the University.

(b) He shall have spent at least two terms in Cornell University in study towards the doctor's degree.

(c) Permission to count such time as residence may be given by the Dean of the Graduate School for a period not to exceed one term, when the application is unanimously approved by the members of the student's Special Committee. When a longer period of outside study is required, application for an extension of time should be made to the General Committee, which may, at its discretion, extend the period to two terms. In no event, however, shall a student acquire a total of more than two terms' residence under these provisions.

(d) A student who avails himself of this privilege shall continue to work under the general direction of his Special Committee. Whenever possible, however, the work should be carried on under the immediate supervision of a competent director, acting for the Special Committee and to be designated by that Committee.

(e) Reports regarding the progress of the work shall be made as directed by the Special Committee at intervals not in excess of one month.

The Thesis or Essay

The subject of the thesis, or essay,[1] approved by the chairman of the candidate's Special Committee, must be filed with the Dean at least six months before the candidate intends to complete all the requirements for the degree for which he is a candidate.

The thesis must be acceptable to the candidate's Special Committee in respect of both scholarship and literary quality. The completed thesis must be in the hands of the Special Committee at least fifteen days before the final examination for the Master's degree, or Examination B or C[2] for the Doctor's degree; and during the five days immediately preceding this examination a typewritten copy, approved by all members of the Special Committee, shall be on file in the office of the Graduate School. Under no circumstances may either of these final examinations be given before the thesis has been accepted and filed.

The thesis must be typewritten, double spaced, on a durable rag bond, 8 x 10½ inches, with a left hand margin of at least an inch and a quarter. The carbon copy need not be on bond paper. The title page of the thesis should be set up according to the following form:

[Title of Thesis]

A Thesis

Presented to the Faculty of the Graduate School of Cornell University for the degree of

[————————]

By

[Author's Name in Full]

[Date on which degree is to be conferred.]

Immediately following the title-page there must be a biographical sketch of the author, in length not exceeding 150 words.

[1]A candidate for the Master's degree may, in the discretion of his Special Committee, present an essay instead of a thesis.

[2]See p. 16.

Before the degree can be conferred two bound typewritten copies (one of which must be a ribbon copy) of the completed thesis, approved by the Special Committee, must be deposited in the office of the Graduate School. These copies become the property of the University Library.

When the Major Subject for the degree of Master of Architecture or the degree of Master of Landscape Architecture is in Design, the candidate is required to deposit, in place of the thesis, either the original drawings or a photographic reproduction of them.

A candidate for the degree of Doctor of Philosophy must deposit in the Office of the Graduate School, along with two bound copies of his thesis, two copies of a typewritten abstract thereof, about 1500 words and not exceeding 1700 words in length, approved by the Chairman of the Special Committee, and must pay to the Treasurer of the University a fee of $10. The abstract will appear in an annual volume, "Abstracts of Theses", to be published by the University. This volume will be available in March or April of the year following that in which the student receives his degree. Any recipient of the Ph.D. who wishes to have a copy of the volume containing the abstract of his thesis should file his name and address in the Office of the Graduate School. To obtain off-prints of the abstract of his thesis, a student must deal directly with the contracting printer. The name of the printer may be learned at any time by inquiry at the Office of the Secretary of the University.

The following rules have been adopted with regard to the preparation of the typewritten abstract. The abstract should be typed double-spaced on one side only of 8x10½ paper. The original copy should be on a bond paper, but the carbon copy may be on a good grade of "onion skin" paper. A margin of at least one and a quarter inches should be allowed on the left-hand side of the sheet. At the top of the first page of the abstract should be placed the title (identical with the title of the thesis) and beneath that the student's name. A margin of at least two inches should be left at the top of this first page. The approval of the Chairman of the Special Committee should be written in the upper left-hand corner of the first page.

Examinations

The following general examinations are required of candidates for advanced degrees:

Qualifying Examinations: required of candidates for the doctor's degree, see below under Examinations for the Doctor's Degree.

Examinations in Foreign Languages: required of candidates for the doctor's degree, see below under Examinations for the Doctor's Degree.

Final Examinations on the major field and on the minor field or fields of study and also on the thesis: required of all candi-

dates for advanced degrees, see below under Examinations for the Master's Degree and Examinations for the Doctor's Degree.

Final examinations are conducted by the student's Special Committee and are open to all members of the Faculty. At the discretion of the Special Committee those under whom the student has had work may be invited to participate in the examination. But the Special Committee alone shall decide upon the merits of the candidate's performance.

Applications for final examinations, bearing the approval of the Special Committee, must be filed in the office of the Graduate School at least five days in advance of the final examination, except that candidates for June degrees must file applications not later than May 1.

Final examinations must be completed within four years after the minimum residence requirement for the degree in question has been satisfied.

A report on each qualifying or final examination shall be filed by the Special Committee in the office of the Graduate School.

For the Master's Degree.

After the thesis, or essay, has been completed and filed in the office of the Graduate School as provided on page 13, the candidate is required to present himself for the final examination, which covers the thesis and the Major and Minor Subjects. The examination may be written or oral, or both, at the option of the Special Committee. In the event of failure in the examination, no re-examination may be held until three months have elapsed.

For the Doctor's Degree.

Examination in languages. Each candidate for the degree of Doctor of Philosophy must demonstrate his ability to read both French and German (or two languages, other than English, approved by his Special Committee), by passing in each of these languages an examination given by a member of the Language Examination Board. The two languages so approved shall be significantly useful in the candidate's field of work and not chosen solely with reference to the preparation of the thesis.

Candidates for the degree of Doctor of Philosophy are expected to meet the foreign language requirements at the beginning of their candidacy at Cornell University for that degree. A minimum of seven terms of residence is required of a candidate who does not pass at least one language examination at this time. The extra term of residence may not be required if, with the approval of the student's Special Committee and of the General Committee of the Graduate School, preparation in foreign language is made during a period when the student is not receiving residence credit.

A minimum of three terms of residence is required after completion of all language requirements, except in the case of a student admitted to candidacy with two or more terms of residence credit; in such case, a minimum of two terms is required.

Language examinations passed within one month after registration are considered as being passed at the time of registration.

Additional requirements in foreign language may be made at the discretion of the student's Special Committee.

Qualifying examination. The primary purposes of the qualifying examination are (1) to ascertain whether the student is qualified to continue work for the doctorate; and (2) to plan the student's work during the remainder of his candidacy. The examination is ordinarily given at the end of the first year of graduate study, if that year is at Cornell. If the student has had one year or more of graduate work elsewhere, the qualifying examination should be given as soon as possible after his entrance into the Graduate School. The qualifying examination may be oral or written or both.

Any member of the Special Committee may waive his part of the qualifying examination. The report on the qualifying examination shall, however, be made by the Special Committee as a whole, after consultation. If a candidate fails to pass the qualifying examination, no re-examination shall be allowed except on recommendation of the Special Committee.

Before presenting himself for Final Examination B or C (see next paragraph), each candidate must have earned at least two terms of residence credit after the passing or the waiving of the qualifying examination.

Final examinations. The final examinations, covering (1) the Major and Minor Subjects and (2) the thesis and related topics, may, at the discretion of the Special Committee, be given either separately or in combination.

When the two parts are given separately, an examination dealing mainly with the Major and Minor Subjects and designated as Final Examination A, may be given at the end of the fourth term of candidacy, or thereafter. Examination A may be both oral and written. The early completion of Examination A will leave the student free to devote his attention to the thesis and collateral studies during the remainder of his candidacy. Final Examination B, on the thesis and related topics and on such other work as the student may have done after completing Examination A, will be given after the residence requirement has been satisfied and the thesis has been completed and filed as provided on page 13. This examination may be oral, or both oral and written, at the discretion of the Special Committee.

When the two parts of the final examination are given in combination, the combined examination, designated as Final Examination C, will be given after the residence requirement has been satisfied and the thesis has been completed and filed, as provided on page 13. Examination C may be both oral and written.

A student who has failed in any Final Examination may not be re-examined within six months.

APPLICATION FOR DEGREES

Advanced degrees are conferred in February, June, and September.

A student desiring to receive his degree in February or September must file an application therefor not later than five days in advance of the date of the final examination for that degree; for a June degree, not later than May 1.

A degree will not be conferred unless all of the requirements have been completed by the days respectively specified in the calendar on page 3.

REGISTRATION

The rules of the University provide: "All students taking work in the Graduate School and/or work leading to, or in contemplation of, an advanced degree, shall at the beginning of each term or session, register both in the Graduate School and with the Registrar of the University."

Candidates for advanced professional degrees should register also with the division concerned.

A graduate student who has completed requirements of residence for his degree and who remains in residence while working on his thesis or while doing other work in contemplation of a degree, must register each term in which he is thus engaged. A student who returns to the University for the sole purpose of completing requirements for an advanced degree, and who is in residence less than two weeks, must register and pay the administration fee, but not tuition.

VACCINATION

Every student matriculating in the University for graduate study, whether in the Summer Session or during the regular terms, is required to present a satisfactory certificate of vaccination against smallpox. This certificate is considered satisfactory only if it certifies to a successful vaccination within the last five years or certifies that at least three unsuccessful attempts at vaccination have been made within that period.

TUITION AND OTHER FEES

A Tuition Fee of $150 for the academic year is to be paid by all students registered in the Graduate School. It is payable in installments of $75 at the beginning of each term.

A member of the teaching or scientific staff registered in the Graduate School whose salary equals or exceeds $1,500 shall pay tuition at the rate of three-quarters of the tuition regularly charged full time students.

Certain classes of students are exempt from the payment of the tuition fee. They are:

1. Graduate students holding certain appointments as University Fellows or Graduate Scholars, and holders of certain temporary fellowships and scholarships.
2. Resident Doctors, upon recommendation of the Dean.
3. In addition to students exempt under the charter of the University from the payment of tuition the following, to the extent herein mentioned, shall also be exempt from such payments of fees:

Upon recommendation by the appropriate college dean and by action of the Board of Trustees, for each appointment, waiver of tuition in the Graduate School and of Laboratory and shop fees in the department or line of work in which he is employed, may be made to a member of the teaching or scientific staff whose salary is below $1,500, subject to the following limitations:

(a) In the case of a candidate for a master's degree or a J.S.D. degree, up to a maximum of four academic terms only, any credits toward residence earned prior to appointment to be included in the four terms.

(b) In the case of a candidate for the Ph.D., until by work here or elsewhere he has completed the minimum residence credit of six terms required by the Graduate School, and for not to exceed two academic terms thereafter.

(c) Whenever waiver of tuition in the Graduate School is involved in the making of any given appointment, said appointment shall not carry a salary in excess of $1,400.

(d) The above regulations shall be applicable to new appointees whose appointments take effect July 1, 1934, or thereafter.

(e) Irrespective of salary received the present practice of including automatically a waiver of tuition with each appointment shall be continued in the case of any student who has held an appointment to the teaching or scientific staff previous to July 1, 1934, who is (1) a candidate for the master's degree, for a total of four terms, any waivers previous to July 1, 1934, included; (2) a candidate for the doctorate, for a period of two terms more than the minimum number of terms of residence at Cornell required to complete the residence requirement for the degree in question, any waivers previous to July 1, 1934, included.

Members of the teaching or scientific staff taking work outside the department or line of work in which they are employed shall be charged tuition in proportion to the amount of work for which they are registered.

An Administration Fee of $25 is to be paid by all students registered in the Graduate School except Honorary Fellows and Resident Doctors. It is payable in installments of $12.50 at the beginning of each term.

A Matriculation Fee of $11 is required of every student upon his first entrance into the University. It must be paid at the time of registration and is not refundable.

*A Health and Infirmary Fee** of $6 a term is required of all students (except Honorary Fellows, Resident Doctors and students registered in the Medical College in New York City) at the beginning of each term. For a statement of the privileges given in return for this fee, see the General Information Number.

A Graduation Fee of $20 is required, at least ten days before the degree is to be conferred, of every candidate for an advanced degree. The fee will be returned if the degree is not conferred.

A Thesis Fee of $10 is required, at least ten days before the degree is to be conferred, of each candidate for the degree, Doctor of Philosophy. This fee is in addition to the $20 graduation fee.

*Teachers and others not on the University teaching staff taking four hours of work or less, whose tuition payments have been regularly prorated, and who reside and regularly commute to the University from without the area of the city and town of Ithaca, shall be exempt from the payment of the Infirmary fee upon the understanding that if they should be admitted to the Infirmary they will pay the regular daily rate. To such students, membership in Willard Straight Hall is optional.

Laboratory Fees. Every person taking laboratory work in courses in which a fee is charged must pay to the Treasurer of the University the required fee or the required deposit for the materials *et cetera* that are to be used in the work.

*A Willard Straight Hall Membership Fee** of $5 a term is required of all graduate students except those who are members of the instructing staff, for whom membership is optional. The use of the hall is restricted to those who have paid this fee.

Fees for the Summer Session. Graduate students taking work in any of the summer courses must register both in the Graduate School and in the Summer Session and must pay a tuition fee of $50 and a Willard Straight Hall membership fee of $3 for each Summer Session; provided, however, that students registered as candidates for degrees in the Graduate School before April 1, 1935, may pay a tuition fee of $30, an administration fee of $6.25, and a Willard Straight fee of $3 for the Summer Session of 1937. Graduate students registering for the first time as a candidate for a degree at Cornell must also pay the matriculation fee of $11. The usual laboratory fees and deposits and motor vehicle fees listed below are required.

Motor Vehicle Registration and Parking Fees. Students who have or operate a motor-driven vehicle in Ithaca or vicinity must register each term with the Committee on Traffic Control. The fee for such registration is $1 each term during the academic year and $.50 during the Summer Session. The fee of $1 a term during the academic year and $1.50 during the Summer Session is required of each student who has received permission from the Committee on Traffic Control to park a motor vehicle on the University Campus.

Personal Direction. Students carrying on studies during the summer as candidates for advanced degrees under Personal Direction are required to register with the Registrar as well as in the Graduate School and to pay an administration fee of $6.25 and a Willard Straight Hall membership fee of $3.

Students registered under Personal Direction during the summer who desire residence credit for their work, must pay tuition for the credit desired pro rata at the rate charged for the regular academic year, such payment to admit them to the current Summer Session classes without additional tuition payments; provided that the amount of tuition paid is at least equal to that charged students registered in the Summer Session. Students registered under Personal Direction during the summer, not for credit, are exempt from the payment of tuition, but may not attend either as visitors or for subsequent credit, any of the classes or exercises of the Summer Session.

The privilege of taking work under Personal Direction during the summer without the payment of tuition shall be restricted to bona fide candidates for a degree at Cornell University.

Tuition and other fees become due when the student registers. The University allows twenty days of grace in each term, five days in the Summer Session. The last day of grace is generally printed on the registration coupon which the

*See footnote on page 18.

student is required to present at the Treasurer's office. Any student who fails to pay his tuition charges, other fees, and other indebtedness to the University, or who, if entitled to free tuition, fails to claim it at the Treasurer's office and to pay his fees and other indebtedness, within the prescribed period of grace, is thereby dropped from the University unless the Treasurer has granted him an extension of time to complete payment. The Treasurer is permitted to grant such an extension when, in his judgment, the circumstances of a particular case warrant his doing so. For any such extension the student is assessed a fee of $2. A reinstatement fee of $5 is assessed any student who is permitted to continue or return to classes after being dropped from the University for default in payments. The assessment may be waived in any instance for reasons satisfactory to the Comptroller and the Registrar, when such reasons are set forth in a written statement.

Students registering at any time during the last ten weeks of either the first or the second term are required to pay tuition at the rate of ten per cent of the regular tuition of the term for each week or fraction of a week between the day of registration and the last examination day of the term. Students registering at any time during the last five weeks in the short summer courses are required to pay tuition at the rate of twenty per cent of the term's tuition for each week or fraction of a week between the day of registration and the last examination day of the term.

A tuition fee or other fee may be changed by the Trustees at any time without previous notice.

LIVING EXPENSES IN ITHACA

A student at Ithaca ought to have at least $700 for living expenses during the school year from September till June, exclusive of the tuition and other fees, clothing, and traveling expenses. One must expect to pay at least $500 for board and lodging for that period. There are no boarding houses near the University, and students get their meals in restaurants and cafeterias. If one is used to frugal living and is willing to take an inferior room and to budget as little as necessary for meals, one may be able to do with somewhat less than the above estimate. If the student is to live in Ithaca throughout the calendar year he had better estimate his living expenses at the rate of twenty dollars a week.

Opportunities for self-support are limited. For further information consult the leaflet *Self-help*, which will be mailed free to any applicant by the Secretary of the University, 27 Morrill Hall.

LOANS

The Graduate Student Loan Fund

Contributions from the alumni of Cornell University have made it possible to establish a Graduate Student Loan Fund for use of graduate students at Cornell University. Applications for loans from this fund should be made in writing to the office of the Graduate School or to the Secretary of the University, Mr. Woodford Patterson, Morrill Hall.

Loan Funds for Women Graduate Students

For the academic year 1937–38 there will be available a loan fund of about $400, for the use of women graduate students, provided by

the Ithaca Branch of the Association of American University Women, and Mu Chapter of Pi Lambda Theta. Applications should be made in writing to the Office of the Graduate School.

A loan fund is available for the use of women graduate students in science, provided by Alpha Chapter of Sigma Delta Epsilon, Graduate Women's Scientific Fraternity. Applications should be made in writing to the Treasurer of Sigma Delta Epsilon, Morrill Hall, Cornell University.

FELLOWSHIPS, SCHOLARSHIPS, PRIZES

Honorary Fellowships

Holders of the Doctor's degree or other persons of recognized standing as scholars who wish to continue work in a field in which they have already achieved distinction may, in the discretion of the Faculty, be appointed to honorary fellowships. These fellowships cover all fees except laboratory charges. Actual residence at the University and regular registration in the Graduate School are required of incumbents.

Fellowships and Graduate Scholarships
AWARD AND TENURE

Appointments to fellowships and scholarships for the ensuing academic year are made by the Faculty, upon recommendation of the professors concerned, on April 1 of each year.

Official forms for making application for fellowships and graduate scholarships may be obtained from the Office of the Graduate School. All applications, together with supporting letters, testimonials, and other pertinent information, shall be filed in the office of the Dean of the Graduate School on or before March 1 of the academic year preceding the one for which application is made.

The Faculty of the Graduate School has the authority to combine the stipends of two or more scholarships or fellowships in order to increase the stipend of a single scholarship or fellowship; or to divide a given fellowship into two or more scholarships.

The term of each fellowship and graduate scholarship is one academic year.

Students holding fellowships or graduate scholarships may not accept other appointments, but are expected to devote their time uninterruptedly to the prosecution of their studies, except that they may be called upon to assist in instruction for a maximum of six clock hours a week.

The moneys due on fellowships and graduate scholarships shall be payable at the office of the Treasurer of the University in eight equal installments with the first payment due October 15 and the other payments due on the fifteenth day of each succeeding month.

Prospective graduate students who wish also to apply for positions as teaching or research assistants should address applications for such

positions directly to the Department or College concerned, and not to the Office of the Graduate School.

Fellowships and Scholarships for 1938–39

For 1938–39 there are offered the following fellowships and scholarships carrying stipends as indicated and exemption from tuition unless otherwise noted:

Agriculture

The Clinton DeWitt Smith Fellowship in Agriculture. Stipend $400. Does not carry exemption from tuition.

The University Fellowship in Agriculture. Stipend $400. See also under Animal Biology and Botany.

Animal Biology

The Schuyler Fellowship in Animal Biology. Stipend $400.

The Graduate Scholarship in Animal Biology. Stipend $200.

Architecture

The University Fellowship in Architecture or Landscape Architecture. Stipend $400.

The *Graduate Scholarship in Architecture, Landscape Architecture, or Fine Arts.* Free tuition only; no stipend.

Botany

The Goldwin Smith Fellowship in Botany, Geology, or Physical Geography. Stipend $400. Awarded for work in Botany in 1938–39.

Chemistry

The Sage Fellowship in Chemistry. Stipend $600.

The duPont Fellowship in Chemistry. Stipend $750.

Classics

Two *Fellowships in Greek and Latin.* Stipend $400 each.

Two *Scholarships in Greek and Latin.* Stipend $200 each.

Economics

Cornell-Brookings Fellowship in Economics. Stipend $1,000. The Brookings Institution of Washington, D. C., and Cornell University are joint participants in offering this fellowship. It is awarded by the Graduate School of Cornell University to a graduate student previously in residence at Cornell. The fellow must be regularly registered in the Graduate School, but is in residence at the Brookings Institution.

The President White Fellowship in Political and Social Science.[1] Stipend $600. Awarded in alternate years in Government and Economics. Awarded in Government, 1938–39.

The Fellowship in Political Economy. Stipend $600. Awarded in 1938–39 and alternate years.

Education

(See Honorary Scholarships in Education below.)

Engineering, Civil, Mechanical, and Electrical

Two or more of the following fellowships or scholarships may be combined if such combination be deemed desirable.

The McGraw Fellowship in Civil Engineering. Stipend $400.

[1]See footnote on page 23.

The Graduate Scholarship in Civil Engineering. Stipend $200.

The Sibley Fellowship in Mechanical and Electrical Engineering. Stipend $400.

The Charles Bull Earle Memorial Fellowship in Mechanical and Electrical Engineering. Stipend $400.

The Edgar J. Meyer Memorial Fellowship in Engineering Research. Stipend $400.

See also the John McMullen Research Scholarships and the Elon Huntington Hooker Fellowship in Hydraulics, listed below.

English

The Cornell Fellowship in English. Stipend $600.

Entomology and Nature Study

(See Comstock Scholarships below.)

Geology

The Graduate Scholarship in Botany, Geology or Physical Geography. Stipend $400. Awarded for work in Geology in 1938–39.

See also the Eleanor Tatum Long Graduate Scholarship, listed below.

German

The University Fellowship in German. Stipend $400.

Government

The President White Fellowship in Political and Social Science.[1] Stipend $600. Awarded in alternate years in Government and Economics. Awarded in Government in 1938–39.

History

The President White Fellowship in Modern History.[1] Stipend $500. May at the discretion of the Faculty, be made a traveling fellowship, with a stipend of $650.

The Fellowship in American History. Stipend $400.

The George C. Boldt Fellowship in History. Stipend $1,000. Does not carry exemption from tuition.

The Graduate Scholarship in History. Stipend $200.

Home Economics

The Anna Cora Smith Fellowship in Home Economics. Stipend $800. Does not carry exemption from tuition.

Landscape Architecture

See Architecture.

Mathematics

The Erastus Brooks Fellowship in Mathematics. Stipend $600.

Philosophy

Three *Susan Linn Sage Fellowships in Philosophy.* Stipends $600 each.

One or more of the *Susan Linn Sage Fellowships in Philosophy* may, in the discretion of the Faculty, be divided to make two *Susan Linn Sage Graduate Scholarships in Philosophy*, stipends $300 each.

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[1]Holders of the President White Fellowships in Modern History and in Political and Social Science may be called upon to be in attendance for a certain period each day in the President White Library, where they will ordinarily do a large part of their study.

Physical Geography

See Geology.

Physics

The President White Fellowship in Physics. Stipend $600.

The stipend of this Fellowship may, at the discretion of the Faculty, be reduced to $400 and the remaining $200 be assigned to a Graduate Scholarship.

See also Special Temporary Fellowships, page 26.

Psychology

The Susan Linn Sage Fellowship in Psychology. Stipend $400.

The Susan Linn Sage Graduate Scholarship in Psychology. Stipend $200.

Romance Languages

The University Fellowship in Romance Languages. Stipend $400.

Veterinary Medicine

The Graduate Scholarship in Veterinary Medicine. Stipend $200.

Tuition Scholarships

For graduate students the Board of Trustees has established thirty tuition scholarships, twenty for work in the endowed colleges and ten for work in the state-supported colleges. They entitle the holder to exemption from payment of tuition fees, but not other fees, for the duration of the appointment. Applications should be made to the professor, or professors, in whose field the applicant is working or to the office of the Graduate School. Awards are made in May of each year.

Comstock Scholarships

Under the terms of the will of the late Professor John Henry Comstock there have been established two graduate scholarships, each carrying a stipend of $150. For the year 1938–39 these scholarships have, by vote of the Faculty of the Graduate School, been allocated to the fields of Entomology and Nature Study. Applications may be made to the office of the Graduate School or to a professor in either of the above fields. These scholarships do not carry free tuition.

Phi Kappa Phi Scholarship

The Phi Kappa Phi Scholarship, established by the Cornell Chapter of Phi Kappa Phi, is open to graduate students in any field of study. In awarding the scholarship preference is given to applicants who are members of the honor society of Phi Kappa Phi. The scholarship carries free tuition in the Graduate School and a stipend fixed yearly for each succeeding year by the Executive Committee of the Cornell Chapter of Phi Kappa Phi. For the year 1937–38 the stipend was fixed at $150. Applications for this scholarship should be made on the regular scholarship application forms of the Graduate School and should be filed in the office of the Graduate School not later than March 1 preceding the academic year for which the scholarship is desired.

Honorary Scholarships in Education

Five free tuition scholarships in the Graduate School are available to persons of superior qualifications, residents of New York State, seeking preparation for public school service in the field of rural education. Preference is given to persons in the following groups who have been released from their regular positions for the purpose of graduate study: (1) principals and teachers in the public schools of New York State, located in places of less than 4,500 population; (2) members of the staff of any New York State normal school or teachers college. Applications should be made to the Director of the Graduate School of Education.

The John McMullen Research Scholarships

The John McMullen Research Scholarships: Open to graduates in Civil, Mechanical, or Electrical Engineering. These scholarships were founded by a bequest of John McMullen, of Norwalk, Conn., to Cornell University "for the purpose of creating and maintaining free scholarship or scholarships for the education of young men as engineers, the details as to the amounts of said scholarships and the qualifications of the beneficiaries to be left to said institution to determine, said scholarships to be known as the John McMullen Scholarships." With the avails of this bequest the Board of Trustees has established several research scholarships of an annual value of $1,000. The scholarships have not been assigned to any particular school of the college, but will be awarded as conditions dictate. Each holder of one of these scholarships will devote half of his time for eleven months of the year to an assigned research problem. The balance of the time is to be spent in graduate study as candidate for an advanced degree in engineering. Applications will be judged upon the demonstrated ability of the applicant to make satisfactory progress in the problem which might be assigned to him. Correspondence regarding contemplated problems and applications should be addressed to the Dean of the College of Engineering.

The Elon Huntington Hooker Fellowship in Hydraulics

This fellowship was founded in 1919 by E. H. Hooker, a graduate of the School of Civil Engineering of the class of 1894, and is offered for research in experimental hydraulics in Europe or America. It is open to graduates of the School of Civil Engineering and similar schools of equivalent rank. The stipend of the fellowship is $510. Applications should be sent to the Director of the School of Civil Engineering.

The Eleanor Tatum Long Graduate Scholarship

The Eleanor Tatum Long Graduate Scholarship in Structural Geology is open to graduate students who are majoring in the branch of Geology named. Application for the scholarship should be

made to the Department of Geology. The stipend is approximately $1,000 a year, and does not carry free tuition.

Special Temporary Fellowships

In addition to the fellowships enumerated above, the income of the Susanna Phelps Gage Fund for research in physics may, upon the recommendation of the professors in the Department of Physics, be devoted to the support of fellowships in Physics.

At the present time the following special fellowships are also awarded by the Faculty of the Graduate School:

The American Cyanamid Company Fellowship (Vegetable Crops).

The American Zinc and Chemical Company Fellowship (Agronomy).

The Anheuser-Busch Fellowship (Poultry Husbandry).

The Charles Lathrop Pack Fellowships in Nature Education (Nature Education).

The Dairy and Ice Cream Machinery and Supplies Association Fellowship (Dairy).

The Freeport Sulfur Company Fellowship (Animal Nutrition and Plant Pathology).

The Frosted Foods Fellowship No. 3 (Foods Chemistry).

The G. L. F. Poultry Fellowship (Poultry Husbandry).

The Lederle Fellowship (Veterinary Medicine).

The Lily Disease Investigation Fellowship (Plant Pathology).

The Nassau County Farm Bureau Association Fellowship (Plant Pathology).

The New York Florists' Club Fellowship for Floriculture Research (Floriculture and Ornamental Horticulture).

The New York Florists' Club Fellowship for the Investigation of Diseases of Carnations (Plant Pathology).

The New York Florists' Club Fellowship for the Investigation of Diseases of Roses Grown under Glass (Plant Pathology).

The Staten Island Growers' Fellowship (Plant Pathology).

The Stauffer Chemical Company and Freeport Sulphur Company Fellowship for the Study of Injury to Plants by Sulfur-containing Materials Applied as Sprays and Dusts (Plant Pathology).

The Texas Gulf Sulfur Company Fellowship for the Study of the Insecticidal and Fungicidal Properties of Sulfur (Entomology and Plant Pathology).

It is impossible at the present time to announce these fellowships as annually awarded to applicants. Information in regard to them may at any time be obtained by correspondence with the respective departments.

The Graduate Prize in Philosophy

The Graduate Prize in Philosophy has an annual value of about twenty-five dollars, and is open for competition to all students registered in the Graduate School of Cornell University.

The prize will be awarded to the graduate student who submits the best paper embodying the results of research in the field of philosophy. To be acceptable, the paper must show independent scholarship and research in dealing with philosophical ideas. The subject of the paper may be either historical or critical and constructive in character. It may be concerned either with problems of pure philosophy or with the philosophical bearing of the concepts and methods employed in mathematics or in any of the natural or humanistic sciences.

Papers submitted in competition must be deposited in the office of the Dean of the Graduate School on or before the first of May. Each paper is to be typewritten, and must bear a fictitious signature and be accompanied by the name of the writer in a sealed envelope.

The prize will be awarded by a committee appointed by the President of the University. A copy of the successful paper is to be deposited in the University Library by the Dean of the Graduate School.

THE UNIVERSITY LIBRARIES

OTTO KINKELDEY, *Librarian;* E. R. B. WILLIS, *Associate Librarian;* G. L. BURR, *Librarian Emeritus of the President White Library;* HALLDOR HERMANNSSON, *Curator of the Icelandic Collection;* G. L. HAMILTON, *Curator of the Dante and Petrarch Collections;* Miss GUSSIE E. GASKILL, *Curator of the Wason Chinese Collection;* L. W. MORSE, *Librarian of the Law Library;* W. W. ELLIS, *Librarian of the Agricultural College Library.*

The University Libraries comprise the General Library of the University, the Seminary Libraries in the General Library Building, the Architectural Library, the Chemical Library, the Sibley Engineering Library, the Civil Engineering Library, the Law Library, the Flower Veterinary Library, the Barnes Hall Library, the Goldwin Smith Hall Library, the Van Cleef Memorial Medical Library, the Library of the New York State College of Agriculture, the Library of the New York State Agricultural Experiment Station at Geneva and the Library of the College of Home Economics. The total number of bound volumes in them is now about nine hundred thousand. The number of periodicals, transactions, and other serials currently received, is over two thousand, and of most of these complete sets are on the shelves.

In addition to the general store of books which a University Library of this size may be expected to contain, there are many special collections, assembled by scholars or with scholarly intent. Among the more noteworthy are:

THE PRESIDENT WHITE LIBRARY, received in 1891 as a gift from the first President of the University and largely increased by subsequent gifts and purchases. It includes special collections on the History of Superstition, the Age of the Reformation, and the French Revolution.

THE DANTE, PETRARCH, AND ICELANDIC COLLECTIONS, for which separate catalogues have been printed, were gathered by the first Librarian, Willard Fiske, who gave them to the University and bequeathed funds for their upkeep.

THE MAY COLLECTION relating to the history of slavery had as its nucleus the Library of the late Rev. Samuel J. May, long secretary of the American Anti-slavery Society.

THE WASON COLLECTION of books dealing with China and the Chinese was bequeathed to the Library by Charles William Wason, '76, with provision for its increase.

THE WORDSWORTH COLLECTION, formed by Cynthia Morgan St. John, presented to the University in 1925 by Mr. Victor Emanuel, '19, now includes more than 2,500 books by and about Wordsworth.

For the study of English, of the classical languages, of the Germanic and Romance languages, of philosophy, of politics and economics, of American and of European history, there have been provided in the library building seven seminary rooms, each equipped with a carefully chosen body of reference books, to which advanced students in these fields have access. In connection with the scientific and technical laboratories similar collections have been formed and well supplied with reference books, standard works, and sets of periodicals, conveniently arranged for study and research.

Cards of admission to the shelves in the stackrooms and to the White Historical Library will be issued to graduate students for the purpose of consultation and research. The privilege of taking books for home use is granted to all students who comply with the library regulations.

LECTURES IN BIBLIOGRAPHY. As a part of the work of the General Library, Mr. Willis, associate librarian, offers a series of informal talks to graduate students in the second term on the resources and facilities of the Library and on the employment as aids to research of the general bibliographical helps.

FIELDS OF INSTRUCTION

The several fields of instruction of the Graduate School are described in the pages that follow hereafter.

Arrangement of Subjects. Subjects are grouped in broad fields as follows, and in the following order:

Architecture and the Fine Arts.
Languages and Literatures.
Philosophy.
History and the Social Sciences.
Animal Sciences.
Plant Sciences.
Physical Sciences.
Agriculture.
Education.
Engineering.
Home Economics.
Hotel Administration.
Law.
Veterinary Medicine.
The Medical Sciences as presented in the Medical College, New York City.
The Agricultural Sciences as presented in the New York State Experiment Station at Geneva.

Approved Major and Minor Subjects. For each field there is given an approved list of titles from which candidates for advanced degrees may choose major and minor subjects. The boldface numerals (**1, 2, 3, 4**) have the following meaning:

1, approved as major subject for the Ph.D.
2, approved as major subject for the master's degree.
3, approved as minor subject when the major is in the same field.
4, approved as minor subject when the major is in another field.

Undergraduate and Graduate Courses. There is, in general, no sharp distinction, at Cornell University, between graduate and undergraduate courses. In this announcement courses intended primarily for graduate students are titled in **boldface** type. Courses intended primarily for undergraduates are titled in *italics*, and are given in skeleton outline only; for details see the respective college announcements.

ARCHITECTURE AND FINE ARTS

The Faculty of the Graduate School by its action of January 27, 1933, created the Division of Architecture and Fine Arts for the more effective administration of the work leading to the professional degrees of Master of Architecture, Master of Landscape Architecture, and Master of Fine Arts. Those primarily concerned with these professional degrees are the Professors and Assistant Professors of Architecture, of Landscape Architecture, of Painting and Sculpture, of Music, of Poetry, of Drama, and of Aesthetics.

Courses under the jurisdiction of the Division of Fine Arts are available to candidates for advanced degrees other than those mentioned above, subject to such conditions as may be imposed by the student's Special Committee.

Approved Major and Minor Subjects (key to symbols on p. 29)

(The combination of subjects chosen must be approved by the professors in the student's major field. Certain subjects outside the field of Fine Arts may be chosen for a minor with the approval of the professors concerned.)

Aesthetics **2,3,4**
Architectural Construction **2,3,4**
Architectural Design **2,3,4**
City and Regional Planning **2,3,4**
Composition Relative to Pictorial and Decorative Art **2,3,4**
Dramatic Production **2,3,4**
Dramatic Technique **2,3,4**
Drawing **2,3,4**
History of Architecture **1,2,3,4**
History of Landscape Architecture **2,3,4**
History of Music **2,3,4**
History of Painting **2,3,4**
History of Painting and Sculpture **1,2**
History of Sculpture **2,3,4**
Landscape Design **2,3,4**
Modeling **2,3,4**
Musical Composition **2,3,4**
Musicology **1,2,3,4**
Painting **2,3,4**
Planting Design **2,3,4**
Playwriting **2,3,4**
Poetry **2,3,4**
Sculpture **2,3,4**
Theory of Music **2,3,4**

AESTHETICS

Professors R. M. OGDEN and R. W. CHURCH.

The courses in Aesthetics offered by the Philosophy Department are:

Philosophy 8a, b. Three hours a week. Throughout the year.

Philosophy 19. Advanced readings in Aesthetics. First term, to be repeated in second term. Assistant Professor CHURCH. Three hours a week.

Philosophy 29. The Philosophy of Value. Second term. Assistant Professor CHURCH. M W F 12. Goldwin Smith 220.

A study of Realist, Idealist, and Naturalist theories of value.

ARCHITECTURE

Professors F. H. BOSWORTH, A. C. PHELPS, GEORGE YOUNG, jr., L. P. BURNHAM, H. E. BAXTER, A. D. SEYMOUR, jr., W. McL. DUNBAR, G. D. CLARKE, J. A. HARTELL, and J. N. TILTON, jr.

Graduate work is offered in architectural design, in the history of architecture, in advanced construction, and in city and regional planning.

Candidates for the degree of Master of Architecture must have had preliminary training in the subjects elected for graduate work equivalent to that required in like subjects in this University for the degree of Bachelor of Architecture.

The facilities for graduate work in architecture are excellent. Large, well lighted drafting-rooms and studios are provided and a special architectural library, comprising several thousand books, photographs, lantern slides, and numerous original drawings, is situated in White Hall where it is easily accessible to the student.

Instruction is given by means of lectures, seminary discussions, and especially by direct personal criticism and advice.

Architectural Design. Professors BOSWORTH, BURNHAM, and SEYMOUR.
History of Architecture. Professors PHELPS and DUNBAR.
Architectural Construction. Professors YOUNG, BAXTER, and TILTON.
City and Regional Planning. Professor CLARKE.

THE HISTORY AND PRACTICE OF THE FINE ARTS

Professors O. M. BRAUNER, CHRISTIAN MIDJO, W. K. STONE, H. P. CAMDEN, K. L. WASHBURN, D. L. FINLAYSON, and A. C. PHELPS.

Graduate work is offered in historical, theoretical, or creative work in the field of the fine arts.

Candidates for the degree of Master of Fine Arts must be holders of a baccalaureate degree and must spend at least one year in residence following the granting of such degree.

Drawing and Painting. Professors BRAUNER, MIDJO, STONE, and WASHBURN.
Composition. Professor MIDJO.
Sculpture. Professor CAMDEN.
History of Art. Professor FINLAYSON.
History of Architecture. Professor PHELPS.
Other members of the staff will cooperate as necessary.

LANDSCAPE ARCHITECTURE

Professors E. D. MONTILLON, EDWARD LAWSON, G. D. CLARKE, and R. W. CURTIS, and the Faculty of Architecture.

Graduate work in Landscape Architecture is offered in design, history, and planting design.

Candidates for the degree of Master of Landscape Architecture must have had preliminary training in the subjects elected for graduate work equivalent to that required in like subjects in this University for the degree of Bachelor of Landscape Architecture.

Landscape Design. Professors MONTILLON and LAWSON.
History of Landscape Architecture. Professors MONTILLON and LAWSON.
Planting Design. Professors LAWSON and CURTIS.
Park and Parkway Design. Professor CLARKE.

MUSIC

Professors PAUL J. WEAVER, OTTO KINKELDEY, ANDREW C. HAIGH, RONALD INGALLS, and LUTHER M. NOSS.

1. *Theory Practice of Music.* Assistant Professor Noss. T Th 2.
5. *The Art of Music.* Professor WEAVER. M W F 10.
10. *History of Music.* Professor WEAVER. T Th 11.
20. *Harmony, First Year.* Assistant Professor Noss. M W F 12.
21. *Harmony, Second Year.* Assistant Professor Noss. M W F 9.
24. *Counterpoint.* Assistant Professor HAIGH. T Th 9.

25. *Double Counterpoint, Canon and Fugue.* Assistant Professor HAIGH. M W F 8.

32. *Historical Survey of Piano Music.* First term. Assistant Professor HAIGH. M W F 2.

33. *Historical Survey of Orchestral Music.* Second term. Assistant Professor INGALLS. M W F 2.

40. *Composition, First Year.* Assistant Professor HAIGH. T Th S 11.

41. *Composition, Second Year.* Assistant Professor HAIGH. T Th S 9.

50. **Bach.** Second term. Professor WEAVER. T 4-6.

51. **Haydn and Mozart.** First term. Assistant Professor INGALLS. M 4-6.

60. and 61. *Applied Music* (*organ, piano, violin*). Assistant Professors NOSS, HAIGH, and INGALLS, respectively. Hours to be arranged.

Seminary in Musicology. Professor KINKELDEY. **(Music 100.)** Primarily for graduates who have the requisite reading knowledge of one or more of the important foreign languages, a fair knowledge of musical theory, and some skill in practical music. The work is intended to make the student acquainted with the accomplishments of the past and with modern methods and aims in all fields, scientific, aesthetic, and historical, of musical research and investigation. Special topics or fields of study will be selected for each term after consultation with the class.

DRAMA AND THE THEATRE

Professors A. M. DRUMMOND, W. H. STAINTON, and EDWIN NUNGEZER; *Doctor* H. A. MYERS.

The degree of Master of Fine Arts in Drama and Dramatic Production will be granted to candidates of special aptitude in the practical phases of Dramatic Production or Playwriting. Their program must include suitable studies in related Fine Arts; two years of residence will normally be required; and a major practical project in the second year will be the thesis.

THE CORNELL UNIVERSITY THEATRE provides, in its *Laboratory Theatre* division, for public presentations of the work of graduate students in Dramatic Interpretation and Acting; in its *Studio Theatre* productions, for presentation of the work in Playwriting; and in the *Summer Theatre*, an opportunity for intensive work in all phases of theatre practice. *Director of the University Theatre*, A.M. DRUMMOND; *Assistant Director*, W. H. STAINTON; *Technical Director*, J. COLBY LEWIS; *Rural Drama*, H. DARKES ALBRIGHT; *Costumes*, ELIZABETH D. WORMAN.

Dramatic Structure. Dr. MYERS. (*English* 90, T Th S 11).

The English Drama to 1642. Assistant Professor NUNGEZER. (*English* 42, M W F 11).

Shakespeare. Professor DE VANE. (*English* 46, M W F 10).

Dramatic Literature. Dr. MYERS. (*English* 150. Supplementary to English 90. T 7:30).

Dramatic Production. Assistant Professor STAINTON. (*Public Speaking* 41, first term, M W F 12).

Advanced Dramatic Interpretation and Acting. Professor DRUMMOND. (*Public Speaking* 42, Th 2-4).

Stagecraft. Assistant Professor STAINTON. (*Public Speaking* 45, second term, M W 12, T 1:40-4).

Stage Lighting. Assistant Professor STAINTON. (*Public Speaking* 45*a*. First term, T 1:40-4 or as arranged).

Stage Design and Theatre Crafts. Mr. LEWIS. (*Public Speaking* 46, throughout the year, T Th 12).

History of Theatrical Costume. Miss WORMAN. (*Public Speaking* 47, throughout the year, M W F 10).

History of the Theatre. Professor DRUMMOND. (*Public Speaking* 48. Not given in 1937-38).

Playwriting. Professor DRUMMOND. (*Public Speaking* 49*b*, T Th 12).

Dramatic Production; in relation to aesthetic principles. Professor DRUMMOND. (*Public Speaking* 66. Second term, W 2-4).

Dramatic Art. Professor DRUMMOND. (*Public Speaking* 67, M 2-4. Not given in 1937-38.)

Modern Theories of Stage Presentation. Assistant Professor STAINTON. (*Public Speaking* 68, M 2-4, or as arranged.)

Theatre Practice. Professor DRUMMOND or Assistant Professor STAINTON. (*Public Speaking* 91. Correlated with the work of The University Theatre. Throughout the year and Summer Session. Hours to be arranged.)

POETRY

Professors W. C. DEVANE, F. C. PRESCOTT, C. S. NORTHUP, B. S. MONROE, L. N. BROUGHTON, LANE COOPER, W. H. FRENCH, EDWIN NUNGEZER, and W. M. SALE.

See also courses described under English Language and Literature, p. 37.

22. *Nineteenth Century Poetry.* Three hours a week, throughout the year.
37. *Chaucer.* Three hours a week, throughout the year.
44. *Sixteenth Century Literature.* Three hours a week, throughout the year.
46. *Shakespeare.* Three hours a week, throughout the year.
50. *Seventeenth Century Literature.* Three hours a week, first term.
52. *Milton.* Three hours a week, second term.
54. *Eighteenth Century Poetry.* Two hours a week, throughout the year.
64. *Shelley.* Two hours a week, first term.
68, 69. *Victorian Literature.* Three hours a week, throughout the year.
70, 72. *American Literature.* Three hours a week, throughout the year.
80. *Contemporary Criticism.* Three hours a week, second term.

104. **Principles of Literary Criticism.** Throughout the year. Professor COOPER. W 11-12:50. Goldwin Smith 127.

A study of the chief theories of poetry, and chief kinds of literature, with illustrations drawn from writers both ancient and modern.

106. **Dante in English.** Throughout the year. Professor COOPER. M 11-12:50. Goldwin Smith 127. Given in alternate years.

Reading for the sake of literary and historical perspective, followed by a more intensive study of select cantos of the *Commedia*. A knowledge of Italian is not required.

108. **Elizabethan Seminary.** Throughout the year. Assistant Professor NUNGEZER. Room and hour to be arranged.

Studies in representative non-dramatic literature of the second half of the sixteenth century, with emphasis on significant problems.

110. **The Seventeenth Century.** Throughout the year. Professor DEVANE. Room and hour to be arranged.

A brief survey of Continental and English literature of the early Renaissance, followed by a detailed study of English literature from 1590 to 1660.

111. **A Survey of English Criticism.** Throughout the year. Professor PRESCOTT. Room and hour to be arranged.

A study of representative English writers, with special reference to the theory of poetry.

116. **Wordsworth and his Contemporaries.** Throughout the year. Professor BROUGHTON. M 4-6. Goldwin Smith 338.

First term: a detailed study of the works of Wordsworth and their influence on contemporary English thought and literature. Second term: the contemporaries of Wordsworth.

136. **Victorian Poetry.** Throughout the year. Professor DEVANE. Room and hour to be arranged.

LANGUAGES AND LITERATURES

THE CLASSICS

Professors C. L. DURHAM, H. L. JONES, HARRY CAPLAN, and JAMES HUTTON, Dr. C. C. GREENE, and Mr. F. O. WAAGÉ.

Approved Major and Minor Subjects (key to symbols on p. 29)

Latin Language and Literature **1,2**
Latin Literature **2,3,4**
Latin Language **3,4**
Vulgar Latin **3,4**
Mediaeval Latin Literature **3,4**
Classical Rhetoric (in translation) **3,4**
Greek Language and Literature **1,2**
Greek Literature **2,3,4**
Greek Language **3,4**
Comparative Indo-European Linguistics **1,3,4**
Classical Archaeology **1,2,3,4**
Greek Archaeology **2,3,4**
Roman Archaeology **2,3,4**

Admission to graduate study in a subject included in the group of the Classics, except in Archaeology, assumes a knowledge of the field selected equivalent in general to that expected of a student who has pursued the subject concerned throughout four years of undergraduate study in a college of recognized standing.

Graduate work in the Classics is conducted in the main by the seminary system, the object of which is training in the methods, the principles, and the performance of independent research and criticism, and the work is therefore as far as possible put into the hands of the students themselves. Subjects other than those investigated in one of the seminaries of the year are ordinarily presented by courses of lectures.

Two seminary rooms in the Library Building are reserved for the exclusive use of graduate students in the Classics. In addition to the various complete sets of philological and of archaeological journals and standard works of reference in these rooms, the general University Library is at the disposal of the graduate students; stack permits are available when required, and special collections of books can be transferred from the general library to the seminary rooms when needed.

Two fellowships in Greek and Latin are awarded annually.

The income of the Charles Edwin Bennett Fund for Research in the Classical Languages is used each year in the way best suited to promote the object for which the fund was established.

Doctoral dissertations of an appropriate nature will be accepted for publication in the *Cornell Studies in Classical Philology.*

GREEK

1a. *Greek for Beginners.* Introduction to Homer's Iliad. Three hours a week, both terms.

1b. *Homer's Iliad.* Continuation of Greek 1a. Three hours a week, both terms.

2a. *Attic Greek. Plato, Selected Dialogues.* Three hours a week, both terms.

2b. *Euripides, Iphigenia in Tauris* and *Alcestis; New Testament, Selections.* Three hours a week, both terms.

5. *Greek Composition.* One hour a week, throughout the year.

7. *Greek Myths.* Illustrated lectures. First term, two hours a week.

8. *Illustrated Lectures on Ancient Greece and Greek Life.* Second term, two hours a week.

17. **Aristophanes, Clouds; Sophocles, Oedipus Rex, Antigone.** Throughout the year. Prerequisite, Greek 2b. Professor CAPLAN. T Th S 11. Goldwin Smith 124.

20. **Lyric Poetry; Aeschylus, Prometheus Vinctus; Theocritus; Demosthenes, Philippics.** Throughout the year. Prerequisite, Greek 17. Professor CAPLAN. T Th S 10. Goldwin Smith 124.

[22. **Plato, the Republic; Pindar, Selected Odes; Thucydides.** Throughout the year. Prerequisite, Greek 20. Not given in 1937-38.]

25. **Advanced Greek Composition.** Second term. Prerequisite, Greek 5. Professor JONES. Th 2. Goldwin Smith 124.

33. **Seminary. Greek Rhetoric and Oratory.** Professor CAPLAN. W 2. Goldwin Smith 121.

[40. **Seminary. The Greek Anthology.** Development of the Epigram and of related literary forms; history of the collections. Assistant Professor HUTTON. Not given in 1937-38.]

[41. **Seminary. Strabo; or Homeric Geography.** Professor JONES. Not given in 1937-38.]

See also readings in GREEK PHILOSOPHY (under PHILOSOPHY), INDO-EUROPEAN PHILOLOGY (under LATIN), METHODS OF LITERARY AND LINGUISTIC STUDY, AND PRINCIPLES OF LITERARY CRITICISM (under COMPARATIVE STUDY OF LITERATURE), and ANCIENT HISTORY (under HISTORY).

ARCHAEOLOGY AND ANCIENT ART

Mr. WAAGÉ.

1. *History of Greek Sculpture.* Three hours a week, first term.
2. *Art of the Roman Empire.* Three hours a week, first term.
[3. *Ancient Art.* Three hours a week, first term. Not given in 1937-38.]
4. *Ancient Painting.* Two hours a week, first term.
[5. *History of Ancient Coins.* Two hours a week, first term. Not given in 1937-38.]

101. **Pausanias and the Topography of Greece with special reference to Athens.** Mr. WAAGÉ. Goldwin Smith 35.

102. **Problems in Classical Archaeology.** Mr. WAAGÉ. Goldwin Smith 35.

LATIN

1a. *Freshman Course: For Students Offering Three Units of Entrance Latin.* Ovid; Virgil; Horace, Odes and Epodes. Three hours a week, both terms.

1. *Freshman Course: For Students Offering Four Units of Entrance Latin.* Cicero, De Senectute; Martial, Epigrams; Horace, Odes and Epodes. Three hours a week, both terms.

3. *Sight Translation.* One hour a week throughout the year.

8. *Terence; Catullus; Horace, Satires and Epistles; Tacitus, Agricola; Livy; Seneca, Epistles.* Three hours a week throughout the year.

11. *Survey of Roman Literature,* with interpretation of representative selections. Two hours a week, second term.

12. *Epic Poetry: Ennius; Virgil, Georgics, The Last Six Books of the Aeneid.* Two hours a week, first term.

[16. *The Greater Republican Writers.* Throughout the year. Plautus; Cicero; Lucretius. Not given in 1937-38.]

17. **Literature and History of the Early Empire.** Throughout the year. Assistant Professor HUTTON. T Th S 9. Goldwin Smith 128.
Tacitus: Annals; Juvenal; Pliny's Letters; Suetonius.

21. *Latin Writing, Elementary Course.* One hour a week throughout the year.

26. *Teachers' Training Course.* Second term. Professor DURHAM. M W 12. Goldwin Smith 128.

[27. *Topography and Architectural Remains of Rome.* Not given in 1937-38.]

[41. **Seminary. Horace.** Professor CAPLAN. Not given in 1937-38.]

42. **Seminary. Plautus.** Throughout the year. Professor DURHAM. T 2. Library, Classical Seminary Room.

45. **Latin Writing, Advanced Course.** Throughout the year. Dr. GREENE. M 2. Goldwin Smith 128.

47. **Historical Latin Syntax.** Second term. Professor DURHAM. M W 12. Goldwin Smith 128.

[48. **Vulgar Latin: Petronius, Cena Trimalchionis; Vulgar Latin Inscriptions, including Christian Inscriptions.** Professor DURHAM. Not given in 1937-38.]

[49. **Indo-European Philology; Sounds and Flexions of Latin; Italic Dialects.** Professor DURHAM. Throughout the year. Not given in 1937-38.]

50. **Latin Epigraphy.** First term. Professor DURHAM. M W 12. Goldwin Smith 128.

COMPARATIVE STUDY OF LITERATURE

Professor LANE COOPER (*Professor of the English Language and Literature*) and *Assistant Professor* JAMES HUTTON (*Professor of the Classics*).

Approved Major and Minor Subjects (key to symbols on p. 29)

Dante **1, 2, 3, 4**
English Language and Literature **1, 2, 4**
Literary Criticism **1, 2, 3, 4**
Old and Middle English **1, 2, 3, 4**
Writers on Art **2, 3, 4**

Once the usual demands for entrance into the Graduate School are satisfied, no particular requirement but special fitness is made of candidates for an advanced degree who desire entrance into this field of work, which is closely related to English Philology in the broad sense of the term. Philology is here taken to mean the conjoint study of language and literature. The candidate must evince some special fitness for either the literary or the linguistic side of the work, but in any case must not be deficient in literary appreciation. He will have opportunity to prove his worth in the first year of graduate study. In general, one year of satisfactory graduate work is enough for the degree of Master of Arts. Students who are permitted to advance toward the doctoral degree commonly expect to receive it after two years more—but the attainment of the doctorate in three years must not be regarded as a fixed rule. The work for both degrees will be adapted to the needs and purposes of the individual candidate; great care will be taken to find a suitable subject for the "thesis." The work is in the main designed to develop good scholars and effective teachers for colleges and universities.

Apart from a broad culture, however attained, the best foundation for this work is undergraduate study of the classics. Those who wish to be candidates should use every opportunity to improve their acquaintance with Greek and Latin literature, whether in the original or through translations, and with mediaeval literature—for example, in Old and Middle English, which had best be begun before the first year of graduate work. The graduate student must bring a love of good literature with him, and not expect to acquire it at a late date, for his special studies now presuppose that love. In general, a good candidate is one who has been drawn to read the best books, and has read them, from the age of eight or ten years on, and who has had a broad and sound course of study as an undergraduate. This course should have included one satisfactory year of French, at least two years of German, and a fair amount of Latin. For those who have not had Greek in the preparatory school, it is desirable to begin it as early as the Sophomore year in college; but it may be begun later; and candidates who have not studied the Greek language will not be rejected on that account. A student who has had a broad general culture, and has done very well in classics, history, biology, or mathematics, may expect to succeed in the comparative study of literature.

Good doctoral dissertations will be accepted for publication in the *Cornell Studies in English.*

27. *Modern Writers on Art.* Throughout the year, three hours a term.

28. *English Translations of Greek and Latin Classics.* Throughout the year, three hours a term.

105. *General Reading.* First term. Three hours.

[103 a. **Old English.** First term. Professor COOPER. Given in alternate years, not in 1937–38.]

103 b. **Middle English.** Second term. Professor COOPER. M W F 10. Goldwin Smith 127.

A study of the foundations of the English language and literature, with emphasis upon the chief writers of the fourteenth century, especially Chaucer, and upon their relations to Blake, Wordsworth, Kipling, and others. Some attention is paid to literary species, and to earlier and later translations of the Bible.

104. **Principles of Literary Criticism.** Throughout the year. Professor COOPER. W 11-12:50. Goldwin Smith 127.

A study of the chief theories of poetry, and chief kinds of literature, with illustrations drawn from writers both ancient and modern. This and the following courses are mainly designed for prospective college and university teachers.

106. **Dante in English.** Throughout the year. Professor COOPER. M 11-12:50. Goldwin Smith 127. Given in alternate years.

Reading for the sake of literary and historical perspective, followed by a more intensive study of select cantos of the *Commedia.* A knowledge of Italian is not required.

[107. **Methods of Literary and Linguistic Study.** Throughout the year. Professor COOPER. Given in alternate years, not in 1937-38.]

Reading in the *Encyklopädie* of August Boeckh, followed by a study of more recent treatises with special reference to the ancient classics and English.

109. **Chaucer Seminary.** Throughout the year. Professor COOPER. Tuesday, 7:30 p. m. English Seminary Room.

A survey of books and topics that are essential to the study of Chaucer and his age; systematic reading of his works; a detailed examination of significant problems.

ENGLISH LANGUAGE AND LITERATURE

Professors W. C. DEVANE, F. C. PRESCOTT, C. S. NORTHUP, LANE COOPER, B. S. MONROE, L. N. BROUGHTON, F. M. SMITH, W. H. FRENCH, EDWIN NUNGEZER, E. A. TENNEY and W. M. SALE, and *Doctors* J. C. ADAMS and H. A. MYERS.

Approved Major and Minor Subjects (key to symbols on p. 29)

American Literature **1, 2, 3, 4**
Chaucer and his Contemporaries **1, 2, 3, 4**
Dramatic Literature **1, 2, 3, 4**
Eighteenth Century Literature **1, 2, 3, 4**
Elizabethan Literature **1, 2, 3, 4**
English Prose Fiction **1, 2, 3, 4**
Literary Theory **1, 2, 3, 4**
Middle English **1, 2, 3, 4**
Old English **1, 2, 3, 4**
Seventeenth Century Literature **1, 2, 3, 4**
The English Drama **1, 2, 3, 4**
The English Language **1, 2, 3, 4**
The Romantic Period **1, 2, 3, 4**
Victorian Literature **1, 2, 3, 4**

The contents of these fields will vary, according as they are chosen for majors or minors and for the master's degree or the doctor's degree.

For their first term of residence, students need only designate their fields as American Literature, English Literature, or English Language. In subsequent terms they will designate them substantially as above.

Among the books available to the student are complete sets of the publications of the Early English Text, Chaucer, Scottish Text, Percy, English Dialect, Shakespeare, New Shakspere, Spenser, Philological, Malone, and other societies; of the Arber, Bullen, Grosart, and Farmer reprints; and of all the important periodicals dealing with the English language and literature. Most of the American and foreign dissertations on English subjects, standard and other editions of individual authors, English and American, and several special collections are also in the Library, which is exceptionally rich in Old and Middle English and in the Elizabethan and Victorian periods. The Hart Memorial Library, founded by the late Professor James Morgan Hart, contains about four thousand seven hundred and fifty volumes, including valuable collections in the bibliography of English philology. This library, in Goldwin Smith Hall, is for the use of graduate students and members of the Faculty. The Department has also a seminary room in the University Library. *Cornell Studies in English*, a series of monographs issued by the Department, affords some opportunity for the publication of work accomplished by graduates as well as by members of the staff. Twenty-seven numbers have appeared.

Candidates for an advanced degree may take their major subject in literature or in language. In general, thirty-three hours of college English are required before a student may enter upon candidacy for an advanced degree. Work in philosophy, history, and languages, ancient and modern, may, at the discretion of the candidate's Special Committee, be counted against a shortage in undergraduate English. Training in the Greek and Latin literatures is especially desirable as preparation for graduate work in English. All candidates must have a reasonable familiarity with Old and Middle English; must have a general knowledge of English literature and English history; and must accomplish satisfactory work in research. Candidates for the Master's degree must have sufficient knowledge of French or German to make use of scholarly works in one of those languages, and candidates for the Doctor's degree must have a similar knowledge of both French and German, and a reading knowledge of Latin.

One fellowship of the value of $600 is awarded annually to a graduate student in English. The holder of the fellowship is exempt from the payment of tuition. The fellowship is ordinarily awarded only to an applicant who has had one year or more of graduate study.

22. *Nineteenth Century Poetry.* Three hours a week, throughout the year.
27. *Modern Writers on Art.* Three hours a week, throughout the year.
28. *English Translations of Greek and Latin Classics.* Three hours a week, throughout the year.
32. *Old English.* Three hours a week, throughout the year.
37. *Chaucer and his Age.* Three hours a week, throughout the year.
38. *Middle English Metrical Romances.* Two hours a week, second term.
39. *Medieval Legend and Romance.* Three hours a week, second term.
42. *The English Drama to 1642.* Three hours a week, throughout the year.
44. *Sixteenth Century Literature.* Three hours a week, throughout the year.
46. *Shakespeare.* Three hours a week, throughout the year.
50. *Seventeenth Century Literature.* Three hours a week, first term.
52. *Milton.* Three hours a week, second term.
54. *Eighteenth Century Poetry.* Two hours a week, throughout the year.
56. *Eighteenth Century Prose.* Three hours a week, throughout the year.
57. *The Eighteenth Century Novel.* Three hours a week, throughout the year.
58. *Biography.* Two hours a week, throughout the year.
64. *Byron and Shelley.* Two hours a week, first term.
66. *Early Nineteenth Century Novel.* Three hours a week, second term.
68, 69. *Victorian Literature.* Three hours a week, throughout the year.
70, 72. *American Literature.* Three hours a week, throughout the year.
74. *The English Language.* Two hours a week, second term.
76. *English Usage and Style.* Three hours a week, throughout the year.

78. *Short Story Writing.* Three hours a week, throughout the year.
80. *Contemporary Criticism.* Three hours a week, second term.
85. *Modern Poetry.* Three hours a week, throughout the year.
90. *Dramatic Structure.* Three hours a week, throughout the year.
95. *Myths in English Literature.* Two hours a week, second term.
99. *Oral Expression for Teachers.* Three hours a week, throughout the year.

100. **Bibliography and Method:** an introduction to Graduate Research in English. First term. Professor NORTHUP. T Th 12. Goldwin Smith 338.

A survey of the bibliography of the English language and literature; practice in compiling special bibliographies in the student's chosen field; some attention to paleography; the technique of textual study; critical study of scholarly articles and monographs; practice in assembling and organizing data for scholarly papers; values in evidence. Recommended for all students entering upon graduate study.

101. **Old English Literature.** Either term. Professor MONROE. T Th 3, or other hours to be arranged. Goldwin Smith 162.

Reading of selected Old English works including *Beowulf* or some of the Cynewulfian poetry; studies in textual criticism and in style and metre; supplementary reading.

104. **Principles of Literary Criticism.** Throughout the year. Professor COOPER. For details see Comparative Study of Literature.

105. *General Reading.* First term. Professor COOPER. For details see Comparative Study of Literature.

106. **Dante in English.** Throughout the year. Professor COOPER. For details see Comparative Study of Literature.

[107. **Methods of Literary and Linguistic Study.** Throughout the year. Professor COOPER. For details see Comparative Study of Literature. Not given in 1937-38.]

108. **Elizabethan Seminary.** Throughout the year. Assistant Professor NUNGEZER. Room and hour to be arranged.

Studies in representative non-dramatic literature of the second half of the sixteenth century, with emphasis on significant problems.

109. **Chaucer Seminary.** Throughout the year. Professor COOPER. For details see Comparative Study of Literature.

110. **The Seventeenth Century.** Throughout the year. Professor DEVANE. Room and hour to be arranged.

111. **Poetic Theory and Criticism.** Throughout the year. Professor PRESCOTT. Room and hour to be arranged.

A study, mainly historical, of English critical ideas and their sources in other literatures.

116. **Wordsworth and His Contemporaries.** Throughout the year. Professor BROUGHTON. M 4-6. Goldwin Smith 338.

First term: a detailed study of the works of Wordsworth and their influence on contemporary English thought and literature. Second term: the contemporaries of Wordsworth.

120. **The Age of Johnson.** Throughout the year. Professor SALE. Room and hour to be arranged.

A seminary in the literature of the late eighteenth century. Reports, discussions, and conferences.

130. **Studies in the Romantic Movement.** Throughout the year. Dr. GUSTAFSON. Room and hour to be arranged.

A study in the origins and development of certain typical romantic ideas and moods such as medievalism, Orientalism, romantic melancholy, the cult of *le moi*, and primitivism. Particular attention given to the relation between English romantic tendencies and the romanticism of the Continent.

135. **Nineteenth Century Fiction.** Throughout the year. Professor NORTHUP. Th 4-6. Goldwin Smith 220.

Studies in the development of the novel from Scott to Galsworthy.

136. **Victorian Poetry.** Throughout the year. Professor DEVANE. Room and hour to be arranged.

137. **Middle English Literature.** Throughout the year. Professor NORTHUP. M W 10. Goldwin Smith 338.

Studies of important poetry and prose from the Conquest to Malory and of leading problems needing research.

140. **American Literature.** First term. Professor PRESCOTT. Room and hour to be arranged.

Emerson, Thoreau, and Whitman, and their relation to New England Transcendentalism.

141. **The English Language.** Throughout the year. Professor MONROE. W 3, or other hours to be arranged. Goldwin Smith 162.

A study of selected topics either independently or in connection with other courses in language and literature.

146. **Shelley.** Second term. Professor PRESCOTT.

A study of Shelley's poetical and prose works in relation to his life and time.

150. **Dramatic Structure.** Throughout the year. Dr. MYERS. W 7:30. Goldwin Smith 159.

A study of dramatic history and theory, with reading of representative plays. This course is supplementary to English 90, Dramatic Structure, which should precede or accompany it.

GERMANIC LANGUAGES AND LITERATURES

GERMAN

Professors A. B. FAUST, A. W. BOESCHE, P. R. POPE, and A. L. ANDREWS.

Approved Major and Minor Subjects (key to symbols on p. 29)

German Literature **1, 2, 3, 4**
German Philology **1, 2, 3, 4**

In the advanced courses in this subject the work is twofold, literary and philological. The history of German literature from the earliest period to the present day is sketched in outline lecture courses with collateral reading. Special topics are selected for detailed study such as the epic and lyric poetry of the Middle High German period, the literature of the Reformation, the classical period, the drama of the nineteenth century, and contemporary literature. The courses offered in philology include the study of Gothic and of Old and Middle High German. They also afford an introduction to the science of language.

The seminaries in German literature and philology aim to impart the principles and methods of investigation. A teachers' course deals with class-room methods and theories of instruction in the modern languages.

All the work in German is greatly facilitated by an exceptional library equipment. The nucleus was formed by the acquisition of the Zarncke library, one of the largest collections of rare books for the study of German literature and philology ever brought to America. With constant enlargements the library has become one of the most serviceable in the country. The German seminary room in the University Library contains books for ready reference, including philological journals and reviews.

Candidates for advanced degrees in German are expected to have an adequate knowledge of French and Latin. A fellowship in German is awarded annually.

1. *Course for Beginners.* Six hours a week. Repeated in second term.
1a. *Course for Beginners.* Three hours a week. Throughout the year.
1b. *Course for Chemists.* Three hours a week. Throughout the year.
3. *Intermediate Course.* Five hours a week. Repeated in second term.
3a. *Intermediate Course.* Three hours a week. Throughout the year.
4. *Elementary German Composition and Conversation.* Three hours a week. Throughout the year.
5. *Rapid Reading Course.* Three hours a week. Throughout the year.

6. *German Civilization.* Two hours a week. Second term.
7. *Reading and Composition.* Six hours a week. Second term.
8. *Scientific German.* Three hours a week. Second term.
10. *Advanced German Composition and Conversation.* Three hours a week. Throughout the year.

[11. *Schiller's Dramas.* Three hours a week, first term. Not given in 1937-38.]

12. *Schiller's Poems.* Three hours a week, second term.
13. *Goethe's Life and Works.* Three hours a week, first term.
14. *Goethe's Faust.* Three hours a week, second term.
15. *Survey of German Literature.* Three hours a week, both terms.

[17. *Nineteenth Century Drama.* Three hours a week, second term. Not given in 1937-38.]

18. *Lessing's Life and Works.* Three hours a week, second term. Given in alternate years.

[25. *Wagner's Life and Works.* Three hours a week, first term. Not given in 1937-38.]

[40. *Teachers' Course in Methods.* Two hours a week, second term. Not given in 1937-38.]

16. **Contemporary German Literature.** First term. Credit three hours. Prerequisite, German 1-5, or the equivalent. Professor FAUST.

A study of the literature of Modern Germany since 1880, including foreign influences. Lectures in German, collateral readings, reports, and investigations.

[30. **Der deutsche Einschlag in der Bevölkerung der Vereinigten Staaten. Geschichtliche Entwickelung und Bedeutung im Aufbau des amerikanischen Volkes. Kulturelle und literarische Beziehungen.** First term. Prerequisite, German 15, or the equivalent. Professor FAUST. Three hours a week. Given in alternate years, not in 1937-38.]

Lectures in German; collateral reading in German.

37. **Middle High German.** Both terms. Prerequisites, German 10 and six hours of literature. Professors ANDREWS and POPE. Three hours a week.

42. **Gothic.** First term. Professor BOESCHE. Three hours a week.

Streitberg's *Gotisches Elementarbuch* and *Die Gotische Bibel*, ed. by Streitberg. This course will serve as a general introduction to Germanic philology.

43. **Old High German.** Second term. Prerequisite, German 37. Professor BOESCHE. Three hours a week.

Braune's *Althochdeutsche Grammatik* and *Althochdeutsches Lesebuch.* A study, mainly linguistic, of the oldest German texts. It should be preceded by the course in Gothic.

[47. **Germanic Antiquities.** Second term. Prerequisite, Gothic. Professor ANDREWS. One hour a week. Given in alternate years, not in 1937-38.]

A consideration of the sources of knowledge of the Germanic people up to and including the migrations.

48. **Principles of Germanic Philology.** Second term. Professor ANDREWS. Two hours a week.

A discussion of the fundamental principles of linguistic relationships within the old Germanic dialects. Lectures and illustrative problems. This course should be preceded by those in Gothic and Old High German.

49, 50. **Seminary in German Literature.** Two hours a week. First term, Professor FAUST; second term, Professor POPE. Th 3-5. Goldwin Smith 181.

A study of special literary problems, as: Der junge Goethe; Goethe's *Faust* II; Lessing's *Hamburgische Dramaturgie*; the "Sturm und Drang" Period; German-American Literature; Problems in German Literature since 1880; Methods of Approach in the Study of German Literature.

52. **Seminary in German Philology.** Second term. Professor BOESCHE. Two hours a week.

A detailed study of early German texts such as the smaller Old High German poems, or of questions in Historical German Syntax.

Scandinavian Languages and Literatures

Professor Halldor Hermannsson.

Approved Major and Minor Subjects (key to symbols on p. 29)

Danish, Norwegian, Swedish Literature **3, 4**
Modern Icelandic Literature **2, 3**
Old Norse-Icelandic Language and Literature **1, 2**
Old Norse-Icelandic Literature **2, 3, 4**

The Fiske Icelandic Collection of the University Library, comprising about 20,000 books and pamphlets, offers excellent facilities for advanced work in Old Norse-Icelandic language and literature, Norse mythology and heroic legends, runology, and early Scandinavian history, as well as in Modern Icelandic language and literature. The library also has a small collection of books on the other modern Scandinavian languages and literatures to which some additions are made annually.

1. **Old Icelandic.** Throughout the year. T Th S 11. Library, Greek and Latin Seminary.

2. **Modern Icelandic.** Second term. Three hours a week. Hours to be arranged.

3. **Danish and Dano-Norwegian.** First term. Three hours a week. Hours to be arranged. Given in alternate years.

[4. **Swedish.** First term. Three hours a week. Given in alternate years, not in 1937-38.]

5. **Old Norse-Icelandic Literature.** Second term. Two hours a week. W F 12.

[6. **Modern Scandinavian Literature.** Second term. W F 12. Given in alternate years. Not given in 1937-38.]

[7. **Early Scandinavian Civilization and History.** Second term. Two hours a week. Given in alternate years, not in 1937-38.]

Lectures dealing especially with Old Norse mythology and the Viking Age.

RHETORIC AND PUBLIC SPEAKING; DRAMA AND THEATRE

Professors A. M. Drummond, G. B. Muchmore, H. A. Wichelns, Harry Caplan, W. H. Stainton, R. H. Wagner, and C. K. Thomas; *Doctor* H. D. Albright.

Approved Major and Minor Subjects (key to symbols on p. 29)

Division of Rhetoric and Public Speaking

Classical Rhetoric **3, 4**
History of Public Address **3**
Medieval Rhetoric **3, 4**
Principles of Public Address **3**
Rhetoric and Public Speaking **1, 2, 4**

Division of Dramatic Production

Drama and the Theatre **1**
Dramatic Production **2, 3, 4**
Playwriting **2, 3, 4**
Theatre Techniques **2, 3, 4**

Division of Phonetics

Speech and Phonetics **2, 3, 4**

The chief aim of graduate work in rhetoric and in dramatic production is to develop competent investigators and teachers for colleges and universities.

Candidates should have the background of a thorough undergraduate course centering in literature, history, and philosophy; should be able to speak and write

good English; should have reasonable proficiency in public speaking and reading; and should be conversant with the literature of their chosen field. Candidates for the Master's degree should have a reading knowledge of French or of German; candidates for the Doctor's degree must, before admittance to candidacy, demonstrate their ability to make use of French and of German. Applicants are advised to enter into correspondence as to their qualifications well in advance of the date at which they propose to begin residence.

All candidates must attain a reasonable knowledge of speech training and phonetics; must acquire a specialist's knowledge of the literature and history of their chosen field, and must accomplish satisfactory work in research. In most cases, the work will require more than the minimum periods of residence. For the Doctor's degree, residence in this University during two academic years will be necessary.

Properly qualified students may select Speech Training and Phonetics as a major subject for the Master's degree; as a minor subject for either degree.

Candidates for the Doctor's degree whose major interest is in Rhetoric, that is, in the principles, history, and criticism of public address, will be advised to make English Literature one of their minor subjects.

Candidates for the Doctor's degree whose major interest is in Drama and the Theatre will be required to take Dramatic Literature as a minor subject, unless they have already pursued systematic study in this field, and such candidates must expect to be in residence two years and one summer beyond the requirements for the Master's degree.

Candidates for the Master's degree in Dramatic Production will require at least one academic year and one summer session of residence.

The degree of Master of Fine Arts in Drama will be granted to candidates showing special aptitude in the practical phases of Dramatic Production or Playwriting. Their program must include suitable studies in related Fine Arts; two years of residence will normally be required; and a major practical project in the second year will be the thesis.

Opportunities for theatre practice of which students will be expected to avail themselves are afforded by various branches of THE CORNELL UNIVERSITY THEATRE, as follows: in the *Laboratory Theatre*, for public presentations of the work of graduate students in Dramatic Interpretation and Acting; in the *Studio Theatre*, for production of the work in Playwriting; and in the *Summer Theatre*, for intensive work in all phases of theatre practice. *Director of the University Theatre*, A. M. DRUMMOND; *Assistant Director*, W. H. STAINTON; *Technical Director*, J. COLBY LEWIS; *Rural Drama*, H. D. ALBRIGHT; *Costumes*, ELIZABETH D. WORMAN.

13. **Advanced Argumentation.** Second term. Assistant Professor WAGNER. M W F 11. Goldwin Smith 236.

[15. **Advanced Public Speaking.** Assistant Professor MUCHMORE. Not given in 1937-38.]

16. **Forms of Public Address.** Second term. Professor WICHELNS. T Th 10 and an hour to be arranged. Goldwin Smith 236.

21. **History of Rhetoric and Oratory.** Throughout the year. Professor WICHELNS. M W F 10. Goldwin Smith 236.

23. **Classical Rhetoric.** First term. Assistant Professor WAGNER. Th 2-4. Goldwin Smith 241.

A study, in English translation, of Greek and Latin theories of public address with illustrations from ancient and modern speeches.

24. **Public Opinion and the Method of Argument.** Second term. Professor WICHELNS. T 11, Th 11-1. Goldwin Smith 234.

Modern theories of public discussion, mass persuasion, and opinion control.

25. **British Rhetoric and Oratory.** Second term. Assistant Professor WAGNER. Th 2-4. Goldwin Smith 245.

[27. **American Rhetoric and Oratory.** Professor WICHELNS. Not given in 1937-38.]

30. *Phonetics and Speech Training.* First term. Assistant Professor THOMAS. M W F 9.

[31. **Advanced Phonetics and Speech Training.** First term. Assistant Professor THOMAS. Not given in 1937-38.]

32. **Principles of Speech Correction.** First term. Assistant Professor THOMAS. Hours to be arranged.
Study of principles correlated with supervised practice in the Speech Clinic.

41. **Dramatic Production: Direction.** First term. Assistant Professor STAINTON. M W F 12. Morse, Stage Laboratory.
Dramatic interpretation and the related principles of stage direction and production.

42. **Advanced Dramatic Interpretation and Acting.** Throughout the year. Professor DRUMMOND. Th 2-4. Goldwin Smith 242.
A practical course in direction, rehearsal, and acting, leading to public presentations in the Laboratory Theatre; special attention to oral interpretation.

45. **Dramatic Production: Stagecraft.** Second term. Assistant Professor STAINTON. M W 12. Laboratory, T 1:40-4, or as arranged. Morse, Stage Laboratory.
Stage production; problems and practice in construction and design.

45a. **Dramatic Production: Stage Lighting.** First term. Assistant Professor STAINTON. T 1:40-4, or as arranged. Morse, Stage Laboratory.

46. *Stage Design and Theatre Crafts.* Throughout the year. Mr. LEWIS. T Th 12.

47. *History of Theatrical Costume.* Throughout the year. Miss WORMAN. M W F 10.

[48. **History of the Theatre.** Professor DRUMMOND. Not given in 1937-38.]

49b. **Playwriting.** Throughout the year. Professor DRUMMOND. T Th 12. Goldwin Smith 242.

[51. **Problems and Methods.** Professor DRUMMOND. Not given in 1937-38.]

91. **Theatre Practice.** Throughout the year and Summer Session. Professor DRUMMOND or Assistant Professor STAINTON. Hours to be arranged.
Projects correlated with the work of the University Theatre.

Greek Rhetoric and Oratory. Professor CAPLAN. See Greek 33.

Dramatic Literature. See English 42, 46; and especially English 90, Dr. MYERS.

Fine Arts. See especially Architecture 425, 072; Philosophy 8a, 8b; Music 5, 10.

Seminary Courses

60. **Rhetorical Criticism.** First term. Professor WICHELNS. Th 2-4. Goldwin Smith 235.

[62. **Philosophy of Rhetoric.** Professor WICHELNS. Not given in 1937-38.]

63. **Speech Training.** First term. Assistant Professor THOMAS. Hours to be arranged.
General Phonetics; methods of speech improvement; theory of voice and speech.

66. **Theories of Dramatic Production.** Second term. Professor DRUMMOND. W 2-4. Goldwin Smith 242.
The chief theories of dramatic production in relation to aesthetic principles.

[67. **Dramatic Art.** Professor DRUMMOND. Not given in 1937-38.]

68. **Modern Theories of Stage Presentation.** Assistant Professor STAINTON. M 2-4, or as arranged. Goldwin Smith 242.

Dramatic Literature. See especially English 150. Dr. MYERS.

ROMANCE LANGUAGES AND LITERATURES

Professors J. F. MASON, G. L. HAMILTON, LAURENCE PUMPELLY, G. I. DALE, and M. G. BISHOP.

Approved Major and Minor Subjects (key to symbols on p. 29)

Contemporary French Literature **3, 4**
General History of French Literature **3, 4**
French Language **1, 2, 3, 4**
French Literature **1, 2**
French Philology **1, 2, 3, 4**
French Literature of the Sixteenth Century **3, 4**
French Literature of the Seventeenth Century **3, 4**
French Literature of the Romantic Period **3, 4**
Medieval French Literature **3, 4**
Modern French Literature **3, 4**
Italian **1, 2, 4**
Spanish Language **1, 2, 3, 4**
Spanish Literature **1, 2, 3, 4**
Spanish Philology **1, 2, 3, 4**
Spanish Literature of the Renaissance **1, 2, 3, 4**
Spanish Literature of the Golden Age **1, 2, 3, 4**
Modern Spanish Literature **1, 2, 3, 4**
Spanish Literature of the 18th Century **3, 4**
Spanish Literature of the 19th Century **3, 4**

The collection of French and Spanish books in the University Library is very large, and offers excellent facilities for advanced work. Objects of special pride are the unrivalled Dante and Petrarch collections, the gift of the late Willard Fiske, who likewise presented to the University a unique collection of Rhaeto-Romance works. Smaller collections of Portuguese, Provençal, and Catalan books are also to be found in the University Library. The seminary library contains several thousand volumes including many sets of bound periodicals. A university fellowship in Romance languages (of the value of $400 and free tuition) is annually awarded. This fellowship is ordinarily awarded only to an applicant who has had one year or more of graduate study.

The courses of study in this department are divided into three categories: those intended primarily for undergraduates, those intended alike for undergraduates and graduates, and those intended primarily for graduates. All candidates for advanced degrees in this department must possess a thorough reading knowledge of Latin, French, and German, before announcing their candidacy. A graduate student in Romance languages should have completed some formal course of study in the language and literature of the language which he intends to select as his major subject, and should have adequate preparation for advanced work in his minor subjects.

A candidate for the degree of Master of Arts whose major subject is in Romance languages is expected to present for the approval of the chairman of the Special Committee, within two weeks after registration day, an outline of the work planned for the year. The thesis must, before May 1, be submitted for the criticism of the chairman of the candidate's Special Committee. If not already taken, a course in the philology of the language which constitutes their major subject is required of graduate students in their first year of study.

Candidates for the degree of Doctor of Philosophy are expected to follow advanced courses given in the field in which their major subject lies and to take up such work as will give a comprehensive view of the fields in which their minor subjects lie. It is intended that the last year of preparation for this degree shall be spent chiefly upon the thesis. Further information may be obtained from the professors in this department.

FRENCH

Professors MASON, HAMILTON, PUMPELLY, and BISHOP.

16. *History of French Literature.* Throughout the year.

17. *Literature of the Seventeenth Century.* Throughout the year.

[18. *Literature of the Eighteenth Century.* Throughout the year. Not given in 1937-38.]

[19. *The Romantic Movement in French Literature.* Throughout the year. Not given in 1937-38.]

20. *Modern French Literature.* Throughout the year.

[21. *Contemporary French Literature.* Throughout the year. Not given in 1937-38.]

23. **French Historical Grammar.** First term. Prerequisite, one year of Latin. Professor PUMPELLY. T Th 10. Goldwin Smith 283.

Lectures on the historical development of French from its origins to the present. Primarily for students intending to teach French.

[24. **French Philology.** Throughout the year. Prerequisite, college entrance Latin or the equivalent. Professor PUMPELLY. T 10; Th 2. Goldwin Smith 277. Not given in 1937-38.]

31. **Literature of the Sixteenth Century.** Throughout the year. Professor BISHOP. T Th 12.

41. **Old French Texts.** First term. Professor HAMILTON. Hours and room to be arranged.

[43. **Old Provençal Philology and Literature.** Second term. Professor HAMILTON. Hours and room to be arranged. Not given in 1937-38.]

47. **Modern French Seminary.** Throughout the year. Professor MASON. T 2:30. Library, French Seminary.

ITALIAN

Professor HAMILTON.

4. *Italian Poetry.* Throughout the year.

15. *The Literature of the Italian Renaissance.* Second term.

SPANISH

Professor DALE.

[10. *History of Spanish Literature.* Throughout the year. Not given in 1937-38.]

[15. *Drama of the Golden Age.* First term. Not given in 1937-38.]

17. *Cervantes.* Throughout the year.

[19. *Modern Spanish Literature.* Throughout the year. Not given in 1937-38.]

[20. *Spanish Poetry.* Throughout the year. Not given in 1937-38.]

21. *Spanish Prose since 1898.* Throughout the year.

[41. **Old Spanish.** Throughout the year. Professor DALE. Library, Spanish Seminary. Not given in 1937-38.]

[42. **Calderón and Alarcón.** Throughout the year. Professor DALE. Not given in 1937-38.]

43. **The Picaresque Novel.** Throughout the year. Professor DALE. W 2:15. Library, Spanish Seminary.

SUSAN LINN SAGE SCHOOL OF PHILOSOPHY

Professors G. WATTS CUNNINGHAM, GEORGE H. SABINE, E. A. BURTT, HAROLD R. SMART, RICHARD ROBINSON, RALPH W. CHURCH.

The Susan Linn Sage School of Philosophy was founded through the generosity of the late Henry W. Sage, who endowed the Susan Linn Sage Professorship and gave in addition $200,000 to provide permanently for instruction and research in philosophy.

The *Philosophical Review*, supported by the University and issued under the auspices of the Sage School, is a bi-monthly journal devoted to the interests of philosophy, including logic, metaphysics, ethics, aesthetics, the history of philosophy, and the philosophy of religion. By the terms of its establishment, the *Review* is an absolutely free organ of philosophical scholarship, not devoted to the propagation of any doctrine. The *Cornell Studies in Philosophy* are a series of monograph studies, published from time to time under the editorial supervision of the professors of the School. They offer a channel for the publication of studies begun as dissertations for the doctorate or of other research. Seventeen monographs have been issued.

The instruction offered to graduate students presupposes such undergraduate courses in the subject as would be taken by a student in the College of Arts and Sciences of Cornell University who had elected philosophy as a major subject. Those who have not had equivalent preparation are expected to make up their deficiencies outside the work required for an advanced degree.

The Sage School provides opportunity for advanced study to two classes of graduate students: (1) those whose chief branch of research is in allied fields but who desire to supplement this with a minor in philosophy; (2) those whose major interest is in some branch of philosophy.

1. Graduate students having a major interest in literature or the arts, in history or social studies, or in mathematics or a branch of experimental science, are permitted to choose a minor in philosophy with such emphasis as best suits their needs. For such students the School endeavors to outline a plan of philosophical study (in courses or directed reading) which will form a natural supplement to their field of research.

2. Students whose major interest is in philosophy are required (a) to gain a general knowledge of the whole subject including its history, and (b) to select some aspect or subdivision of it for intensive study and research. The following subjects may be chosen as majors and minors: aesthetics, ethics, history of philosophy, logic and epistemology, metaphysics, and philosophy of religion. Students are encouraged to choose one minor in a subject other than philosophy.

The Sage School offers a Graduate Prize in Philosophy, having an annual value of about twenty-five dollars, for the best essay embodying the results of research. See page 26 above.

The School offers also three Susan Linn Sage Fellowships in Philosophy, having an annual value of $600 each. It reserves the right, however, to divide one or more of these fellowships into two scholarships of $300 each. Both scholarships and fellowships carry free tuition in the Graduate School in addition to the stipend.

PHILOSOPHY

Approved Major and Minor Subjects (key to symbols on p. 29)

Aesthetics **1, 2, 3, 4**
Ethics **1, 2, 3, 4**
History of Philosophy **1, 2, 3, 4**
Logic and Epistemology **1, 2, 3, 4**
Metaphysics **1, 2, 3, 4**
Philosophy **4**
Philosophy of Religion **1, 2, 3, 4**

1. *Philosophical Classics.* Three hours a week, both terms.

2. *Logic.* Three hours a week, second term.
3. *Problems of Philosophy.* Three hours a week, first term.
4. *Ethics.* Three hours a week, second term.
5. *History of Philosophy.* Three hours a week, both terms.
8a. *Aesthetics: Psychology of Aesthetic Perception.* Three hours a week, first term.
8b. *Aesthetics: Philosophy of Art.* Three hours a week, second term.
9. *Religious Problems in Contemporary Thought.* Two hours a week, first term.
10a. *History of Political Theory: Ancient.* Three hours a week, first term.
10b. *History of Political Theory: Modern.* Three hours a week, second term.
13. *The Philosophy of Religion.* Three hours a week, second term.
14. *History of Religions.* Three hours a week, first term.
15. *Philosophy of Science.* Three hours a week, both terms.

Introduction to Legal Philosophy. (See Government 18.)

Symbolic Logic. (See Mathematics 19.)

19. **Advanced Readings in Aesthetics.** First term, repeated in the second term. Assistant Professor CHURCH.

Readings to be selected in accordance with the interests and preparation of the student.

[20. **Contemporary Philosophy.** Throughout the year. First term, Professor BURTT; second term, Assistant Professor SMART. M W F 11. Goldwin Smith 220. Not given in 1937-38.]

Main tendencies of contemporary philosophy, especially British and American.

25. **Plato and Aristotle.** Throughout the year. Assistant Professor ROBINSON. Hours to be arranged. Goldwin Smith 220.

28. **Ethical Theory.** First term. Professor SABINE. T Th S 11. Goldwin Smith 220.

A rapid reading of examples of the main types of modern ethical theory.

29. **The Philosophy of Value.** Second term. Assistant Professor CHURCH. M W F 12. Goldwin Smith 220.

A study in Naturalist, Realist, and Idealist theories of value.

30. **Empiricism and Rationalism.** Throughout the year. Assistant Professor CHURCH. M W F 10. Goldwin Smith 220.

The general history of the two schools with a critical analysis of the main works of Hume and Leibniz.

32. **The Critical Philosophy of Kant.** Throughout the year. Professor SMART. F 2:30, or hours to be arranged. Goldwin Smith 220.

A reading of the principal works of the Critical Period.

33. **The Philosophy of Hegel.** Second term. Professor CUNNINGHAM. W 10-12. Goldwin Smith 220.

A critical analysis of the philosophy of Hegel with special emphasis on the *Phenomenology* and the *Logic.* These two books are studied in alternate years. The *Phenomenology* is to be studied in the year 1937-38.

39. **Seminar in Contemporary Philosophy.** Throughout the year. Professor CUNNINGHAM. M 3, or hours to be arranged. Goldwin Smith 220.

Topic for the year 1937-38: To be announced.

[40. **Seminar in Logic.** Throughout the year. Assistant Professor SMART. T 2, or hours to be arranged. Goldwin Smith 220. Not given in 1937-38.]

41. **Seminar in Philosophy of Religion.** Throughout the year. Professor BURTT. W 3:30, or hours to be arranged. Goldwin Smith 218.

Topic for the year 1937-38: The Concept of God in Modern Philosophy.

[42. **Seminar in Ancient and Medieval Philosophy.** Throughout the year. Assistant Professor ROBINSON. Hours to be arranged. Goldwin Smith 220. Not given in 1937-38.]

43. **Seminar in Political Theory.** Throughout the year. Professor SABINE. F 2:30, or hours to be arranged. Goldwin Smith 220.

Topic for the year 1937–38: The Sociology of Knowledge.

[44. **Seminar in Epistemology.** Throughout the year. Professor BURTT. W 3:30, or hours to be arranged. Goldwin Smith 220. Not given in 1937-38.]

[45. **Seminar in Aesthetics.** Second term. Assistant Professor CHURCH. Hours to be arranged. Goldwin Smith 220. Not given in 1937-38.]

HISTORY AND THE SOCIAL SCIENCES

The subjects of history, economics and government have been united since 1887 in the PRESIDENT WHITE SCHOOL OF HISTORY AND POLITICAL SCIENCE, which bears the name of the first president of the University in especial recognition of the gift of his valuable collection of historical literature to the University Library.

The aims of the President White School are threefold; first, the advancement of knowledge by investigation and publication in the fields of history, economics, politics, jurisprudence, and social science; second, the training of scholars and teachers in these departments of study; third, the training of men and women for the public service, for business, and for professions such as law, journalism, and philanthropy.

ECONOMICS

Professors DONALD ENGLISH, P. T. HOMAN, E. A. J. JOHNSON, M. S. KENDRICK, R. E. MONTGOMERY, P. M. O'LEARY, H. L. REED, F. A. SOUTHARD, and J. L. WOODWARD and *Doctor* R. L. SHARP.

Approved Major and Minor Subjects (key to symbols on p. 29)

Economic History **1, 2, 3, 4**
Economic Theory and Its History **1, 2, 3, 4**
Note. Every candidate for the Ph.D. or A.M. degree who does not elect Economic Theory and Its History as a major or a minor subject will be held for certain required work in that subject.
Labor and Industrial Relations **1, 2, 3, 4**
Money, Banking, and International Finance **1, 2, 3, 4**
Organization and Control of Industry **1, 2, 3, 4**
Public Finance **1, 2, 3, 4**
Anthropology **2, 3, 4**
Sociology **2, 3, 4**

Requirements for the Degree of Ph.D. in the Several Fields of Study

ECONOMIC THEORY AND ITS HISTORY.—When offered as a major: (1) a good general knowledge of the history of economic thought including the classical school and its critics, the more recent important schools of thought, and the principal contemporary theorists; (2) familiarity with the methods of economic analysis and with controversial areas of thought; (3) a detailed knowledge of some period or school together with necessary historical and intellectual background thereto; (4) a knowledge of social and intellectual history sufficient to form a background for an understanding of the development of economic thought.

When offered as a minor: Parts 1, 2, and 4 of above requirement.

MONEY, BANKING, AND INTERNATIONAL FINANCE.—When offered as a major: (1) a detailed understanding of the theory and history of money; monetary system of the U. S.; theory and history of banking; present banking system of the U. S.; foreign exchange; monetary aspects of cyclical fluctuations; (2) an understanding of leading monetary systems of the world; modern central banking theory and practice; banking systems of Canada, England, France, and Germany; international movement of capital.

When offered as a minor: Part 1 of above requirement.

ECONOMIC HISTORY.—When offered as a major: (1) a comprehensive knowledge of the evolution of agriculture, industry and commerce in ancient and medieval times together with an understanding of contemporaneous economic ideas; (2) a comprehensive knowledge of economic history of modern times (in Western World) together with an understanding of intellectual and political movements which have influenced the development of modern economic institutions; (3) a detailed knowledge of at least one special phase of economic history; (4) a knowl-

edge of the bibliography of economic history and ability to appraise the more important generalizations of economic history.

When offered as a minor: Parts 2 and 3 of above requirement.

LABOR AND INDUSTRIAL RELATIONS.—When offered as a major: A good general knowledge of the following divisions of the field of Labor and Industrial Relations and the literature pertaining to each: (1) trade unionism, collective bargaining and industrial arbitration; (2) history, theory and application of labor law; (3) labor management and personnel problems; (4) the national income, its sources and distribution; (5) labor movements and dissenting or protesting economic thought; (6) social insurance. As a background the candidate should have a grasp of the general field of labor conditions and problems, evolution of the wage system, basic material with respect to wage trends, physical production trends, distribution of wealth and income, and the general field of social legislation, together with demonstrated ability to apply quantitative and theoretical methods to problems in the field of industrial relations.

When offered as a minor: two or three of the divisions listed above.

ORGANIZATION AND CONTROL OF INDUSTRY.—When offered as a major: (1) a good general knowledge of the organization of industry; (2) an understanding of the problems of control arising in connection with transportation, public utilities and industrial combinations; (3) a detailed knowledge of organization and problems of control in one of the above three general areas of industry; (4) a knowledge of accounting and corporation finance and, in specific cases, of statistics; (5) a knowledge of constitutional law.

When offered as a minor: Part 1 and a knowledge of corporation finance, accounting, and the problems of control in one general area of industry; and a *detailed* knowledge of accounting *or* corporation finance *or* the problems of control in one general area of industry.

PUBLIC FINANCE.—When offered as a major: (1) a thorough knowledge of the principles and problems of public expenditures and revenues, and of governmental financial policies; (2) an adequate grasp of the facts concerning federal, state, and local public finance in the U. S.; (3) an understanding of these facts in terms of the problems which arise out of them; (4) ability to evaluate ways and means of solving these problems; (5) a broad understanding of the place of public finance in the economic and political order; (6) such specialized knowledge as may be needed for the preparation of a thesis. [Candidates should be grounded in accounting, statistics, finance, and government. Knowledge of the law of taxation, comparative systems of public finance, financial history, and social and political ethics is desirable.]

When offered as a minor: Parts 1 and 5 of the above requirements.

Requirements for the Degree of A.M. in the Several Fields of Study

Graduate students offering any of the several fields in economics as a major or minor for the A.M. degree should consult with members of the Department of Economics to ascertain the exact requirements. In general, the major requirements for the A.M. degree are substantially the equivalent of the minor requirements for the Ph.D. degree.

1. *Modern Economic Society.* Five hours a week, either term.

2a. *Modern Economic Society.* Three hours a week, first term.

2b. *Modern Economic Society.* Three hours a week, second term.

3. *Introduction to Economics.* For students in Engineering and Chemistry. Three hours a week, either term.

11. *Money and Banking.* Three hours a week, either term.

12. *Central Banking and Monetary Policy.* Three hours a week, second term.

13. *Financial History of the United States.* Three hours a week, second term.

15. *Trade Fluctuations.* Three hours a week, first term.

16. **Money and Credit.** Throughout the year. Prerequisite, Economics 11, 14, 15. Professor REED. Th 2-4.

A study of some of the more intricate phases of monetary and banking theory.

21a. *Accounting.* Three hours a week, either term.

21b. *Accounting.* Three hours a week, either term.

26. **Accounting Theory and Problems.** Throughout the year. Prerequisite, Economics 21b, or its equivalent. Professor ENGLISH. T Th 10.

A critical study of the fundamental principles underlying accounting procedure. The solution of typical problems in corporate consolidation, reorganization, and liquidation, and in other special fields.

31. *Corporation Finance.* Three hours a week, first term.

[32a. *Public Control of Business.* Three hours a week, first term. Not given in 1937-38.]

[32b. *Public Control of Business.* Three hours a week, second term. Not given in 1937-38.]

33. *The Control of Economic Activity.* Three hours a week, second term.

34. *Transportation.* Three hours a week, first term.

36. *Taxation.* Three hours a week, second term.

41. *Labor Conditions and Problems.* Three hours a week, first term.

42. *Trade Unionism and Collective Bargaining.* Three hours a week, second term.

43. *Quantitative Measurements of Economic Phenomena.* Two hours a week, first term.

44. *Labor Management and Personnel Problems.* Two hours a week, second term.

45. *The Economics of Dissent.* First term.

46. *Legal and Constitutional Aspects of Labor Problems and Welfare Legislation.* Second term.

47. **Special Studies in Industrial Relations.** Assistant Professor MONTGOMERY.

Discussion and individual investigation of current and theoretical problems in the field of industrial relations. Among the topics for individual study: collective bargaining in selected industries, the application of quantitative methods to the study of labor problems, restatements of traditional wage theory, methods in field research, problems in the field of labor law.

50a. *Introduction to Social Science.* Three hours a week, either term.

50b. *Introduction to Social Science.* Three hours a week, either term.

[51. *Population Problems.* Three hours a week, first term. Not given in 1937-38.]

52. *Delinquency and Crime.* Three hours a week, first term.

54. *The Family.* Three hours a week, second term.

55. *Social Anthropology.* Three hours a week, first term.

56. *Social Anthropology of Religion and Ethics.* Three hours a week, second term.

58. **Seminar in Sociology and Anthropology.** Two hours a week, second term. Assistant Professor WOODWARD and Dr. SHARP.

71a. *International Trade and Finance.* Three hours a week, first term.

71b. *International Trade and Finance.* Three hours a week, second term.

74. *International Economic Organization.* Three hours a week, second term.

81. *Economics of Enterprise.* Three hours a week, first term.

[82. *The Distribution of Income.* Three hours a week, second term. Not given in 1937-38.]

83a. *The Development of Economic Institutions.* Three hours a week, first term.

83b. *The Development of Economic Institutions.* Three hours a week, second term.

[84a. *The Development of Economic Ideas.* Three hours a week, first term. Not given in 1937-38.]

[84b. *The Development of Economic Ideas.* Three hours a week, second term. Not given in 1937-38.]

85. **Economic Theory.** Throughout the year. Professor ————.

[86. **History and Literature of Economic Thought.** Throughout the year. Assistant Professor JOHNSON. F 2-4. Given in alternate years. Not given in 1937-38.]

[87. **Contemporary Economic Thought.** Throughout the year. Professor HOMAN. Given in alternate years. Not given in 1937-38.]

AGRICULTURAL ECONOMICS AND FARM MANAGEMENT

See under AGRICULTURE, p. 101.

ECONOMICS OF THE HOUSEHOLD

See under HOME ECONOMICS, p. 150.

GOVERNMENT

Professors R. E. CUSHMAN, H. W. BRIGGS, and M. A. SHEPARD.

Approved Major and Minor Subjects (key to symbols on p. 29)

American Governmental Institutions **1, 2, 3, 4**
Constitutional Law **1, 2, 3, 4**
International Law and Relations **1, 2, 3, 4**
Political Theory **1, 2, 3, 4**

Note. Other subjects may be chosen in consultation with members of the department.

Graduate courses in Government afford an opportunity to students to carry on research in that field. As preparation for such work a familiarity with the essentials of American political institutions and of the principal systems of European government is assumed, as well as at least an elementary knowledge of American and English or European history. For 1937-38 research in Government will be directed primarily in the fields of American Constitutional Law, Political Theory and International Law and Relations, although topics relating more generally to American or European governmental institutions and political problems may also be selected.

The attention of students desiring to do graduate work in the various fields of public law is directed to the opportunities open to them in the Law School. The courses in that School in Administrative Law, Constitutional Law, International Law, Jurisprudence, Municipal Corporations, Law of Public Utilities, and Trade Regulations, may be elected by graduate students with the consent of the professors in charge. (See Announcement of the Law School.) The members of the faculty of the Law School are willing to cooperate in directing the researches of students in their several fields, and to serve as members of the special committees of such students.

1. *American Government.* Three hours a week. Throughout the year.

2. *Comparative Government.* Three hours a week. First term.

9. *Introduction to International Relations.* Three hours a week. Throughout the year.

10. **Recent and Contemporary Political Theory.** Second term. Credit three hours. Assistant Professor SHEPARD. T Th S 12. Boardman A.

Recent and contemporary political theory; authority, liberty, and obedience; aristocracy and representative government; dictatorship; pluralistic, communistic, and fascistic theories.

11. **Comparative Political Institutions.** Second term. Credit three hours. Assistant Professor SHEPARD. T Th S 10. Boardman C.

A functional study of various institutions and processes of government such as administration and bureaucracy, legislative systems, functional representation and the corporative state, one-, two-, and multi-party systems. Fee, in lieu of textbook $1.

14. **International Law.** Throughout the year. Credit three hours. Assistant Professor BRIGGS. M W F 12. Boardman D.

The nature and basis of international law; the application of international law in municipal and international courts; the general principles of the law of nations. Cases, readings, and discussions.

15. **International Organization.** Second term. Credit three hours. Assistant Professor BRIGGS. M W F 9. Boardman A.

International administrative agencies; collective political intervention; international legislation; the organization and working of the League of Nations; the Permanent Court of International Justice.

18. **Introduction to Legal Philosophy.** First term. Credit three hours. Assistant Professor SHEPARD. T Th S 12. Boardman A.

An analysis of various conceptions of the nature of law, historical, analytical, philosophical, and sociological; the problem of the relation between law and the state.

20. **Constitutional Law: The American Federal System.** First term. Credit three hours. Prerequisite, both terms of Government 1 or the consent of the instructor. Professor CUSHMAN. T Th S 11. Boardman C.

Judicial interpretation of the constitution: the nature of judicial review; separation of governmental powers; relations between state and national government; construction of national powers.

21. **Constitutional Law: Fundamental Rights and Immunities.** Second term. Credit three hours. Prerequisite, Government 20 or the consent of the instructor. Professor CUSHMAN. T Th S 11. Boardman C.

Privileges and immunities of citizenship; protection of civil and political rights; the obligation of contracts; due process of law and the equal protection of the law.

12a. **History of Political Theory: Ancient** (See Philosophy 10a).

12b. **History of Political Theory: Modern** (See Philosophy 10b).

26. **Legal and Constitutional Aspects of Labor Problems and Welfare Legislation** (see Economics 46).

[28. **American Political and Constitutional Theory.** Second term. Credit two hours. Open to qualified seniors and graduates. Consult the instructor before registering. Professor CUSHMAN. T Th 9. Boardman. Not given in 1937-38.]

The philosophical background and evolution of American constitutional doctrines.

135. **Local Government** (see Agricultural Economics 135).

Seminary in Constitutional Problems. Professor CUSHMAN. Throughout the year. Problems of current interest in American Constitutional Law will be selected for individual research. Students will be admitted upon consultation with the instructor.

Seminary in International Law and International Organization. Throughout the year. Assistant Professor BRIGGS. Students will be admitted upon consultation with the instructor.

Seminary in Political Theory. Throughout the year. Assistant Professor SHEPARD. Problems of recent and contemporary political theory.

Seminary in Political Theory. Throughout the year. Professor SABINE.

HISTORY

Professors J. P. BRETZ, CARL BECKER, PRESERVED SMITH, M. L. W. LAISTNER, CARL STEPHENSON, and F. G. MARCHAM, and *Assistant Professors* P. W. GATES and P. E. MOSELY.

Approved Major and Minor Subjects (key to symbols on p. 29)

American History **1, 2, 3, 4**
Ancient History **1, 2, 3, 4**
English History **1, 2, 3, 4**
History of Renaissance and Reformation **1, 2, 3, 4**
Medieval History **1, 2, 3, 4**
Modern European History **1, 2, 3, 4**

A graduate student in history should have a sufficient knowledge of general history and of geography. He should be able to speak and write good English. He should have a reading knowledge of French, of German, and of any other language necessary for the thorough study of his special subject. For work in Medieval History he would need a knowledge of Latin, and for Ancient History both Latin and Greek. It is highly desirable that he should have had the necessary linguistic training as an undergraduate; but deficiencies in this respect may sometimes be made up after entering upon graduate work.

The University Library contains ninety or a hundred thousand volumes dealing with history. In large part these are to be found in the room known as the White Historical Library to which graduate students have immediate access. The historical seminary rooms in the library building are furnished with atlases, dictionaries, bibliographies, and other works of reference, and afford access to the shelves of the Library proper.

It has been from the outset the policy of the University, while providing adequately for the symmetrical growth of the Library, to acquire private collections of books which eminent scholars have through a lifetime of study built up as their tools of research. Thus, for the study of Oriental History, Cornell has been endowed with the EISENLOHR COLLECTION on the history of Egypt, with the WASON COLLECTION on the history and the civilization of China, and with that of President White on the history of Palestine. For the study of the Graeco-Roman world, it acquired that of Charles Anthon. For the Middle Ages, it has notable bodies of books on the birth of the Papal state, on the rise of the Carolingian empire, and in general on the relations of Church and State. For the Renaissance, it can boast the unrivaled FISKE COLLECTIONS on Dante and Petrarch and the world of their time. For the age of the Reformation, for the history of superstition and persecution (notably for Inquisition and Index, for the story of witchcraft, for the beginnings of the sciences, for the rise of tolerance), it is equipped with the riches of the PRESIDENT WHITE LIBRARY; and for the study of the French Revolution that library has no equal on this side of the Atlantic, if anywhere outside of France. For the history of America, the University possesses the library of the historian Jared Sparks, with the MAY COLLECTION on American slavery and the SCAIFE COLLECTION on the Civil War. Professor GOLDWIN SMITH enriched it with his working library of English history; it obtained that of Professor Tuttle on Prussia; from Professor Fiske came one singularly complete on Iceland. In a multitude of other fields it has been found possible to gather for the special student materials for exhaustive research. Many of these collections are endowed with special funds for their increase; and all have been steadily built up with an eye to the needs of the mature student of history.

Three fellowships and a scholarship are annually awarded to graduate students of history. The President White Fellowship in Modern History has a value of $500. It may be granted as a travelling fellowship. The fellowship in American History amounts to $400. The stipend of the George C. Boldt Fellowship in History is $1,000. The Graduate Scholarship in History amounts to $200. Holders of fellowships and graduate scholarships are, with the exception of the Boldt Fellowship, exempt from the payment of tuition. There are several assistantships in history, which are filled preferably by the appointment of graduate students.

Fellowships are ordinarily awarded only to applicants who have had one year or more of graduate study. It will hardly be worth while for persons who have not had a year of graduate study to apply unless they can submit written work of superior quality.

A seminary is conducted in each of the major fields of history and each professor is willing to direct research in his special field.

General courses, not enumerated here, are offered in oriental, ancient, medieval, modern European and English history and in American history, both political and economic. These are intended for undergraduates, but, if supplemented by individual work, one or another of them may sometimes serve the purposes of a graduate student.

American History

Professor J. P. Brětz and *Assistant Professor* P. W. Gates.

82. *American History, 1607-1850.* First term. Three hours a week.
83. *American History, 1850-1936.* Second term. Three hours a week.
86. *American History, 1787-1848.* First term. Three hours a week.
87. *American History, 1848-1914.* Second term. Three hours a week.

89. **American History, 1750-1848:** The Settlement of the Middle West. Throughout the year. Two hours a week. Prerequisite, History 82, 83, or the equivalent. Upperclassmen and graduates. Professor Bretz. T Th 9. Boardman E.

[91. **Recent American History.** Throughout the year. Credit three hours a term. Prerequisite, History 82, 83 or 86, 87, or the equivalent. Assistant Professor Gates. M W F 12. Boardman E. Not given in 1937-38.]

92. **American Colonial History.** First term. Assistant Professor Gates. M W F 12. Boardman E.

93. **Economic History of the United States.** Second term. Assistant Professor Gates. M W F 12. Boardman E.

99. **Seminary in American History.** Throughout the year. Two hours a week. Professor Bretz. Hours to be arranged. First meeting, Monday, Oct. 4, 4 p.m.

100. **Seminary in American History.** Throughout the year. Assistant Professor Gates. Two hours a week. Hours to be arranged.

Ancient History

Professor M. L. W. Laistner.

[1. (14) **Seminary in Roman Historical Inscriptions.** Throughout the year. M 2-4. University Library, Classical Seminary. A reading knowledge of Latin is essential. Not given in 1937-38.]

2. (8) **Seminary in Greek and Roman Historiography.** Throughout the year. M 2-4. Boardman 4.

2. (2) *Greek History, 500-323 B. C.* First term. M W F 11. Boardman E.
3. (3) *The Hellenistic Age.* Second term. M W F 11. Boardman E.

[4. (4) *The Roman Republic, 133-30 B. C.* First term. Not given in 1937-38.]

[5. (5) *The Roman Empire, 30 B. C.-180 A. D.* Second term. Not given in 1937-38.]

[6. (7) *The History of Education (Greek, Roman, and Early Medieval).* First term. Not given in 1937-38.]

Note. The figures in parenthesis are the numbers of the courses and seminars in the Announcement of the College of Arts and Sciences.

English History

Professor F. G. Marcham.

61. *English History.* Three hours a week, throughout the year.

65. **English Constitutional History since 1485.** Throughout the year.

66a and b. *History of England under the Tudors and Stuarts.* Three hours a week, throughout the year. Given in alternate years.

[67 and 68. *History of England from the Eighteenth Century to Present.* Three hours a week, throughout the year. Given in alternate years. Not given in 1937-38.]

69. **Seminary in Tudor and Stuart History.** First term. Professor Marcham.

Study of materials for research in Tudor and Stuart history and some of the leading historical problems of the period.

Medieval History

Professor Carl Stephenson.

21. *Medieval History.*

22. **Medieval Civilization.** Throughout the year. T Th 10. Boardman D.

[24. **English Constitutional History to 1485.** Throughout the year. T Th 10. Boardman C. Not given in 1937-38.]

25. **Seminary in Medieval History.** Throughout the year. Prerequisite, reading knowledge of Latin; German and French desirable. Hours to be arranged.

Modern European History

Professor Carl Becker and *Assistant Professor* P. E. Mosely.

42. *Modern History*, 1600-1914.

50. *Recent European History*, 1878-1936.

[43. **The French Revolution.** Not given in 1937-38.]

A study of French society before 1789, and of the Revolution from 1789 to 1795.

44. **The Napoleonic Era.** Professor Becker.

A study of the organization of France under Napoleon, the establishment of the empire, and the restoration of Europe in 1814-15.

51. **Modern Russia,** 1700–1936. Throughout the year. Assistant Professor Mosely. M W F 11. Boardman D.

Seminary in Modern European History. Professor Becker. Hours to be arranged.

Offers an opportunity to do research in the original sources for the French Revolution or in some closely related field of modern history.

Seminary in Recent European History. Assistant Professor Mosely. Hours to be arranged.

Renaissance and Reformation History

Professor Preserved Smith.

Though Professor Smith offers courses only during the second term of each year, he resides at Ithaca most of the time, and is glad to give conferences and to supervise the preparation of theses even while not teaching.

32. *The Age of the Renaissance and Reformation.*

[36. *History of Education* (*Late Medieval and Modern*). Not given in 1937-38.]

33. *History of Christianity.*

[34. **Historical Method.** Second term. Prerequisite, a reading knowledge of either French or German. S 10-12. Boardman 2. Not given in 1937-38.]

A study of historical method and of the development of modern historiography.

35. **Church History.** Second term. Prerequisite, a reading knowledge of Latin. S 10-12. Boardman 2.

RURAL SOCIAL ORGANIZATION

See under Agriculture, p. 113.

ANIMAL SCIENCES

Graduate work in Animal Sciences at Cornell University is distributed through many Departments in the Colleges of Agriculture, Arts and Sciences, Medicine and Veterinary Medicine. In this announcement little cognizance is taken of college or departmental organization. The various fields of study in which students may elect to pursue their work for the Master's or Doctor's degree are listed alphabetically. After selecting his major field the student should consult the professor in charge (who may become chairman of his special committee) as to the most appropriate minor field or fields. The requirements in each field depend largely on the previous training of the student, and the professor in charge will outline the courses of study and the nature of the thesis or essay that will be required. In each case, however, a candidate for an advanced degree will be expected to have had adequate undergraduate training in the fields in which he plans to specialize.

The laboratory and field equipment and the library facilities available to graduate students in the Animal Sciences at Cornell are those of a major university where the members of the faculty are engaged in research. Each Department has its special facilities in keeping with the nature of the research undertaken, and all enjoy a large central library as well as smaller departmental libraries. Since so many departments and buildings on the campus are involved, attention is called in the alphabetical arrangement to the location of the main office of each field of work.

In some fields, work during the summer, either in the Summer Session or under personal direction, is permitted.

In certain fields there are a limited number of temporary fellowships for special work. In the general field of Animal Biology there is one fellowship with a stipend of $400 and a scholarship with a stipend of $200, each of which carries free tuition. The fellowships and the scholarship are awarded annually.

In the Department of Psychology the Sage Fellowship is usually awarded to a candidate who has completed at least two years of graduate study; the Sage Scholarship to first- or second-year graduates.

Approved major and minor subjects are listed under the respective fields; the key to the numbers in bold-face type will be found on page 29.

ANATOMY

Stimson Hall; *Professors* A. T. KERR and J. W. PAPEZ.

Approved Major and Minor Subjects (key to symbols on p. 29)

Human Anatomy **1, 2, 3, 4**
Neuroanatomy **1, 2, 3, 4**

(See also VETERINARY ANATOMY, **1, 2, 3, 4,** James Law Hall, Professor Earl Sunderville, under VETERINARY MEDICINE, p. 159)

Graduate work in anatomy should be preceded by courses in biology, comparative and human anatomy. A reading knowledge of German and French is essential for successful research in anatomy.

221. *Structure of the Human Body.* Second term. Three lectures and one demonstration a week.

222. *Anatomical Methods.* First term. One lecture and eight hours of laboratory a week.

224. *Artistic Anatomy.* Throughout the year. One lecture and six hours of laboratory a week.

229. *Kinesiology.* First term. One lecture and six hours of laboratory a week.

1. **Anatomy of the Head and Neck.** First term, twenty-four hours a week for six or more weeks. Prerequisites, courses in Zoology, and/or, Comparative

Anatomy. Professors KERR and PAPEZ. Anatomy laboratory, Stimson Hall. Daily except Saturday, 8 a. m. to 4 p. m.

A detailed study of the structures in the head and neck of man, including the eye, ear, nose, pharynx, larynx and cranial nerves, but not the brain. Demonstrations, dissection, and conferences.

2. **Anatomy of the Thoracic Walls and Viscera.** First term, twenty-four hours a week for two or more weeks. Prerequisites, courses in Zoology, and/or, Comparative Anatomy. Professors KERR and PAPEZ. Anatomy laboratory, Stimson Hall. Daily except Saturday, 8 a.m. to 4 p.m.

A detailed study of the human chest walls and of the heart, lungs, vessels, and nerves of the thoracic cavity. Demonstrations, dissections, and conferences.

3. **Anatomy of the Abdominal and Pelvic Walls and Viscera.** First term, twenty-four hours a week for six or more weeks. Prerequisites, courses in Zoology, and/or, Comparative Anatomy. Professors KERR and PAPEZ. Anatomy laboratory, Stimson Hall. Daily except Saturday, 8 a.m. to 4 p.m.

A detailed study of the human abdominal walls and of the organs of the digestive, urinary, and reproductive systems together with the vessels and nerves of the abdominal cavity. Demonstration, dissection, and conferences.

5. **The Nervous System.** Anatomy. Histology and functional systems. Second term. Prerequisites, Anatomy and Histology. Assistant Professor PAPEZ. Nine hours a week, M W F, 1-4 p.m., anatomy laboratory, Stimson Hall.

Dissection of the human spinal cord and brain. Microscopic structure and development of the nervous system of man. Laboratory with demonstrations, conferences, and recitations.

6. **Anatomy of the Living Body.** First term. Three lecture demonstrations a week. Prerequisites, courses in Zoology, and/or, Comparative Anatomy. Professor KERR.

Interpretation of dissecting room material by means of the living body, frozen sections, and special preparations. Supplementary to the work of Courses 1, 2, and 3.

7. **Anatomy of the Upper Extremity.** Second term. Four hours a week for seven weeks. Prerequisites, courses in Zoology, and/or, Comparative Anatomy. Professors KERR and PAPEZ. Anatomy laboratory, Stimson Hall. M 8-12:30.

A detailed study of the bones, joints, muscles, and nerves of the upper extremity of man.

8. **Anatomy of the Lower Extremity.** Second term. Four hours a week for eight weeks. Prerequisites, courses in Zoology, and/or, Comparative Anatomy. Professors KERR and PAPEZ.

A detailed study of the bones, joints, muscles, and nerves of the lower extremity of man.

9. **Topographical Anatomy.** First and second terms. Prerequisites, anatomy courses 1, 2, 3, 7, or 8. Professors KERR and PAPEZ. Anatomy laboratory, Stimson Hall.

The detailed study and dissection of any region of the human body with particular reference to the arrangement of the parts and their variations.

225. **Comparative Neurology.** Second term. Credit three hours. Prerequisite, nine hours of Animal Biology. Assistant Professor PAPEZ. T Th 8-11. Stimson 52.

A comparative study of the vertebrate nervous system based on dissections of brains of shark and dog, and sections of cat brain stem; of the chief nerve mechanisms that determine the form and structure of the nervous systems, their evolutionary and functional significance. One recitation and two laboratory periods.

226. **Cerebral Mechanisms.** Second term. Credit three hours. Prerequisite, course 225. Assistant Professor PAPEZ. Conference hour will be arranged later. By consent of the instructor.

A course of study of the cerebrum of lower mammals and the primates with special reference to the subcortical connections and levels and functional significance of the various cortical regions of the human brain.

250. **Advanced and Research Work in Human Anatomy and Neurology.** Throughout the year. For those who have taken the necessary preliminary courses and are otherwise prepared. Professors KERR and PAPEZ. Hours to be arranged. Anatomy laboratory, Stimson Hall. Two or more laboratory periods a week.

The study and investigation of some special topic with training in methods of research in anatomy.

ANIMAL BREEDING

Poultry Building; *Professors* F. B. HUTT, S. A. ASDELL, G. O. HALL, A. C. FRASER, M. W. HARPER, A. L. ROMANOFF, and J. H. BRUCKNER.

Approved Major and Minor Subjects (key to symbols on p. 29)

Animal Breeding **1, 2, 3, 4**

Before entering upon graduate work the student should have had courses in general biology or zoology, animal or human physiology, organic and inorganic chemistry. For students in the Department of Poultry Husbandry some training or experience in that field is necessary.

The following courses are offered in the Departments of Animal Husbandry (A. H.), Poultry Husbandry (P. H.), and Plant Breeding (P. B.), as indicated. Students are expected to take certain courses in animal physiology, embryology, cytology and histology, and are usually advised to select at least one of these subjects for their minor requirements.

P.H. 20. *Poultry Breeds, Breeding and Judging.* First term. Credit three hours.

P.H. 30. *Poultry Incubation and Brooding.* Second term. Credit two hours.

A.H. 20. *Animal Breeding.* First term. Two lectures and one laboratory a week.

P.B. 101. *Genetics.* First term. Credit four hours.

P.B. 201. **Advanced Genetics.** Second term. Prerequisite, course 101 and Botany 124. Professor FRASER. M F 8-10. Plant Science 146. Laboratory work to be arranged.

Group discussions of advanced principles of genetics, with special attention to methods of analysis. Laboratory studies of experimental data and of genetical "unknowns" in Drosophila. Laboratory fee, $3. Deposit, $2.

P.B. 211. **Statistical Methods of Analysis.** First or second term. Assistant Professor LIVERMORE. Th 1:40-4. Plant Science Building 146.

A discussion of statistical methods for the study of variation, correlation, curve fitting, experimental error and the analysis of variance; and the application of these methods to problems in biology and related fields. Laboratory fee, $2.

A.H. 120. **Problems in Animal Genetics.** First term. Prerequisite, Animal Husbandry 20 or Plant Breeding 101. T Th 11. Recitation by appointment. Professor HARPER.

Lectures, conferences and reports, including statistical methods as applied to breeding animals. The work will consist largely of practice in making reports on statistical problems.

A. H. 125. **Physiology of Reproduction.** Second term. Registration by permission. Assistant Professor ASDELL. M 10. Animal Husbandry Building B.

A course in the physiology of the process of reproduction, chiefly in mammals, and of the related internal secretions.

P.H. 120. **Poultry Genetics.** Second term. Credit three hours. Prerequisites, Plant Breeding 101 and permission of the instructor. Professor HUTT. M W F 11. Poultry Building 305. Given in alternate years.

Inheritance in domestic birds, the application of genetic principles to poultry breeding, disease resistance, hybrid vigor, cytology, physiology of avian reproduction, fertility, embryonic mortality, sex and secondary sex characters.

[P.H. 130. **Advanced Incubation.** Second term. Credit one hour. Research Assistant Professor ROMANOFF. Lectures at hours to be arranged. Given in alternate years, not in 1937-38.]

A consideration of the growth and development of the embryo, with special reference to the principles of artificial incubation.

P.H. 220. **Animal Genetics.** First term. Prerequisites, Plant Breeding 101 and permission of the instructor. Professor HUTT.

Assigned readings and conferences on inbreeding, hybridization, disease resistance, lethal genes, genetic sterility, sex, heredity in laboratory animals, domestic animals and man, sire indices, and other topics. Designed to acquaint the student with the literature and methods of research in animal genetics.

P.H. 229. **Seminar in Animal Breeding.** First and second terms. Professors HUTT, ASDELL, and staff. F 4:15. Poultry Building 201.

Discussion of current literature and special topics of interest to workers in this field.

ANIMAL HUSBANDRY

Animal Husbandry Building; *Professors* F. B. MORRISON, M. W. HARPER, E. S. SAVAGE, L. A. MAYNARD, C. M. MCCAY, E. S. HARRISON, S. A. ASDELL, R. B. HINMAN, G. W. SALISBURY, and J. P. WILLMAN.

Animal Husbandry **1, 2, 3, 4** (See under AGRICULTURE, p. 107)

ANIMAL NUTRITION

Dairy Building; *Professors* L. A. MAYNARD, C. M. MCCAY, L. C. Norris, S. A. ASDELL, F. B. MORRISON, E. S. SAVAGE, and G. F. HEUSER.

Approved Major and Minor Subjects (key to symbols on p. 29)

Animal Nutrition **1, 2, 3, 4**

(See also Foods and Nutrition **1, 2, 3, 4**; Martha Van Rensselaer Hall, *Professors* HELEN MONSCH, MARION PFUND, HAZEL HAUCK, FAITH FENTON, L. A. MAYNARD, and C. M. MCCAY, under HOME ECONOMICS, p. 152)

In order to enter upon graduate study in animal nutrition as a major field the student should have had courses in general biology or zoology, introductory chemistry, organic chemistry, human or animal physiology, physics, and animal breeding or genetics. In the course of their graduate study candidates for the doctor's degree are expected to acquire training in biochemistry, physiology, histology, physical chemistry and biometry, and are generally advised to select one of these fields as a minor.

The following courses are offered in the departments of Animal Husbandry (A.H.) and Poultry Husbandry (P.H.), as indicated:

A.H. 10. *Livestock Feeding.* Second term. Three lectures and one laboratory period a week.

P.H. 110. *Poultry Nutrition.* Second term. Two lectures and one laboratory period a week.

A.H. 110. **Animal Nutrition.** First term. Prerequisite, course A.H. 10 or P.H. 110 or Home Economics 122 and a course in physiology and in organic chemistry. Professor MAYNARD. Lectures, M W F 10. Animal Husbandry Building B.

The chemistry and physiology of nutrition and the nutritive requirements for growth, reproduction, lactation, and other body functions.

A.H. 111. **Animal Nutrition.** Laboratory course. Must be preceded or accompanied by course 110. Registration by permission. Professor MCCAY. M W F 1:40-4. Animal Nutrition Laboratory, Dairy Building.

This course is designed to familiarize the student with the application of chemical methods to the solution of fundamental problems of nutrition. Laboratory fee, $10; breakage deposit, $5.

A.H. 130. **Physiology of Lactation.** Second term. Registration by permission. Professors MAYNARD and ASDELL. W 10. Animal Husbandry Building B.

A discussion of the development of the mammary gland and the physiological process governing its activity.

P.H. 210. **Experimental Methods in Poultry Nutrition.** First term. Registration by appointment. Professor NORRIS. Lecture and laboratory period, W 1:40-5. Poultry Building. Given if desired by a sufficient number of students.

A critical consideration of the domestic fowl as an experimental animal and of the experimental methods used in conducting research projects in poultry nutrition.

219. **Animal Nutrition Seminar.** First and second terms. Registration by permission. Professors MAYNARD, MCCAY, and NORRIS. Weekly conferences, M 4:15.

A consideration of the experimental data on which the principles of animal nutrition are based, and a critical review of current literature.

ANIMAL PATHOLOGY

James Law Hall; *Professors* W. A. HAGAN, PETER OLAFSON, E. L. BRUNETT, and A. ZEISSIG.

Animal Pathology **1, 2, 3, 4** (See under VETERINARY MEDICINE, p. 160)

APICULTURE

Comstock Hall; *Professor* E. F. PHILLIPS.

Apiculture **1, 2, 3,** (See under ENTOMOLOGY, p. 63)

AQUICULTURE

Comstock Hall; *Professor* EMBODY.

Approved Major and Minor Subjects (key to symbols on p. 29)

Aquiculture **1, 2, 3**
Fish Culture **1, 2, 3, 4**

73. *Aquiculture.* First term. Credit three hours.
74. *Fish Culture.* Second term. Credit two hours.

300g. **Research in Aquiculture.** First and second terms. Should be preceded or accompanied by Course 74. Professor EMBODY. Hours, credit, and laboratory fees to be arranged.

Laboratory, field work, and conferences on problems related to the fisheries.

BACTERIOLOGY

Dairy Building; *Professors* J. M. SHERMAN, OTTO RAHN, C. N. STARK, and GEORGES KNAYSI; at Geneva, *Professors* R. S. BREED, H. J. CONN, G. J. HUCKER, and C. S. PEDERSON.

Approved Major and Minor Subjects (key to symbols on p. 29)

Bacteriology **1, 2, 3, 4**

(See also Pathogenic Bacteriology **1, 2, 3, 4,** James Law Hall, *Professors* W. A. HAGAN, PETER OLAFSON, E. L. BRUNETT, AND A. ZEISSIG, under VETERINARY MEDICINE, p. 160)

Before taking up graduate work in bacteriology, it is desirable that the student have general chemistry, qualitative and quantitative analysis, organic chemistry, and introductory courses in the biological sciences.

Formal courses open to undergraduate and graduate students are given in the following subjects:

1. **General Bacteriology.** First term. Credit six hours. Prerequisite, Chemistry 101. Professor STARK, Mrs. STARK, Mr. GUNSALUS, and assistants. Lectures, recitations, and laboratory practice, M W F 1:40–5. Dairy Industry Building 218 and 301.

An introductory course; a general survey of the field of bacteriology, with the fundamentals essential to further work in the subject. Laboratory fee, $15.

103. **Applied Bacteriology.** Second term. Credit six hours. Prerequisite, course 1, quantitative analysis, and organic chemistry. Professors SHERMAN and STARK, Mr. YAWGER, and assistants. Lectures, recitations, and laboratory practice, M W F 1:40-5. Dairy Industry Building 218 and 301.

An advanced course dealing with the important groups of bacteria which are of significance in water, milk, and foods, together with the methods used in the bacteriological analysis and control of these products. Laboratory fee, $15.

105. **Higher Bacteria and Related Microorganisms.** First term. Credit four hours. Prerequisite, course 1. Assistant Professor KNAYSI. Lectures, recitations, and laboratory practice, T Th 1:40-5. Dairy Industry Building 119 and 323.

A study of the higher bacteria, together with the yeasts and molds that are of especial importance to the bacteriologist. Laboratory fee, $15.

210. **Physiology of Bacteria.** Second term. Credit two hours. Prerequisite, course 1 and at least one additional course in bacteriology. Professor RAHN. Lectures, M W 9. Dairy Building 120.

An advanced course in the physiology of bacteria and the biochemistry of microbic processes.

210a. **Physiology of Bacteria, Laboratory.** Second term. Credit three hours. Must be preceded or accompanied by course 210. Professor RAHN and Mr. HEGARTY. M W 1:40-5. Dairy Building.

An advanced laboratory course dealing with the biological principles of growth, fermentation, and death of bacteria. Laboratory fee, $15.

211. **Taxonomy of Bacteria.** First term. Credit two hours. Prerequisite, course 1 and at least one additional course in bacteriology. Professor RAHN. Lectures, T Th 8. Dairy Building 120.

An advanced course, dealing with the natural groups and variability of bacteria, with a study of the systems of nomenclature and classification.

212. **Bacteriological Literature.** Throughout the year. Credit one hour a semester. Professor RAHN. F 8. Dairy Building 120.

Presentation and discussion of current literature in bacteriology.

213. **Morphology and Cytology of Bacteria.** First term. Credit two hours. Assistant Professor KNAYSI. Lectures, W F 5. Dairy Building 119.

The morphology, cytology, and microchemistry of microorganisms.

221. **Seminary.** Throughout the year. Without credit. Required of graduate students specializing in the department. Professor SHERMAN. Hours to be arranged. Dairy Building.

Research problems may be selected in various phases of pure and applied bacteriology; taxonomy; physiology; technique; dairy bacteriology; food bacteriology; water and sanitary bacteriology; industrial fermentations. (For pathogenic bacteriology, see Animal Pathology and Bacteriology; for soil bacteriology, see Agronomy.)

RESEARCH AT THE NEW YORK STATE EXPERIMENT STATION

Work in Dairy, Soil, Fermentation, Food and Systematic Bacteriology is also offered at Geneva. For further information see page 166.

BIOLOGICAL CHEMISTRY

Stimson Hall; *Professor* SUMNER; *Doctors* HOWELL and DOUNCE.

Approved Major and Minor Subjects (key to symbols on p. 29)

Biochemistry **1, 2, 4**

314. *Biochemistry for Undergraduates.* Three lectures a week. First term.

314a. *Biochemistry Laboratory for Undergraduates.* Two afternoons a week. First term.

315. **General Biochemistry.** Second term. Credit seven hours. Intended for Medical and Graduate Students. Professor SUMNER, Dr. HOWELL, Dr. DOUNCE. Lectures, T 8-9, Th F S 9-10; Laboratory, Th 1-4, F S 10-1.

316. **Physical Biochemistry.** Second term. Credit 2 hours. For students of biology and medicine. Can be taken together with Biochemistry 315 or separately. Dr. HOWELL. Lecture, W 9. Laboratory, W 10-12:30.
The applications of physical chemistry to biological problems.

[317. **Enzymes.** First term. Credit two hours. Professor SUMNER. Lectures, T Th 10. Not given in 1937-38.]

319. **Plant Biochemistry.** First term. Credit three hours. Dr. HOWELL. Lectures, T Th 11; Demonstration, S 11.

320. **Advanced Work and Research in Biochemistry.** Throughout the year. Professor SUMNER.

CYTOLOGY

Plant Science Building; *Professor* L. W. SHARP.

Cytology **1, 2, 3, 4** (See under PLANT SCIENCES, p. 74)

DAIRY SCIENCE

Dairy Building; *Professors* J. M. SHERMAN, H. E. ROSS, P. F. SHARP, B. L. HERRINGTON, E. S. GUTHRIE, W. E. AYRES, H. J. BRUECKNER, D. B. HAND, and *Doctor* V. N. KRUKOVSKY.

Dairy Science **1, 2, 3, 4** (See under AGRICULTURE, p. 108)

DISEASES

James Law Hall; *Professors* R. R. BIRCH, H. L. GILMAN, D. W. BAKER; H. J. MILKS, H. C. STEPHENSON; E. L. BRUNETT.

Large Animals **1, 2, 3, 4**
Small Animals **1, 2, 3, 4**
Poultry **1, 2, 3, 4**
(See under VETERINARY MEDICINE, p. 161)

ECOLOGY

Comstock Hall; *Professors* CLAASSEN and READIO.

Insect Ecology **1, 2, 3** (See under ENTOMOLOGY, p. 63)

McGraw Hall; *Professors* A. H. WRIGHT and W. J. HAMILTON, JR.

Vertebrate Ecology **1, 2, 3, 4** (See under VERTEBRATE TAXONOMY AND ECOLOGY, p. 71)

EMBRYOLOGY

Stimson Hall; *Professors* B. F. KINGSBURY and H. B. ADELMANN.

Embryology **3, 4** (See under HISTOLOGY AND EMBRYOLOGY, p. 66)

Comstock Hall; *Professor* O. A. JOHANNSEN.

Insect Embryology **1, 2, 3** (See under ENTOMOLOGY, p. 63)

ENTOMOLOGY

Comstock Hall; *Professors* O. A. JOHANNSEN, J. C. BRADLEY, ROBERT MATHESON, E. F. PHILLIPS, P. W. CLAASSEN, P. A. READIO, G. F. MACLEOD, R. W. LEIBY, C. E. PALM, W. E. BLAUVELT, and D. L. COLLINS and *Doctor* W. T. M. FORBES; at Geneva, *Professors* P. J. PARROTT, H. GLASGOW, P. J. CHAPMAN, F. Z. HARTZELL, and D. M. DANIEL.

Approved Major and Minor Subjects (key to symbols on p. 29)

Apiculture **1, 2, 3**
Insect Ecology **1, 2, 3**

Economic Entomology **1, 2, 3**
Insect Embryology **1, 2, 3**
Entomology **4**
Limnology **1, 2, 3**
Medical Entomology **1, 2, 3**
Insect Morphology **1, 2, 3**
Parasitology **1, 2, 3**
Insect Physiology **1, 2, 3**
Insect Taxonomy **1, 2, 3**

In order to undertake graduate study the student should not only be prepared in the fundamentals of Animal Biology but also have or acquire a foundation in the particular phase of this subject which he intends to pursue and should have a reading knowledge of French and German.

In the summer members of the staff are prepared to direct the research work of graduate students in connection with the Summer Session of Cornell University.

The following undergraduate courses, 12, 15, 21 and 30a, are accounted a part of a preparation for graduate study in entomology:

12. *General Entomology.* Credit three hours. First term.

15. *Wing Venation and Evolution.* Credit one hour. First or second term.

21. *Elementary Morphology of Insects.* Credit three hours. First or second term.

30a. *Elementary Taxonomy of Insects.* Credit one hour. Second term.

The following courses, 30b, 41, 43, 61 and 75, are also recommended for certain phases of the work:

30b. *Entomotaxy.* Credit two hours. Second term, completed first term of following year.

41. *General Economic Entomology.* Credit three hours. Second term.

43. *Insects Injurious to Trees and Shrubs.* Credit two hours. Second term.

61. *General Beekeeping.* Credit three hours. Second term.

75. *Laboratory Methods in General Biology.* Credit two hours. Second term.

Descriptions of the above courses will be found in the Announcement of the College of Agriculture.

31. **Taxonomy of Insects.** This course extends through three terms, but the work of any term may be taken independently. Credit three hours. Prerequisite, courses 12, 15, 21, and 30a. Professor BRADLEY and Mr. PATE. Lecture, W 10. Comstock Hall 300. Laboratory, T Th 1:40-4. Comstock Hall 300.

A survey of the classification of the orders of insects. For the year 1937-38 the orders to be treated are: first term, Hymenoptera and Hemiptera; second term, Apterygota, Orthoptera, Diptera, and small orders. For the year 1938-39 the orders to be treated are: first term, Lepidoptera and Coleoptera; second term, Hymenoptera and Hemiptera. Laboratory fee, $4.50.

122. **Insect Morphology.** Both terms. Credit two hours each term. Prerequisite, courses 21, and 12 or 30a. Professor JOHANNSEN. Lectures, assigned reading, and reports. T Th 10. Comstock Hall 145.

This course deals with the anatomy, histology, embryology and post-embryonic development of insects.

124. **Histology of Insects.** First or second term. Credit two hours. Must be preceded or accompanied by course 122. Professor JOHANNSEN and Dr. BUTT. Laboratory, two periods a week, by appointment. Comstock Hall 170.

Technique in histological methods as applied to insects. Laboratory fee, $3.

[241. **Advanced Economic Entomology.** Throughout the year. Credit two hours a term. Professor READIO. Lecture, M 11. Conference, W 2-4. Not given in 1937-38.]

Given in cooperation with the Division of Entomology of the New York State Agricultural Experiment Station at Geneva, and the extension and research staffs of the Department of Entomology at Cornell University.

A course for the student intending to work in the field of economic entomology, including such subjects as: Principles of insect control by natural agencies, biological control methods, inspection and quarantine regulations, cultural

practices, physical methods, and use of insecticides; methods of planning and conducting experiments in insect control; insectary methods of rearing and studying insects; literature of economic entomology, etc.

51. **Parasites and Parasitism.** Second term. Credit two or three hours. Prerequisite, Biology 1 or Zoology 1. Professor MATHESON, Mr. MILLER, and Mr. HURLBUT. Lecture, T 9. Comstock Hall 200. Practical exercises, M or T 1:40-4.

A consideration of the origin and biological significance of parasitism, and of the structure, life, and economic relations of representative parasites. A limited number of well-prepared students will be permitted to take the extra hour's credit. The work will occupy one afternoon a week and will be devoted to the technique of the diagnosis of parasitic infections, preparation of material from post-mortem examinations, and advanced work in Parasitology. Laboratory fee, $2 or $4.

[52. **Medical Entomology.** Second term. Credit two or three hours. Prerequisite, Zoology 1 or Biology 1. Professor MATHESON, Mr. MILLER, and Mr. HURLBUT. Lecture, T 9. Comstock Hall 200. Practical exercises, T, W or Th 1:40-4. Not given in 1937-38.]

This course deals with insects and other arthropods that are the causative agents of disease in man and animals, or are the vectors, or intermediate hosts, of disease-producing organisms. A limited number of well-prepared students will be permitted to take the extra hour's credit. The work will occupy one afternoon a week and will consist of detailed studies of selected groups of insects in their relation to disease causation or as vectors of pathogenic organisms of animals. Laboratory fee, $2 or $4.

261. **Advanced Beekeeping.** First and second terms. Credit four hours a term. Professor PHILLIPS. M F 11-12:50. Comstock Hall 12.

A technical course covering investigations, especially those of a scientific character, in all phases of apiculture. Special consideration is given to the study of beekeeping regions, with particular reference to conditions in New York.

Designed for advanced students preparing to teach or to do research in apiculture.

118. **The Technics of Biological Literature.** First term. Credit three hours. Professor BRADLEY. Lectures, M F 11. Comstock Hall 300. Library work by assignment.

A critical study of the biologists' works of reference. Practice in the use of generic and specific indices and of bibliographies, and in the preparation of the latter; methods of preparing technical papers for publication; zoological nomenclature. This course is of a technical nature, and is intended to aid students specializing in zoology or entomology in their contact with literature.

RESEARCH

300. **Research.** Throughout the year. Prerequisite, permission to register from the professor under whom the work is to be taken. Comstock Hall.

300a. **Insect Ecology.** Professors CLAASSEN and READIO.

300b. **Insect Morphology and Embryology.** Professor JOHANNSEN, Dr. BUTT.

300c. **Taxonomy.** Professors BRADLEY (all orders), JOHANNSEN, MATHESON (Diptera), CLAASSEN (Plecoptera), READIO (Hemiptera), and Dr. FORBES (Lepidoptera).

300d. **Economic Entomology.** Professors MATHESON, PARROTT, GLASGOW, CHAPMAN, CLAASSEN, and READIO and Assistant Professors LEIBY, MACLEOD and COLLINS.

300e. **Medical Entomology and Parasitology.** Professor MATHESON.

300f. **Apiculture.** Professor PHILLIPS.

300g. **Aquiculture.** Professor EMBODY.

300h. **Limnology.** Professor EMBODY and Dr. MOTTLEY.

300i. **Insect Physiology.** Professors PHILLIPS and MATHESON, and Assistant Professors MACLEOD and COLLINS.

RESEARCH AT THE NEW YORK STATE EXPERIMENT STATION

In addition to the foregoing, graduate research in certain fields of Applied Entomology is also available at Geneva, New York. For further information see page 167.

SEMINARIES

Jugatae. Throughout the year. M 4:30–5:30. Comstock Hall 145.
The work of an entomological seminary is conducted by the Jugatae, an entomological club that meets for a discussion of the results of investigations by its members.

Seminary in Insect Physiology. Throughout the year. Open to qualified graduate students. Assistant Professor MACLEOD. M 6:30-8. Comstock Hall 50.

EXPERIMENTAL ZOOLOGY

McGraw Hall; *Professors* H. D. REED and B. P. YOUNG.
Experimental Zoology **1, 2, 3, 4** (See under ZOOLOGY, p. 72)

FISH CULTURE

Comstock Hall; *Professor* G. C. EMBODY.
Fish Culture **1, 2, 3, 4** (See under AQUICULTURE, p. 61)

HERPETOLOGY

McGraw Hall; *Professors* A. H. WRIGHT and W. J. HAMILTON, JR.
Herpetology **1, 2, 3, 4** (See under VERTEBRATE TAXONOMY AND ECOLOGY, p. 71)

HISTOLOGY AND EMBRYOLOGY

Stimson Hall; *Professors* B. F. KINGSBURY and H. B. ADELMANN.

Approved Major and Minor Subjects (key to symbols on p. 29)

Embryology **3, 4**
Histology **3, 4**
Histology and Embryology **1, 2, 3, 4**

(See also INSECT EMBRYOLOGY **1, 2, 3**; Comstock Hall, *Professor* O. A. JOHANNSEN, under ENTOMOLOGY, p. 63)

Advanced work in histology and embryology is of necessity individual. Advanced students are sometimes recommended to take some one or more of the general courses in the subject. As preliminary to graduate work, students are expected to have had the courses in the tissues and one of the following: the organs, special histology, embryology. A year's work in zoology, biology, anatomy, or physiology may with advantage precede advanced work in this subject.

The Department of Histology and Embryology offers the following courses.

6. *Histology* (*Veterinary*). Four hours a week, throughout the year.
9. *Embryology* (*Veterinary*). Two hours, second term.
10. *Histology* (for medical students). Eight hours. First term.
101. *The Tissues: Histology and histogenesis.* Four hours, first term.
102. *The Organs: Histology and development.* Four hours, second term.
104. *Vertebrate Embryology.* Five hours, second term.

107. **Advanced Histology and Embryology.** Throughout the year. Credit three hours or more a term. Prerequisite, Animal Biology 101, and 102 or 104, or equivalent courses. Professor KINGSBURY, Assistant Professor ADELMANN, and instructor. Day and hours to be arranged. Stimson 43.

115. **Experimental Embryology.** First term. Credit two hours. Assistant Professor ADELMANN. The course will be conducted as a seminar. Lectures with reports by students dealing with the experimental analysis of developmental processes. Hours to be arranged. Stimson.

[120. **The Theory of Development.** First term. Credit two hours. Assistant Professor ADELMANN. Hours to be arranged. Stimson 8. Not given in 1937-38.]

One lecture with collateral reading and reports. A series of lectures upon some important phase of Development.

108. **Seminary.** First and second terms. One hour each week. Thursday, 4:30 p.m., or time to be arranged.

For the discussion of problems in the field of histology, or embryology; for the review of current literature; for the presentation of original work by the members of the staff and those doing advanced work in the department.

Undergraduate courses 101, 102, and 104 (College of Arts and Sciences) may often be attended with advantage by graduate students. Satisfactory work in these obviates the requirements of the Qualifying Examination.

ICHTHYOLOGY

McGraw Hall; *Professors* A. H. WRIGHT and W. J. HAMILTON, JR.
Ichthyology **1, 2, 3, 4** (See under VERTEBRATE TAXONOMY AND ECOLOGY, p. 71)

IMMUNOLOGY

James Law Hall; *Professors* W. A. HAGAN and A. ZEISSIG.
Immunology **1, 2, 3, 4** (See under VETERINARY MEDICINE, p. 160)

INVERTEBRATE ZOOLOGY

McGraw Hall; *Professor* B. P. YOUNG.
Invertebrate Zoology **1, 2, 3, 4** (See under ZOOLOGY, p. 72)

LIMNOLOGY

Comstock Hall; *Professors* EMBODY and CLAASSEN and Dr. MOTTLEY.
Limnology **1, 2, 3** (See under ENTOMOLOGY, p. 63)

MAMMALOGY

McGraw Hall; *Professors* A. H. WRIGHT and W. J. HAMILTON, JR.
Mammalogy **1, 2, 3, 4** (See under VERTEBRATE TAXONOMY AND ECOLOGY, p. 71)

MEDICAL SCIENCE

(See under MEDICAL SCIENCES, p. 162)

MORPHOLOGY

Comstock Hall; *Professor* O. A. JOHANNSEN.
Insect Morphology **1, 2, 3** (See under ENTOMOLOGY, p. 63)
McGraw Hall; *Professor* H. D. REED.
Vertebrate Morphology **1, 2, 3, 4** (See under ZOOLOGY, p. 72)
McGraw Hall; Professor B. P. YOUNG.
Invertebrate Morphology **1, 2, 3, 4** (See under ZOOLOGY, p. 72)

NATURE STUDY

Fernow Hall; *Professor* E. L. PALMER.
Nature Study **1, 2, 3, 4** (See under GRADUATE SCHOOL OF EDUCATION, p. 124)

ORNITHOLOGY

Fernow Hall; *Professors* A. A. ALLEN and G. M. SUTTON.

Approved Major and Minor Subjects (key to symbols on p. 29)

Ornithology **1, 2, 3, 4**

Before registering for a major in Ornithology a student must have thorough training in biology, and in the majority of cases must expect to do summer work on his problem.

9. *General Ornithology.* Second term. Credit three hours.

126. **Advanced Ornithology.** First term. Credit three hours. Prerequisite, course 8 or 9. Professor ALLEN and Mr. KELLOGG. Lecture, W 11. Fernow 122. Laboratory and field work, T Th 1:40-4. Fernow 210.

The structure and classification of birds; geographical distribution; the literature and institutions of ornithology; identification of representative birds of the world. The first part of the term is devoted to field work on the fall migration and the identification of birds in winter plumage. Designed primarily for students specializing in ornithology or animal biology. Laboratory fee, $3.

[131. **Applied Ornithology.** First term. Credit three hours. Should be preceded by course 8 or 9, and presupposes an elementary knowledge of botany and entomology. Professor ALLEN and Mr. KELLOGG. Lecture, W 11. Fernow 122. Laboratory and field work, T Th 1:40-4. Not given in 1937-38.]

This course is intended primarily for students planning to teach biological science or to engage in professional work in ornithology. Field collecting, preparation of specimens, and natural-history photography are emphasized, together with the food and feeding habits of birds; game management; classroom, museum, and Biological Survey methods. Laboratory fee, $3.

136. **Ornithology Seminar.** Throughout the year. M 7:30-9 p. m. Fernow Seminar Room. Required of all graduate students in Ornithology.

300j. **Special Problems in Ornithology.** Professors ALLEN and SUTTON.

PALEONTOLOGY

McGraw Hall; *Doctor* C. W. MERRIAM.

Paleontology **1, 2, 3, 4** (See under GEOLOGY, p. 91)

PARASITOLOGY

Comstock Hall; *Professor* ROBERT MATHESON.

Parasitology **1, 2, 3** (See under ENTOMOLOGY, p. 63)

James Law Hall; *Professor* D. W. BAKER.

Veterinary Parasitology **1, 2, 3, 4** (See under VETERINARY MEDICINE, p. 159)

PATHOLOGY

James Law Hall; *Professor* PETER OLAFSON.

Animal Pathology **1, 2, 3, 4** (See under VETERINARY MEDICINE, p. 160)

PHYSIOLOGY

Stimson Hall; *Professors* H. S. LIDDELL, J. A. DYE, and ————————.

Approved Major and Minor Subjects (key to symbols on p. 29)

Physiology **1, 2, 4**

(See also Animal Physiology **1, 2, 3, 4**; James Law Hall, *Professors* H. H. DUKES, C. E. HAYDEN, and *Doctor* H. T. BATT, under VETERINARY MEDICINE, p. 159)

(See also Insect Physiology **1, 2, 3**; Comstock Hall, *Professors* E. F. PHILLIPS, ROBERT MATHESON, and G. F. MACLEOD, under ENTOMOLOGY, p. 63)

31. **Neuro-Physiology.** Muscle, nerve, central nervous system, and organs of special sense. Second term. Professor LIDDELL. Lectures and laboratory.

34a. **Advanced Physiology.** Autonomic Nervous System, digestion, absorption, and the fate of the absorbed food. Second term, 4 weeks. Two hours credit. Assistant Professor DYE and Dr. ————. Lectures, W Th F S 8. Laboratory, T 9-4 and Th 10-1:30. Stimson.

34b. **Physiology of the Endocrine Glands.** Second term, 4 weeks. Two hours credit. Assistant Professor DYE and Dr. ————. Lectures, W Th F S 8. Laboratory, T 9-4 and Th 10-1:30. Stimson.

Courses 31, 34a, and 34b are those offered to first year medical students. They may be taken separately or as a group.

303. *Elementary Human Physiology.* Either term. Three hours a week.

305. *Physiology of the Vitamins, Ultra-Violet Radiations, and Internal Secretions.* Second term. Three hours a week.

306. *Physiology of Exercise.* First term. Three hours a week.

307. **The Physiology of the Conditioned Reflex.** First term. Credit three hours. Prerequisites, Psychology 1 and Animal Biology 300 or 303. Professor LIDDELL. M W F 9. Amphitheatre, Stimson.

A systematic review, with demonstrations, of methods for establishing conditioned reflexes of glands and muscles. The development of the theory of behavior based upon the conditioned reflex method will be critically presented. A general survey of the work of the nervous system derived from conditioned reflex experiments. This course should be preceded or followed by Animal Biology 225.

308. **Advanced Work and Research in Physiology.** Either term. Two or more hours credit.

309. **Physiology of Circulation, Respiration, Metabolism, Excretion and Animal Heat.** First term. Lectures, recitations, and laboratory. Assistant Professor DYE and Dr. ————. W F 11; W F 1:40-4.

310. **Seminary in Physiology.** Second term. Credit one hour. Day to be arranged. Stimson, 4:15.

Reports on recent advances in physiology.

POULTRY HUSBANDRY

Poultry Building; *Professors* F. B. HUTT, G. F. HEUSER, G. O. HALL, L. C. NORRIS, A. L. ROMANOFF, and J. H. BRUCKNER.

Poultry Husbandry **2, 4** (See under AGRICULTURE, p. 112)

PROTOZOOLOGY

McGraw Hall; *Professor* B. P. YOUNG.

Protozoology **2, 3, 4** (See under ZOOLOGY, p. 72)

PSYCHOLOGY

Morrill Hall; *Professors* MADISON BENTLEY, H. P. WELD, K. M. DALLENBACH, J. G. JENKINS; *Doctor* ————.

Approved Major and Minor Subjects (key to symbols on p. 29)

Applied Psychology **2, 3, 4**
Experimental Psychology **1, 2, 3, 4**
History of Psychology **3**
Physiological Psychology **3**
Psychology **1, 2, 4**
Systematic Psychology **3**

1. *Elementary Psychology.* Three hours a week, either term.

2. *General Psychology.* Three hours a week, second term.

3a and 3b. *Introductory Laboratory.* Six hours a week, either term, or both terms.

4. **Intermediate course in Psychology.** First term. Prerequisite, consent of the instructor. Dr. ————. M W F 9. Morrill 41.

[5. **Perception.** First term. Dr. ————. M W F 9. Morrill 41. Not given in 1937-38.]

6. **Memory, Skill and Work.** Second term. Professor DALLENBACH. M W F 9. Morrill 42.

[7. **Reading of German Psychology.** Second term. Dr. ————. Hours to be arranged. Seminary Room, Morrill. Not given in 1937-38.]

The accurate reading and translation of psychological texts and articles. The course presupposes a knowledge of grammar.

9. **Experimental, Theoretical, and Historical Problems.** Professors BENTLEY, WELD, and DALLENBACH, and Assistant Professor JENKINS. Morrill, Psychological Laboratory.

10. **Social Psychology.** Second term. Prerequisite, consent of the instructor. Professor WELD. M W F 11. Morrill 40.

11. **Physiological Psychology of the Senses.** First term. Prerequisite, consent of the instructor. Professor DALLENBACH. M W F 11. Morrill 42.

A systematic review and criticism of the experimental literature of sense psychology. Lectures, discussions, and demonstrations.

12. **Legal Psychology.** First term. Dr. WELD. M W F 11. Morrill 40.

Psychological aspects of the origin and growth of the law, and of legal theory; psychological problems of evidence and responsibility.

[13. **History of Experimental Psychology.** First term. Prerequisite, consent of the instructor. Dr. ————. T Th S 11. Morrill 41. Not given in 1937-38.]

14. **Contemporary Psychology.** First term. Professor WELD. T Th S 11. Seminary Room, Morrill.

A comparative study of current psychological theory; existential psychology, behaviorism, Gestalt psychology, psychoanalysis, and hormic psychology.

15. **Psychology of the Abnormal.** First term. Prerequisite, consent of the instructor. Professor BENTLEY. M W F 10. Morrill 40.

[16a. **Introduction to Psychotechnology.** Second term. Prerequisite, consent of the instructor. Assistant Professor JENKINS. T Th S 10. Goldwin Smith A. Not given in 1937-38.]

A study of the results of experimental and statistical analyses of psychological problems in vocational guidance, medicine, law, athletics, and problems of everyday existence.

16b. **Psychotechnology in Business and Industry.** First term. Prerequisite, consent of the instructor. Assistant Professor JENKINS. T Th S 10. Goldwin Smith A.

A study of experimental and statistical analyses of psychological problems in vocational selection, industrial production, personnel, advertising, selling, and market research.

17. **Animal Psychology.** First term. Prerequisite, consent of the instructor. Professor BENTLEY. M W F 2. Morrill 42.

The comparative psychology of vertebrate and invertebrate forms. Lectures, discussions, and laboratory.

18. **Genetic Psychology.** Second term. Prerequisite, consent of instructor. Professor BENTLEY. M W F 10. Morrill 40.

A study of the individual life-career and the development of the psychological functions. Lectures and textbook assignments.

[20. **The Correlational and the Psychophysical Methods.** First term. Professor DALLENBACH. M W F 2-4. Morrill, Psychological Laboratory. Not given in 1937-38.]

[21. **Technique of Experimentation.** Second term. Professor BENTLEY. T Th 2. Morrill, Psychological Laboratory. Not given in 1937-38.]

A study of the principles and processes of psychological research.

24. **Theory of Education.** (See Education 5.) Professor OGDEN.

VERTEBRATE TAXONOMY AND ECOLOGY

McGraw Hall; *Professors* A. H. WRIGHT and W. J. HAMILTON, JR.

Approved Major and Minor Subjects (key to symbols on p. 29)

Animal Ecology **1, 2, 3, 4**
Herpetology **1, 2, 3, 4**
Ichthyology **1, 2, 3, 4**
Mammalogy **1, 2, 3, 4**
Vertebrate Ecology **1, 2, 3, 4**
Vertebrate Zoology **1, 2, 3, 4**

8. *Elementary Taxonomy and Natural History of Vertebrates.* Credit three hours each term.

110. *Economic Zoology.* Credit one hour. First term.

Descriptions of courses 8 and 110 will be found in the Announcements of the College of Arts and Sciences and the College of Agriculture.

22. **Ichthyology, Advanced Systematic and Field Zoology.** Throughout the year. Credit three hours a term. Professor WRIGHT and Assistant Professor HAMILTON. Lectures, T Th 8. Laboratory, S 8-10:30.

In the lectures, special emphasis is laid on the principal phases of animal life; the taxonomy, origin, and evolution of fossil and living groups; geographical distribution; and the literature and institutions of zoology. Laboratory periods are devoted to the identification of exotic and indigenous forms.

[23. **Herpetology (Amphibia).** First term. Credit three hours. Professor WRIGHT and Assistant Professor HAMILTON. Not given in 1937-38.]

[24. **Herpetology (Reptilia).** Second term. Credit three hours. Professor WRIGHT and Assistant Professor HAMILTON. Not given in 1937-38.]

[25. **Mammalogy.** Throughout the year. Credit three hours a term. Professor WRIGHT and Assistant Professor HAMILTON. Lectures, T Th 8. McGraw 7. Laboratory, F 1:40-4 or Sat. 8-10:30. Not given in 1937-38.]

Discussion of principal phases of mammalian life: origin, distribution, habits and literature. Laboratory periods are devoted to methods of field collecting, census taking, life history studies, preparation of skins and skeletons, and identification of North American species. Laboratory fee, $3.

112. **Literature of Economic Zoology, Conservation, and Ecology.** Second term. Credit one hour. Professor WRIGHT, Assistant Professor HAMILTON, and others. Th 7:30 p.m. McGraw 7.

The literature of economic zoology, ecology, limnology, oceanography, and kindred fields; fish and fisheries (for profit and pleasure); amphibians and reptiles, their uses; small and big game (commercial and sport); aquaria; zoological gardens; preserves; game farms; animals in relation to recreation, settlement, forestry, agriculture, and other industries; biologic resources, their exploration, conservation, utilization, and management.

67. **Seminary in Systematic Vertebrate Zoology.** First and second terms. Professor WRIGHT. T 7 p.m.

Life-zone plans of North America, 1917-1936. Distribution and origin of life in North America. Zoogeography of the Old World. Animal coloration. Other topics, to be announced.

300a. **Research in Vertebrate Taxonomy and Natural History.** Professor WRIGHT and Assistant Professor HAMILTON.

ZOOLOGY

McGraw Hall; *Professors* H. D. REED and B. P. YOUNG.

Approved Major and Minor Subjects (key to symbols on p. 29)

Experimental Zoology **1, 2, 3, 4**
Invertebrate Zoology **1, 2, 3, 4**
Invertebrate Morphology **1, 2, 3, 4**
Protozoology **2, 3, 4**
Vertebrate Morphology **1, 2, 3, 4**
Zoology **1, 2, 3, 4** (may be chosen as a major subject for the master's degree when the minors are in other sciences)

In order to undertake graduate study the student not only should be prepared in the fundamentals of Zoology but also should have or acquire a foundation in the particular phase of this subject which he intends to pursue.

The members of the staff are prepared to direct the research work of graduate students in connection with the Summer Session of Cornell University.

1. *Introductory Zoology.* Three hours a week. Throughout the year.

11. *Comparative Anatomy.* Three hours a week. Throughout the year.

16. **Invertebrate Zoology.** Throughout the year. Prerequisite course 1 or equivalent. Assistant Professor B. P. YOUNG. Lecture, M 12; Laboratory, T and Th 1:40-4. McGraw 102.

A comprehensive consideration of the morphology, classification, development and phylogeny of the invertebrates.

99. **Zoological Problems.** Professor H. D. REED, Assistant Professor B. P. YOUNG, and Dr. SENNING.

An introduction to research.

Graduate Work in General Zoology, Morphology, Experimental Zoology and Protozoology. Throughout the academic year and summer period. Professors H. D. REED and B. P. YOUNG.

PLANT SCIENCES

BOTANY AND PLANT PHYSIOLOGY

Professors K. M. WIEGAND, LEWIS KNUDSON, A. J. EAMES, L. W. SHARP, O. F. CURTIS, W. C. MUENSCHER, L. C. PETRY, and E. F. HOPKINS; at Geneva, *Professors* M. T. MUNN, G. P. VAN ESELTINE, and B. R. NEBEL.

Approved Major and Minor Subjects (key to symbols on p. 29)

Botany **2, 4**
Cytology **1, 2, 3, 4**
Economic Botany **1, 2, 3, 4**
Plant Morphology (including Anatomy) **1, 2, 3, 4**
Paleobotany **1, 2, 3, 4**
Plant Physiology **1, 2, 3, 4**
Plant Taxonomy **1, 2, 3, 4**

The laboratories of the department are in the Plant Science Building, one of the buildings of the College of Agriculture, and are well equipped with the necessary apparatus and collections for research. The herbarium contains abundant local and foreign material for taxonomic study.

The very rich flora about Ithaca and its accessibility make the location especially advantageous for all phases of botany, as material may be easily obtained. Gardens and greenhouses are also available for the growing of experimental material.

The University Library and the library of the College of Agriculture are well equipped with special works and periodicals dealing with all phases of botanical science. A department library in which are kept the books in more constant use has been established in connection with the laboratories.

A seminary in plant physiology offers to graduate students opportunity to become familiar with current work in plant physiology and to consider the relations of this work to agricultural practices. At these meetings there are also held general conferences and discussions of opinions or methods not conveniently or appropriately dealt with in the general courses. Seminaries are conducted in cytology and frequently also in the taxonomy of vascular plants and plant morphology. The purpose of these various seminaries is not only to keep abreast of the literature of the subject, but to furnish to the student an opportunity to gain experience in presenting the results of his own research or in critically evaluating the work of others. Graduate students are expected to attend the seminaries dealing with their special fields of work.

As a prerequisite for work in general botany, anatomy, cytology, and comparative morphology, the student will be expected to have a knowledge of the fundamental features of botanical science. For work in paleobotany a knowledge of the fundamental features of both botany and geology is prerequisite.

A fundamental training in botany and chemistry is required of any student who expects to major in plant physiology. If it is not possible to obtain this training before entering upon graduate work at Cornell, then the student will be expected to broaden his knowledge in botany and chemistry after beginning graduate work.

The University conducts a Summer Session in which there is opportunity for graduate study and research in botany. The Summer Session is six weeks in length, but a longer period of study can be arranged. A prospective student contemplating summer work in botany and plant physiology should correspond with Professor WIEGAND or others of the staff before coming to Ithaca.

A fellowship carrying a stipend of $400 and a scholarship with a stipend of $200 are awarded in alternate years to graduate students in Botany. Holders of these are exempt from the payment of tuition. In 1938-39 the fellowship will be awarded.

Plant Physiology

Professors Knudson, Curtis, and Hopkins.

31. *Introductory Plant Physiology.* First or second term. Credit four hours. Lectures, T Th 10. Plant Science 233. Laboratory, T Th or W F 1:40–4. Assignment to laboratory section must be made at time of registration.

231. **Plant Physiology, Advanced Lecture Course.** Throughout the year. Credit three hours a term. Prerequisite, training in botany and chemistry, to be determined in each case by the department. Professors Knudson and O. F. Curtis. Lectures, M W F 10. Plant Science 143.

Lectures and discussions on physiological processes of plants and the factors influencing them and the relations of these processes to plant behavior.

232. **Plant Physiology, Advanced Laboratory Course.** Throughout the year. Credit three hours a term. Prerequisite or parallel, course 231. Professors Knudson and O. F. Curtis, Assistant Professor Hopkins, and Dr. Clark. Laboratory, M 1:40-4, S 8-12:30. Plant Science 241. Laboratory fee each term, $10; breakage deposit, $5.

Principally a quantitative study of various phases of plant physiology. The student will apply chemical, physical, and bacteriological methods in the study of plant physiological processes. Special attention will be given to technique.

233. **Seminary in Plant Physiology.** Throughout the year. Required of graduate students in Plant Physiology. Professors Knudson and O. F. Curtis, Assistant Professor Hopkins, and Dr. Clark. Conference, F 11. Plant Science.

The presentation and discussion of current contributions to plant physiology; reports on the research problems of graduate students and members of the staff.

Research in Plant Physiology. Professors Knudson, Curtis, and Hopkins.

Plant Anatomy

Professors Eames and Petry.

123. **Plant Anatomy.** First term. Prerequisite, course 1 or the equivalent. Professor Eames. T 9-12:30; Th S 9-11:30. Given in alternate years.

A detailed study of the internal structure of vascular plants with emphasis on determination and interpretation.

Research in Anatomy. Professor Eames.

Cytology

Professor Sharp.

124. **General Cytology.** First term. Credit four hours. Prerequisites, Botany 1 or Zoology 1 or equivalent. Professor L. W. Sharp. Lectures, M W 9. Plant Science 233. Laboratory, M W or T Th 10-12:30 or T Th 1:40-4. Plant Science 219. Assignment to laboratory section must be made at time of registration.

The principal topics considered are cells and their components, nuclear and cell division, meiosis and fertilization, and the relation of these to problems of development, reproduction and heredity. Both plant and animal materials are used. Microtechnic is not included. Laboratory fee, $5.

125. **Microtechnic.** Second term. Credit three hours. Prerequisite, permission to register. Professors Eames and L. W. Sharp. Lectures and demonstrations, T 11-1. Other hours to be arranged. Plant Science 219.

For advanced students who require training in the preparation of plant materials for histological and cytological study. Laboratory fee, $5. The cost of additional materials is likely to be from $10 to $20.

224. **Advanced Cytology.** Second term. Credit two hours. Prerequisites, Botany 124, Plant Breeding 101, and permission to register. Professor L. W. Sharp. Lecture, W 9. Plant Science 233. Laboratory and seminar, S 10-12:30. Plant Science 228.

An advanced course dealing mainly with recent researches in cytogenetics.

Research in Cytology. Professor Sharp.

RESEARCH AT THE NEW YORK STATE EXPERIMENT STATION

Cytological research in relation to cultivated plants is also available at Geneva. For further information see page 166.

MORPHOLOGY

Professors EAMES, SHARP, and PETRY.

(**Comparative Morphology of Fungi.** Given in the Department of Plant Pathology.)

[126. **Morphology of Vascular Plants.** Second term. Prerequisite, Course 1 or its equivalent, and permission to register. Professor EAMES. T Th 9-12:30. Given in alternate years. Not given in 1937-38.]

An advanced course in the comparative morphology, life histories, and phylogeny of vascular plants.

Research in Morphology. Professors EAMES and PETRY.

TAXONOMY

Professors WIEGAND, MUENSCHER, and EAMES.

13. **Trees and Shrubs.** First term. Credit three hours. Prerequisite, course 1 or its equivalent. Assistant Professor MUENSCHER and Mr. LAWRENCE. Lecture, T 8. Plant Science 143. Laboratory or field work, M W or T Th 1:40-4. Plant Science 211. One all-day field trip is required.

The identification of trees and shrubs in summer and in winter conditions. During the first part of the term the work covering identification is done largely in the field. The work of the latter part of the term is a study of the taxonomy of woody plants. Laboratory fee, $3; deposit, $5.

117. **Taxonomy of Vascular Plants.** Second term. Credit four hours. Prerequisite, course 1 or its equivalent. Professor WIEGAND. Lecture, M 9. Laboratory, M W F 1:40-4. Plant Science 211.

A study of the kinds of seed plants and ferns, their classification into genera, families, and orders, and field work on the local flora. Emphasis is placed on wild plants, but the more commonly cultivated varieties receive some attention. Those desiring advanced work on special groups or problems may follow this with course 145. Laboratory fee, $4; deposit, $5.

219. **Advanced Taxonomy of Vascular Plants.** Second term. Credit one or two hours. Prerequisite, course 117 or its equivalent. Professor WIEGAND. Hours to be arranged. Plant Science 211.

Special round-table discussion of topics of particular interest to the taxonomist. One hour may be devoted to practical work on some group of plants.

Research in Taxonomy. Professors WIEGAND and EAMES.

RESEARCH AT THE NEW YORK STATE EXPERIMENT STATION

Research in taxonomy of fruits and vegetables is also available at Geneva. For further information see page 166.

PALEOBOTANY

Professors PETRY and EAMES.

Research.

ECONOMIC BOTANY

Professor MUENSCHER.

3. **Poisonous Plants.** Second term. Credit one hour. Registration by permission. Assistant Professor MUENSCHER. Discussion and demonstrations, F 1:40-4. Plant Science 353.

Special emphasis is placed on the identification, poisonous properties, and distribution of poisonous plants. Laboratory fee, $2.

15. **Weed Identification and Control, and Seed Analysis.** First term. Credit three hours. Prerequisite, course 1 or its equivalent. Assistant Professor MUENSCHER. Lecture, S 8. Plant Science 143. Laboratory, F 1:40-4 and S 9-11:20. Plant Science 353.

Special emphasis is given to the habits, characteristics, and properties which make weeds harmful or undesirable, the losses and injury produced by them, and the method for their prevention, eradication, and control. Field and laboratory practice in the identification of weeds and seeds and practice in the recognition of seed impurities are provided. Students wishing to do additional or special work on seed analysis or testing may register in course 145. Laboratory fee, $3.

215. **Seminar in Economic Botany.** First term. Open to qualified students. Assistant Professor MUENSCHER. Hours to be arranged.

The general subject for 1937-38 consists of a discussion of problems and contributions relating to weed control.

Research. Economic Botany.

GENERAL BOTANY

Professor PETRY and instructors.

1. *General Botany.* Throughout the year. Two lectures and one laboratory period a week.

21. *Advanced General Botany.* Second term. Lectures, T Th 9. Plant Science 141. Laboratory, T Th 10-12:30. Plant Science 228. Dr. PALMQUIST.

OTHER COURSES

[141. **History of Botany.** Second term, without credit. A course of lectures given by various members of the staff with the purpose of acquainting advanced students of botany with the historical development of their science. Not given in 1937-38.]

145. **Special Problems in General Botany, Ecology, Economic Botany, Taxonomy, Morphology, Anatomy, Paleobotany, Cytology, and Physiology.** Throughout the year. Credit not less than two hours a term. By appointment. Professors WIEGAND, KNUDSON, EAMES, L. W. SHARP, O. F. CURTIS, and PETRY, and Assistant Professors MUENSCHER and HOPKINS.

Students engaged on special problems may register in this course. They must satisfy the instructor under whom the work is taken as to preparation for the problem chosen. The laboratory fee depends on the nature of the work and on the number of credit hours.

RESEARCH AT THE NEW YORK STATE EXPERIMENT STATION

In addition to the foregoing, graduate research in seed investigations in also available at Geneva. For further information see page 168.

PLANT BREEDING

Professors R. A. EMERSON, H. H. LOVE, C. H. MYERS, F. P. BUSSELL, A. C. FRASER, R. G. WIGGANS, and J. R. LIVERMORE; *Doctor* ERNEST DORSEY; at Geneva, *Professor* R. WELLINGTON.

Approved Major and Minor Subjects (key to symbols on p. 29)

Genetics **1, 2, 4**
Plant Breeding **1, 2, 4**
Statistical Methods of Analysis **1, 2, 4**

Students who are chiefly interested in the application of genetical principles to crop improvement will doubtless prefer to register in *plant breeding* Problems. for research will involve studies of such characters as yield, quality, disease and insect resistance, and the like. Those students for whom the theoretical aspects of genetics hold the greater appeal, will register in *genetics*. Their research prob-

lems will usually stress gene analyses and chromosomal relationships. Statistical methods include the analysis of data from any field of research, and a study of experimental methods and field plot technique.

The laboratories of this department are supplied with calculating machines necessary for statistical investigations, and are equipped with cameras and accessories for photographic work. The departmental library contains the principal books and periodicals dealing with plant breeding, evolution, and genetics. The department has greenhouse room approximating 2000 square feet of floor space, a part of which is available for the use of graduate students. A garden near the laboratories affords the necessary room for most of the plant material used by graduate students. For more extensive plantings, room is provided on the University farms.

It is advisable that the student, before entering upon graduate work, should have had the following courses or their equivalent: genetics, plant breeding, general botany or elementary zoology or biology, elementary plant, animal or human physiology, introductory inorganic chemistry, and elementary organic chemistry. A student who has not had most of these subjects will ordinarily find it impossible to complete his graduate work in the minimum time.

Students majoring in plant breeding will ordinarily find it necessary to remain in Ithaca during the summer, or to make satisfactory arrangements for growing and studying elsewhere the plant materials used in connection with their research problems. Since the department has accommodations for only a limited number, prospective students will find it to their advantage to correspond with a member of the departmental staff some months prior to entering upon their work.

101. *Genetics.* Four hours a week. First term.

103. *Plant Breeding.* Three hours a week. Second term.

150. *Special Problems.* One or two hours. First or second term

201. **Advanced Genetics.** Second term. Prerequisite, course 101 and Botany 124. Professor FRASER. M F 8-10. Plant Science 146. Laboratory work to be arranged.

Group discussions of advanced principles of genetics, with special attention to methods of analysis. Laboratory studies of experimental data and of genetical "unknowns" in Drosophila. Laboratory fee, $3. Deposit, $2.

211. **Statistical Methods of Analysis.** First or second term. Assistant Professor LIVERMORE. Th 1:40-4. Plant Science 146.

A discussion of statistical methods for the study of variation, correlation, curve fitting, experimental error, and the analysis of variance; and the application of these methods to problems in biology and related fields. Laboratory fee, $2.

Seminary. Second term. Professors EMERSON, LOVE, MYERS, BUSSELL, FRASER, WIGGANS, and LIVERMORE, and Dr. DORSEY. W 11. Plant Science 146.

RESEARCH AT THE NEW YORK STATE EXPERIMENT STATION

Research in fruit breeding problems, is also available at Geneva. For further information see page 166.

PLANT PATHOLOGY

Professors L. M. MASSEY, H. H. WHETZEL, DONALD REDDICK, M. F. BARRUS, H. M. FITZPATRICK, CHARLES CHUPP, W. H. BURKHOLDER, F. M. BLODGETT, D. S. WELCH, K. H. FERNOW, A. G. NEWHALL, W. D. MILLS, C. E. F. GUTERMAN, A. B. BURRELL, E. M. HILDEBRAND, P. P. PIRONE, K. G. PARKER, and V. L. FRAMPTON; at Geneva, *Professors* O. A. REINKING, J. G. HORSFALL, W. O. GLOYER, J. M. HAMILTON, H. S. CUNNINGHAM, L. M. COOLEY, R. O. MAGIE, and D. H. PALMITER.

Approved Major and Minor Subjects (key to symbols on p. 29)

Mycology **1, 2, 3, 4**
Plant Pathology **1, 2, 3, 4**

The laboratories of the department are fully equipped for teaching and research in this subject. Many pieces of apparatus for use in connection with

specialized research problems are available and additional apparatus can be supplied whenever it is needed. Greenhouses having about 5,000 square feet of floor space afford facilities for experimental work and for the culture of diseased and healthy plants for class use. These houses are divided into compartments so that various artificial conditions of temperature and moisture can be maintained for diverse types of plants and kinds of experimental work. Field laboratories in important crop sections of the State are maintained through co-operation with growers. These laboratories provide certain graduate students who receive fellowships (several of which are usually available each year) with an opportunity of pursuing investigations on a large scale under most favorable commercial conditions.

The pathological herbarium includes a local collection of fungi and pathological materials and sets of well-known fungous exsiccati. The library contains most of the important works on plant pathology, mycology, and bacteriology, complete sets of the more important journals, many monographs, and practically all the experiment station literature on these subjects.

Candidates for the Doctor's degree should spend at least one season in the field in order to come into contact with the practical aspects of control problems. Students preparing for graduate work in plant pathology are urged to obtain a thorough knowledge of elementary physics and chemistry, including organic and physical chemistry, and of general botany, plant histology, and plant physiology. A reading knowledge of French and German is indispensable in phytopathological research and must be acquired before the beginning of the third semester of graduate work. Candidates for advanced degrees must have fundamental training in the subjects enumerated above. Opportunity is afforded for further study in these subjects after entering the Graduate School, but a student availing himself of this opportunity can not expect to receive a degree in the minimum amount of time required for residence. Members of the staff are prepared to direct investigation in the various sub-divisions of the broader field. It is urged that prospective students correspond with a member of the departmental staff some months in advance of the time when they expect to enter upon their work.

1. **General Plant Pathology.** First or second term. Professor WHETZEL. Lecture, W 8. Practice and conferences, any two periods, T W Th F 1:40-4. Plant Science Building 336, 341, 343, and 362.

A fundamental introductory course treating of the nature, cause, and control of plant diseases. Required of all graduate students. This course is also offered during the six-weeks summer session.

2. **Principles of Plant Disease Control.** First term. Professor WHETZEL. Lecture, Th 8. Practice, M Th 1:40-4. Plant Science Building 342.

A consideration of the principles and methods in plant disease control. Required of all graduate students.

201. **Advanced Plant Pathology.** First and second terms. Professor MASSEY. Lecture, F 9. Plant Science Building 336. Practice, T F 10-12:30. Plant Science Building 304.

A presentation and analysis of the experimental and empirical knowledge of plant diseases. The phenomena of infection, susceptibility, host reactions, and symptomatology are critically considered.

111. **Forest and Shade-tree Pathology, and Tree Surgery.** Second term. Prerequisite, course 1. Assistant Professor WELCH. Lecture, T 9. Plant Science Building 336. Practice, M 10-12:30. Plant Science Building 362.

A course designed especially for students in conservation, forestry and ornamental horticulture, dealing with the recognition and control of diseases of forest, shade, and ornamental trees and shrubs, and the principles of tree repair.

121. **Comparative Morphology of Fungi.** First term. Prerequisite, Botany 1 or the equivalent. Professor FITZPATRICK. Lecture, M W 9. Practice, M W 1:40-4. Plant Science Building 333. Given in alternate years.

A synoptical course designed to acquaint the student with the general field of mycology. Emphasis will be placed on morphology and phylogeny, rather than on taxonomy. This course is also offered during the six-weeks summer session.

[221. **Mycology.** First and second terms. Prerequisite, Botany 1 or the equivalent. Professor FITZPATRICK. Lecture, M W 11. Practice, T Th 1:40-4. Plant Science Building 329. Given in alternate years. Not given in 1937-38.]

An intensive study of the morphology, taxonomy, and phylogeny of the fungi (Phycomycetes and Ascomycetes).

222. **Mycology.** First and second terms. Prerequisite, Botany 1 or the equivalent. Professor FITZPATRICK. Lecture, M W 11. Practice, T Th 1:40-4. Plant Science Building 329.

Alternating with course 221, and dealing with the Basidiomycetes and Fungi Imperfecti.

In the six-weeks summer session the groups of the fungi are studied in successive summers in the following order, (1) Phycomycetes, (2) Ascomycetes, (3) Basidiomycetes, (4) Fungi Imperfecti. By repeating the course, the student may obtain in four summers the equivalent of Plant Pathology 221 and Plant Pathology 222. He may begin with any one of the four groups, and need not take them in unbroken sequence. In the 1937 Summer Session, group (3) will be given.

231. **History of Plant Pathology.** First and second terms. Requires a reading knowledge of French and German. Professor WHETZEL. Designed especially for graduate students specializing in Plant Pathology.

241. **Research.** Professors MASSEY, WHETZEL, REDDICK, BARRUS, FITZPATRICK, CHUPP, BURKHOLDER, BLODGETT, WELCH, FERNOW, NEWHALL, MILLS, GUTERMAN, BURRELL, HILDEBRAND, PIRONE, PARKER, and FRAMPTON.

242. **Seminary.** Members of the staff. Weekly.

243. **Literature Review.** Members of the staff. Bi-weekly.

RESEARCH AT THE NEW YORK STATE EXPERIMENT STATION

Research in the diseases of fruits, vegetables and canning crops and special investigations involving *Fusaria* is also available at Geneva. For further information see page 166.

PHYSICAL SCIENCES

ASTRONOMY AND GEODESY

Professor S. L. BOOTHROYD and *Doctor* R. W. SHAW.

Approved Major and Minor Subjects (key to symbols on p. 29)

Theoretical Astronomy **2, 4,**
Geodetic Astronomy **2, 3, 4**
Spectroscopic Binary Orbits **2, 4**
Geodesy **1, 2, 3, 4**
Astrophysical Research **1, 2, 3, 4**

Those electing a major in Astronomy will be required to take courses 184, 185, 186 and 187 and those electing a major in Geodesy will be required to take courses 186 and 188 and Surveying 216. In either case the candidate must present evidence that his training in Mathematics and Physics and in Civil Engineering for majors in Geodesy is sufficiently thorough to warrant undertaking the advanced courses. Those selecting Astronomy or Geodesy as a minor may select such courses as meet their requirements provided the necessary prerequisites are offered.

For work in Practical Astronomy, the Observatory equipment includes a superb 12-inch equatorial; an astronomical transit by Troughton and Simms; an astronomical transit and zenith telescope by Fauth; altazimuths by Troughton and Simms and by Fauth; a Howard Sidereal Clock; chronographs and photographic equipment as well as smaller instruments.

The Geodetic equipment, besides that mentioned above, also includes a Mendenhall Half-second Pendulum Apparatus of the pattern once used in the United States Coast and Geodetic Survey; also equipment for the investigation of standards of length.

Study along the lines of Celestial Mechanics and Theoretical Astronomy or advanced work in Astronomical Spectroscopy may be undertaken by students under the direction of the head of the department. Students contemplating an astronomical career are advised to arrange, in consultation with the head of the department, for courses in Mathematics, Physics, and Astronomy.

180. *Introduction to Astronomy.* Three hours a week, either term.

181. *The Solar System.* Three hours a week, second term.

182. *The Elements of Field Astronomy.* Two hours a week, either term.

184. *The Sun, Stars, and Nebulae.* Three hours a week, first term.

185. *Theoretical Astronomy.* Second term. Credit three hours. Prerequisites, Math. 4a and 4b, Physics 61 and 62 and Astronomy 184. Professor BOOTHROYD and Dr. SHAW. Hours and special work to be arranged.

186. *Geodetic Astronomy.* Credit three hours, either term or spread throughout the year.

187. **Spectroscopic Binary Orbits.** Throughout the year. Credit two hours a term. Professor BOOTHROYD and Dr. SHAW. Prerequisites, Astronomy 184, or equivalent. Hours to be arranged.

Study of the theory of Spectroscopic Binary Orbits and measurement and reduction of a suitable series of spectrograms and computation of the orbital elements from the resulting radial velocities.

188. **Geodesy.** Throughout the year. Credit two hours a term. Prerequisites, Astronomy 186, Surveying 213 and 216 or the equivalent. Professor BOOTHROYD. Hours to be arranged.

Laboratory involving the determination of the intensity of gravity, the investigation of the errors of graduated circles and of other geodetic equipment. Assigned reading and discussion of articles in current geophysical literature.

189. **Astrophysical Research.** Throughout the year. Credit two hours a term. Prerequisites, Astronomy 184 and 187 and Physics 130. Professor

BOOTHROYD and Dr. SHAW. Hours and research problem to be arranged in consultation with Professor BOOTHROYD and Dr. SHAW.

CHEMISTRY

Professors W. D. BANCROFT, G. W. CAVANAUGH, E. M. CHAMOT, A. W. BROWNE, F. H. RHODES, T. R. BRIGGS, JACOB PAPISH, J. R. JOHNSON, C. W. MASON, M. L. NICHOLS, and A. W. LAUBENGAYER; *Doctors* W. F. BRUCE, J. L. HOARD, C. C. WINDING, and W. T. MILLER; at Geneva, *Professors* D. K. TRESSLER, A. W. CLARK, and Z. I. KERTESZ.

Approved Major and Minor Subjects (key to symbols on p. 29)

Inorganic Chemistry **1, 2, 3, 4**
Analytical Chemistry **1, 2, 3, 4**
Organic Chemistry **1, 2, 3, 4**
Physical Chemistry **1, 2, 3, 4**
Chemical Microscopy and Metallography **1, 2, 3, 4**
Industrial Chemistry **1, 2, 3, 4**
Agricultural Chemistry **1, 2, 3, 4**

A graduate student who desires to take either a major or a minor subject in chemistry should select any one of the above seven branches.

A prospective graduate student is strongly advised to communicate, when applying for admission, with a member of the faculty in the branch of Chemistry in which he wishes to have his major subject. In general, members of the Special Committee should be chosen from different fields of Chemistry. It is desirable that candidates for the degree of Doctor of Philosophy select at least one minor subject outside of chemistry.

A graduate student who desires to take a minor subject in chemistry with some field other than chemistry as the major subject, will be required to offer introductory courses in inorganic chemistry, qualitative analysis and quantitative analysis as preliminary to his graduate study. The work upon his minor subject in chemistry may be taken in any branch of the subject that he is qualified to pursue, and may comprise advanced courses selected from the subjoined list, with the approval of his Special Committee.

Graduate students intending to teach chemistry in secondary schools are advised to confer with the departmental Graduate Scholarship Committee regarding preparation for this work.

Candidates for the degree of Master of Arts, Master of Science, or Doctor of Philosophy, with major in Chemistry will be required to offer for admission the equivalent of Introductory Inorganic Chemistry 101 and 105; Qualitative Analysis 205 and 206, or 210; Quantitative Analysis 220 and 221, or 225; Introductory Organic Chemistry 305, and 310 (one term); Introductory Physical Chemistry 405, and 410 (one term); they must also present the equivalent of two units of German.

Before admission to candidacy for the degree of Master of Chemistry, students must have completed the requirements for the degree of Bachelor of Chemistry at Cornell University, or must offer the full equivalent of these requirements if they enter from other institutions.

Candidates for the degree of Doctor of Philosophy with major in Chemistry must have completed, before the beginning of the last year of residence, the equivalent of Advanced Quantitative Analysis 230, Introductory Organic Chemistry Laboratory 310 (second term), and Introductory Physical Chemistry Laboratory 410 (second term). Graduate students entering from approved universities may take, during their residence for the advanced degree, such of these required courses as they have not already pursued. If a graduate student lacks at entrance several of these preliminary courses, more than the minimum period of residence may be necessary.

Every candidate is required to pass a departmental Qualifying Examination before he is allowed to begin actual experimental work on his thesis problem. This examination will comprise tests in the following four Divisions of Chemistry:

(A) Inorganic and General, (B) Analytical, (C) Organic, and (D) Physical. The individual tests, each consisting of a written examination covering a period of two or three hours, will be given in succession at intervals of one week.

One such Qualifying Examination is given at the beginning of each regular term, and at the end of the second regular term of the University year, on days set by the Committee on Qualifying Examinations. The candidate should present himself for the Qualifying Examination not later than the beginning of the term in which he expects to begin actual laboratory work on his thesis problem. In the light of the candidate's achievement in this examination, his Special Committee may further examine his qualifications for graduate study.

After the candidate has passed the Qualifying Examination, and has completed his minor subjects, he will be required to pass a general examination, both written and oral, on his major and minor subjects. Upon recommendation of the candidate's Special Committee, this examination may be taken toward the end of the term preceding his last year of residence. This procedure makes it possible for the candidate to devote his last year of residence to uninterrupted research on his thesis. At the close of his period of residence, and after the acceptance of his thesis, the candidate will be required to pass a final oral examination on the thesis and on related subjects.

As an alternative procedure, the general examination on major and minor subjects and on the thesis may be taken after the acceptance of the thesis.

Graduate students are required to register with the Department of Chemistry on the registration days at the beginning of each term. Entering students must consult with the chairman of the departmental Graduate Scholarship Committee at this time.

For a more detailed description of the courses in the various branches of chemistry, see the Announcement of the Department of Chemistry.

All courses in Chemistry are open to properly qualified graduate or undergraduate students. It may be necessary for a graduate student in chemistry to take one or more of the courses designated by italics as primarily for undergraduates, either as prerequisite to his graduate work or as an essential part of his major and minor subjects.

Fellowships and scholarships are ordinarily awarded only to students who have had at least a year of graduate study.

All courses listed below are to be given in the Baker Laboratory of Chemistry.

Inorganic Chemistry

102a. *General Chemistry.* First term. Credit three hours. Open only to students who have not had chemistry.

102b. *General Chemistry.* Second term. Credit three hours. Continuation of 102a.

104a. *General Chemistry.* First term. Credit three hours. For students who have had a course in chemistry.

104b. *General Chemistry.* Second term. Credit three hours. Continuation of 104a.

106. *General Chemistry.* Lecture, recitation, and laboratory. Throughout the year. Credit three hours a term. For students of Engineering.

130. **Advanced Inorganic Chemistry.** Throughout the year. Credit three hours a term. Prerequisite or parallel courses, Chemistry 405 and 410. Professor Laubengayer. M W F 11. Baker 107.

Lectures. The chemical elements are discussed in the order in which they occur in the Periodic Table of Mendeléeff, with special attention to the group properties of the elements and to the relations of the groups to one another. The rare elements are treated in detail.

135. **Advanced Inorganic Chemistry.** Either term. Credit one to six hours. Prerequisite, Chemistry 305 and 310. Professor Browne, Professor Laubengayer, and assistants. Day and hour to be arranged. Baker 178 and 122.

Laboratory practice. The preparation, purification, properties, and reactions of inorganic compounds including those of the rarer elements.

Chemistry 135 is designed to accompany Chemistry 130, but either course may be taken separately.

[140. **Selected Topics in Advanced Inorganic Chemistry.** Second term. Credit two hours. Prerequisite Chemistry 405, and 410, or special permission. Professor BROWNE. W F 9. Baker 107. Given in alternate years, not in 1937-38.]

[150. **The Chemistry of Glass.** Second term. Credit one hour. Professor LAUBENGAYER. M 9. Baker 107. Open to students who have had or are taking course 405, and to others by special permission. Not given in 1937-38.]

A discussion of the development and manufacture of glass and related ceramic ware, such as pottery and porcelain, with special emphasis on the relations between constitution and physical and chemical properties. Inspection trips to nearby ceramic plants will be arranged.

160. **Chemistry of the Rare Elements.** Throughout the year. Credit two hours. Prerequisite, first term of Chemistry 130, or by special permission. Professor PAPISH. T Th 9. Baker 302.

Lectures. Occurrence, distribution and associations of the rare elements; chemical reactions of the rare elements and of their salts, including analytical reactions.

165. **Chemistry of the Rare Elements.** Throughout the year. Credit two or more hours. Prerequisite or parallel course, Chemistry 160. Professor PAPISH and assistant. Hours to be arranged. Baker 318.

Laboratory practice. Extraction, recovery and purification of the rare elements, and preparation of their salts. Chemical analysis of the rare elements.

195. *Research for Seniors.* Throughout the year. Credit two or more hours a term.

ANALYTICAL CHEMISTRY

201. *Introductory Analytical Chemistry.* Either term. Credit four hours.

203. *Introductory Qualitative Analysis.* Second term. Credit five hours.

205. *Introductory Qualitative Analysis.* First term. Credit three hours.

206. *Introductory Qualitative Analysis.* First term. Credit three hours.

210. *Introductory Qualitative Analysis.* Shorter course. Repeated in the second term. Credit three hours.

220. *Introductory Quantitative Analysis.* Repeated in the second term. Credit three hours.

221. *Introductory Quantitative Analysis.* Repeated in the second term. Credit three hours.

225. *Introductory Quantitative Analysis.* Shorter course. Repeated in the second term. Credit three hours.

230. *Advanced Quantitative Analysis.* Repeated in the second term. Credit three hours.

[235. **Advanced Quantitative Analysis.** Second term. Credit two hours. Prerequisite, first term of Chemistry 405. Professor NICHOLS. M W 12. Baker 207. Given in alternate years, not in 1937-38.]

A theoretical discussion of selected topics in quantitative analysis including sampling, indicators, potentiometric and conductometric titrations, together with the development and present status of various analytical methods.

250. *Gas and Fuel Analysis.* Second term. Credit three hours.

270. **Special Methods of Quantitative Analysis.** Either term. Credit two or more hours. Prerequisite, Chemistry 230 and 235. Professor NICHOLS and assistants. Day and hour to be arranged. Baker 277.

Laboratory practice in the application of special methods such as indirect analysis, conductometric and potentiometric titrations, etc., to quantitative analysis and the analysis of special materials. The study of the important methods and special forms of apparatus used in scientific gas analysis. Electrochemical methods for the determination of silver, lead, copper, tin, nickel, cobalt, zinc, iron, etc.; the analysis of alloys and ores.

Within certain limits the work may be selected to suit the requirements of the individual student.

275. **Quantitative Microanalysis.** First term. Credit three or more hours. Prerequisite, course 230 and special permission. Professor NICHOLS. Hours to be arranged. Baker 282.

Laboratory practice in typical methods of both organic and inorganic quantitative microanalysis.

280. **Emission Spectroscopy in Chemical Analysis.** Either term. Credit three hours. Prerequisite, Chemistry 225 or 220, and Physics 21 and 22, or by special permission. Professor PAPISH and assistant. Laboratory hours to be arranged. Baker 396. Conference, hour to be arranged.

The construction and use of spectroscopic equipment; spectrum excitation; qualitative and quantitative spectrochemical analysis.

295. *Research for Seniors.* Throughout the year. Credit two or more hours a term.

ORGANIC CHEMISTRY

305. *Introductory Organic Chemistry.* Throughout the year. Credit three hours a term.

310. *Introductory Organic Chemistry.* Throughout the year. Credit three hours a term.

315. **Advanced Organic Chemistry.** Throughout the year. Prerequisite, Chemistry 305 and 310. Professor JOHNSON, Dr. BRUCE, Dr. MILLER. T Th 9. Baker 177.

Lectures. First term, survey of the more important classes of organic compounds and their reactions. Second term, discussion of general topics (tautomerism, molecular rearrangements, stereochemistry). Students may register for either term separately.

320. **Advanced Organic Chemistry.** Either term. Credit two to six hours a term. Prerequisite, Chemistry 305 and 310. Professor JOHNSON, Dr. BRUCE, and assistants. Day and hour to be arranged. Baker 208. Conference, F 12. Baker 206.

Laboratory practice. An advanced course in the preparation of organic compounds. The original literature is consulted, and the student is required to repeat some extended and important piece of work, and to compare his results with those published.

325. **Special Topics in Organic Chemistry.** Throughout the year. Credit two hours. Prerequisite, Chemistry 315 or 340, or the consent of the instructor. Professor JOHNSON, Dr. BRUCE and Dr. MILLER. M W 11. Baker 207.

Lectures. A presentation and discussion of special fields and current theories of organic chemistry. For 1937-38 the topics will be: first term, Physical Aspects of Organic Chemistry; second term, Organic Chemistry of Natural Products (Plant and Animal Pigments, Vitamins, Hormones); for 1938-39, first term, Heterocyclic Compounds; second term, Survey of Special Synthetic Methods (including industrial processes).

340. **Identification of Organic Compounds.** Second term. Credit four hours. Prerequisite, Chemistry 305 and 310. Dr. BRUCE and assistants. Lectures and conferences, T Th 10. Baker 206. Three laboratory periods, M T W or Th 1:40-4. Baker 350. With the permission of the instructor, students may register for three hours credit (two laboratory periods).

The classification reactions of organic compounds and the preparation of solid derivatives are applied to the identification of unknown organic substances.

375. *Elementary Organic Chemistry.* First term. Lectures and laboratory, six hours credit. For students preparing for the study of medicine.

395. *Research for Seniors.* Throughout the year. Credit two or more hours a term.

Physical Chemistry

401. *Principles of Physical Chemistry.* Throughout the year. Credit three hours a term. Lectures and laboratory. Primarily for students in the biological sciences.

405. *Introductory Physical Chemistry.* Throughout the year. Credit three hours a term. Lectures.

It is advisable, but not obligatory that course 410 accompany this course.

410. *Introductory Physical Chemistry.* Throughout the year. Credit three hours a term. Prerequisite or parallel course, Chemistry 405. Laboratory practice and recitations.

If one term only is taken, registration for the second term is advised.

420. **Advanced Physical Chemistry.** First term. Credit three hours. Prerequisite, Chemistry 405. Dr. Hoard. Lectures and recitations. M W F 12. Baker 7.

Exposition of the principles of physical chemistry from the mathematical standpoint, with emphasis on the solution of simple problems.

[425. **Applications of the Phase Rule.** First term. Credit two hours. Prerequisite, Chemistry 405. Professor Briggs. M W 11. Baker 7. Not given in 1937–38.]

The study and interpretation of typical phase diagrams in systems of one, two, three and four components. Special attention will be paid to equilibria in saturated salt solutions and to the problem of indirect analysis.

430. **Colloid Chemistry.** First term. Credit two hours a term. Open to candidates for the degree of Bachelor of Chemistry if they have completed Chemistry 405, to others only by special permission. Professor Briggs. T Th 10. Baker 7.

Lectures. The theory of colloid chemistry and its application in the arts.

[435. **Chemistry of Solids.** First term. Credit two or three hours. Prerequisite or parallel courses, Chemistry 405, and Chemistry 530 or 545, or special permission. Professor Mason and Dr. Hoard. Hours to be arranged. Given in alternate years, not in 1937–38.]

A general discussion of the formation and growth of metallic and chemical crystals, their physical and chemical behavior, and the relationships between lattice structure and chemical constitution. In the last third of the course, the physical chemistry of crystal lattices is covered in some detail.

445. **Introductory Electrochemistry.** Second term. Lectures, informal recitations, and laboratory. Credit three hours. Prerequisite, Chemistry 405, Professor Briggs and assistants. Lectures, M W 12. Baker 7. Laboratory. T W Th or F 1:40-4. Baker 1-A.

Theory of electrolysis and the voltaic cell, including the theory and practice of determining transference numbers, the activities of ions, oxidation-reduction potentials, solubility by electrometric methods, and similar subjects.

[450. **Applied Electrochemistry.** First term. Credit two hours. Prerequisite, Chemistry 445. Professor Briggs. M W 11. Baker 7. Given in alternate years, not in 1937-38.]

Lectures. The electrolytic refining and extraction of metals; the electrolytic manufacture of organic and inorganic compounds; the theory and practice of storage cells; the electric furnace.

By taking Course 465 (2 or more hours), the student may supplement this course with laboratory practice dealing with the various topics presented in the lectures. The experiments include the measurement and study of decomposition voltages; current and energy efficiencies in electrolysis; the deposition of metals; the preparation of chemical compounds by electrolysis; and the testing of storage cells.

465. **Advanced Laboratory Practice in Physical Chemistry.** Either term. Credit variable, but not to exceed six hours a term. Prerequisite, determined in each case by the professor in charge. Professors Bancroft and Briggs and assistants. Hour and place to be arranged.

[470. **Thermodynamics.** Throughout the year. Credit three hours a term. Prerequisite, Chemistry 405 and 420, or special permission. M W F 9. Baker 18. Not given in 1937–38.]

Development of the general equations of thermodynamics from the first and second laws. Exposition of the concepts of entropy and free energy. Applications to the study of physico-chemical equilibria in gases, liquids, solids, and liquid solutions. Problems.

[480. **Statistical Mechanics.** Second term. Credit three hours. Prerequisite, first term Chemistry 470. Not given in 1937–38.]

Exposition of the equilibrium theory of statistical mechanics from the standpoint of the Gibbs canonical ensemble. Mechanical interpretation of the principles of thermodynamics, with application to simple thermodynamic systems.

[490. **Introductory Quantum Mechanics with Chemical Applications.** Second term. Credit three hours. Open to qualified students by permission. Hours to be arranged. Not given in 1937–38.]

Elementary presentation of the principles of quantum mechanics. Development of the basic ideas underlying the quantum mechanical theory of the chemical bond.

495. *Research for Seniors.* Throughout the year. Credit two or more hours a term.

Chemical Microscopy and Metallography

530. *Introductory Chemical Microscopy.* Repeated in the second term. Credit three hours.

Graduate students are advised to take this course the first term.

535. **Microscopic Qualitative Analysis (Inorganic).** Either term. Credit two or more hours. Prerequisite, Chemistry 530. Professor Mason and assistants. Laboratory periods, to be arranged. Baker 378.

Laboratory practice in the examination and analysis of inorganic substances containing the more common elements with special reference to rapid qualitative methods and to the analysis of minute amounts of material.

540. **Microscopical Methods in Organic Chemistry.** Either term. Credit two or more hours. Prerequisite, Chemistry 530, and special permission. Professor Mason and assistants. Day and hour to be arranged. Baker 378.

Laboratory practice. General manipulative methods applicable to small amounts of material, crystallization procedures, determination of melting points and molecular weights; chemical tests and reactions for elements, radicals, and various types of organic compounds. Preparation of simple derivatives.

545. **Metallography.** First term. Credit three hours. Prerequisite, Chemistry 405, or Engineering 3X31 as a parallel course, or special permission. Professor Mason and assistants. Laboratory, M T or Th F 1:40–4. Baker 384. Lecture or conference, Th 10.

Laboratory practice and conferences. An introduction to the principles and methods involved in the study of the structure of metals. The relation of microscopical appearances to thermal history and mechanical properties. Preparation of specimens for macroscopic and microscopic study. Metallographic microscopes and their use.

550. **Advanced Metallography.** Second term. Credit variable. Prerequisite, Chemistry 545, and consent of the instructor. Professor Mason. Hours to be arranged. Baker 384. Fee variable.

Laboratory practice and reports. The work may be selected in accordance with the interests of the student, from topics such as heat treatment and structures of various ferrous or non-ferrous alloys, special methods of polishing, etching, and photomicrography, or minor research problems.

565. **Special Methods in Chemical Microscopy.** Either term. Credit one or more hours. Prerequisite, special permission. Professor Mason. Day and hour to be arranged. Baker 378 and 382.

Laboratory practice may be elected in various fields such as photomicrography, ultramicroscopy, crystal studies, micro-manipulations, quantitative determina-

tions, and the microscopy of industrial materials, pigments, textiles, papers, and foods.

595. *Research for Seniors.* Throughout the year. Credit two or more hours a term.

Chemical Engineering and Industrial Chemistry

705. *Unit Operations of Chemical Engineering.* Throughout the year. Credit three hours a term.

710. **Unit Operations of Chemical Engineering.** Laboratory. Throughout the year. Credit two hours a term. Professor Rhodes and Dr. Winding.

715. **Unit Processes of Chemical Engineering.** Second term. Credit three hours. Prerequisite or parallel course, Chemistry 705. Professor Rhodes. M W F 11. Baker 177.

Lectures. A discussion of the important typical unit processes of chemical engineering, as, for example, nitration, sulphonation, esterification, caustic fusion, chlorination, etc.

725. **The Chemistry of Fuels.** First term. Credit three hours. Prerequisite, or parallel course, Chemistry 705. Professor Rhodes. M W F 11. Baker 177.

Lectures. The chemistry of coal, coke, petroleum, tars and the fuel gases. Particular stress is laid upon the theoretical chemistry involved in the carbonization of coal, the gasification of coal, and the distillation and refining of petroleum and tar.

730. **Chemical Plant Design.** Throughout the year. Credit three hours a term. Prerequisite, Chemistry 705. Professor Rhodes and Dr. Winding. Day and hour to be arranged.

One conference and two laboratory periods. Practice in the calculation and design of chemical plant equipment.

735. **Plant Inspections.** Second term. Credit one hour. Prerequisite or parallel course, Chemistry 705.

Visits to plants typical of various chemical industries. A trip during spring vacation will be a feature of this course. Fee, covering expenses, to be announced.

740. **Chemical Engineering Computations.** Throughout the year. Credit two hours. Dr. Winding.

750. **Furnace Metallurgy.** Second term. Credit two hours. Prerequisite or parallel course, Chemistry 405. Professor Rhodes. T Th 10.

Lectures. A discussion of the reactions involved in the smelting of ores and the furnace refining of metals. The discussion is accompanied by problems dealing with the various subjects discussed.

795. *Research for Seniors.* Throughout the year. Credit two or more hours a term.

Biological Chemistry

See under Animal Sciences, p. 62.

Agricultural Chemistry

Students will not be allowed to register in courses in Agricultural Chemistry until after they have taken and passed Chemistry 101 and 105 or their equivalent.

805. **Introductory Agricultural Chemistry (Fertilizers, Insecticides, Soils).** First term. Credit two hours. Prerequisite, Chemistry 305 (or 375). Professor Cavanaugh. T Th 11. Baker 302.

Lectures. The relation of chemistry to agriculture; an introduction to the study of plant growth, the composition and chemical properties of soils, fertilizers, amendments, insecticides, and fungicides.

810. *Introductory Agricultural Chemistry.* First term. Credit three hours.

815. **Introductory Agricultural Chemistry (Foods and Feeds).** Second term. Credit two hours. Prerequisite, Chemistry 305 (or 375). Professor Cavanaugh. T Th 11. Baker 302.

Lectures. Discussion of the sources, chemical composition, and properties of the principal foods and feeds such as cereals, fruits, animal products, and dairy products. Relation of methods of preservation and manufacture to the nutritive value of foods.

820. *Introductory Agricultural Chemistry* (*Food Analysis*). Second term. Credit three hours.

825. *Elementary Agricultural Chemistry.* Second term. Credit three hours.

830. *Elementary Chemistry of Food Products.* Second term. Credit two hours.

835. **Advanced Agricultural Chemistry (Fertilizers, Insecticides, Soils).** Either term. Credit two or more hours. Prerequisite, Chemistry 810. Professor CAVANAUGH and assistant. Day and hour to be arranged. Baker 350.

Laboratory practice. Advanced work in the chemistry of soils, fertilizers, plant composition, insecticides, or fungicides Special topics may be selected.

840. **Advanced Agricultural Chemistry (Foods and Feeds).** Second term. Credit two or more hours. Prerequisite, Chemistry 820. Professor CAVANAUGH. Day and hour to be arranged. Baker 350.

Laboratory practice. Special topics in the chemistry of foods and food preparations.

895. *Research for Seniors.* Throughout the year. Credit two or more hours a term.

RESEARCH AT THE NEW YORK STATE EXPERIMENT STATION

Research work in agricultural and food chemistry is also offered at Geneva. For further information see page 166.

SPECIAL TOPICS

910. **Special Topics in Chemistry.** First term. Credit one hour. T 11. Baker 207.

The use of chemical literature; methods of research; administration of chemical laboratories; patent law; and other special topics. Graduate students are advised to take this course before beginning their thesis work.

1000. **Non-Resident Lectures on the George Fisher Baker Foundation.** Credit two hours. T Th 12. Baker 177.

First term: **The Nature of the Chemical Bond.** Professor LINUS C. PAULING, California Institute of Technology.

NON-RESIDENT LECTURESHIP

The George Fisher Baker Non-Resident Lectureship in Chemistry at Cornell University was established early in the year 1926 by a gift from Mr. Baker, the income to be used by the University for the benefit and advancement of teaching and research in Chemistry and allied sciences. Under this plan the University invites eminent men of science to come to Cornell, each for one or two semesters, to present the most recent advances, and the methods and results of their own investigations, in the fields in which they have won distinction. A private office and a research laboratory are placed at the disposal of the Non-Resident Lecturer and he is thus enabled to carry forward investigational work while in residence at Cornell.

The Non-Resident Lecturers under the George Fisher Baker Foundation deliver two lectures a week, and hold a colloquium. In some cases they also conduct experimental research with a few advanced students.

The program for these lectures is as follows:

FIRST TERM, 1937-38

To be announced.

SECOND TERM, 1937-38

To be announced.

GEOLOGY

Professors H. RIES, O. D. VON ENGELN, C. M. NEVIN, and J. D. BURFOOT, and *Doctor* C. W. MERRIAM.

Approved Major and Minor Subjects (key to symbols on p. 29)

Regional Geography **1, 2**
Mineralogy **1, 2, 3, 4**
Economic Geology **1, 2, 3, 4**
Paleontology **1, 2, 3, 4**
Petrography **1, 2, 3, 4**
Geomorphology **1, 2, 3**
Glacial Geology **1, 2, 3, 4**
Structural Geology **1, 2, 3, 4**
Stratigraphy **1, 2, 3, 4**
Sedimentation **1, 2, 3, 4**
Metamorphism **1, 2, 3**
Commercial Geography **4**
Historic Geology **3, 4**
Physical Geography **2, 3, 4**
Geology **4**
Geography **4**

Under the general title of geology are included dynamic and structural geology, physical, regional, and economic geography, geomorphology, glaciology, mineralogy, crystallography, petrography, paleontology and stratigraphic geology, economic geology.

Graduate work in Geology may include, in addition to work done in Ithaca, the opportunity to spend part of the time in investigation under approved direction in the field away from Ithaca.

The University Library has a most extensive collection of private publications, magazines, and geological society transactions, as well as files of North American, European, and other geological survey reports. In the Geological Department there is the entire library of the late Professor H. S. Williams, and a collection of over 60,000 author's separates.

Special rooms are available for graduate students for carrying on research work.

The department is provided with apparatus for different kinds of photographic work, and for polishing and sectioning ores, minerals, and rocks.

A seismograph station is located in McGraw Hall.

A. *General Geology and Physiography.* Throughout the year. Three hours a week.

100. *Introductory Geology.* Three hours a week. Either term.

SEDIMENTATION AND STRUCTURAL GEOLOGY

Professor NEVIN.

A student taking a major in this branch of geology must first have had at least elementary work in such other branches of geology as the professor in charge may prescribe.

101. *Selected Problems in Geology.* Second term. Two hours a week.

102. **Structural Geology.** First term. Credit three hours. Prerequisite, Geology A or equivalent. Professor NEVIN. Lectures, M W 11. Laboratory, W 1:40.

Geologic structures and their causes. A basic course for all students majoring in this branch of geology.

103. **Sedimentation.** First term. Credit three hours. Prerequisite, Geology A. Professor NEVIN. Lectures, M W 9. Laboratory, M 1:40.

The principles involved in the formation of sediments. Laboratory work consists of experimentation with sedimentary processes and field investigations.

107. **Geologic Surveying.** Given in the summer field school. Credit six hours. Professor NEVIN.

106. **Special Work in Structural Geology and Sedimentation.** Directed reading and original investigation adapted to the needs of the student. Professor NEVIN.

GEOMORPHOLOGY AND GLACIAL GEOLOGY

Professor VON ENGELN.

The region around Ithaca affords excellent and varied illustrations of physiographic and glacial phenomena. For many years the teachers and advanced students of physical geography have been engaged in investigation of the local field problems, and there is further opportunity of this kind. The main laboratory is well equipped with topographic maps and photographs; the collection of relief models is notably complete and there is an experimental laboratory with apparatus and facilities for carrying on a variety of experiments in the development of land forms, etc. The work in this branch also includes introductory courses in economic and regional geography. Such studies in correlation with physical geography and geomorphology may be the preparation for advanced regional study and investigation. For teachers of Physical Geography in the secondary schools who wish to secure a Master's degree a definite program with a thesis subject appropriate to their needs has been outlined. Such work can be pursued in successive Summer Session terms.

200. **Geomorphology.** Three hours a week, first term. Prerequisite, Geology A. Professor VON ENGELN. Lectures, T Th 9. Laboratory, Tuesday 1:40. Physiography Laboratory, McGraw.

The technology of geomorphological description and interpretation of land forms with regard to process and stage and the adjustment of topography to structure. The precepts of the German school are given consideration.

203. *Geography of North America.* Three hours a week, second term.

206. *Commercial Geography.* Three hours a week, second term.

207. *Geography of Europe.* Three hours a week, first term.

205. **Glaciers and Glaciation.** Second term. Credit three hours. Prerequisite, Geology A. Professor VON ENGELN. Lectures, T Th 9. Laboratory, T 1:40. Physiography Laboratory, McGraw.

Living glaciers and the phenomena of the glacial period. One or more Saturdays devoted to all-day excursions in the spring. Mapping and interpretation of glacial deposits.

208. **Advanced Physiography and Regional Geography.** Both terms. Prerequisites, an adequate background of course work in geology, especially in physiography and related subjects. Professor VON ENGELN. Hours by arrangement. Physiography Laboratory.

Particular problems, especially those of glaciology and the relation of geological structure to topography and physiographic history. In general students with a minor in physiography are expected to undertake work in this course.

209. **Seminar.** First or second or both terms. Prerequisites as for course 208. Professor VON ENGELN. Usually Monday afternoon 4. Physiography Laboratory.

Reviews of current literature or of the original literature on some topic within the field of this branch of the department.

MINERALOGY, CRYSTALLOGRAPHY, AND PETROGRAPHY

Assistant Professor BURFOOT.

The laboratory equipment is relatively good as regards petrographic microscopes, apparatus for chemical and physical investigations of rocks, and apparatus for special crystallographic determinations. There are also collections of rocks and study collections of minerals, including the Benjamin Silliman, Jr., collection, acquired before the opening of the University in 1868.

Special graduate courses in this division are not offered, but advanced work is adapted to the needs of the individual. Some of the less special courses are,

however, so dependent on a rather advanced knowledge of physics or chemistry or of both that they are to be considered as requiring the maturity of graduates, although open also to undergraduates with sufficient preparation.

311. *Elementary Mineralogy.* Three hours a week. Either term.

[312. **Crystallography.** First term. Credit three hours; if taken after 311, credit two hours. Assistant Professor BURFOOT. Lectures, M W 9. Laboratory to be arranged. Mineralogy Laboratory, McGraw. Not given in 1937-38.]

The classification and theory of crystals, considered, where feasible, from the point of view of the general internal structure.

313. **Advanced Mineralogy.** First term. Credit three hours. Prerequisite, Mineralogy 311. Assistant Professor BURFOOT. Lectures, T Th 11. Laboratory to be arranged. Mineralogy Laboratory, McGraw. Given in alternate years.

Among the subjects considered are symmetry classes, crystal imperfections, and a description of the commoner minerals with principles emphasized where appropriate. Atomic structure and its relation to the various properties of minerals are considered where feasible.

[316. **Metamorphic Geology.** First term. Credit two hours. For advanced students. Registration by permission only. Assistant Professor BURFOOT. T Th 11. Given in alternate years, not in 1937-38.]

A general survey of the field of metamorphic geology with especial emphasis on processes and criteria. Metamorphic differentiation, the facies classification of metamorphic rocks, and retrogressive metamorphism are among the subjects considered. Special suites illustrating these phenomena are used. Work with the petrographic microscope will be given to those students who are qualified and desire to take it.

317. **Optical Determination of Minerals.** First term. Credit three hours. Prerequisite, Geology 311. Assistant Professor BURFOOT. Lectures, T Th 10. Laboratory, S 9–11:30. Mineralogy Laboratory, McGraw.

The theory and use of the microscope in the determination and study of minerals and rocks. The commoner rock-forming minerals are studied in fragments and in thin-section.

[318. **Petrography.** Second term. Credit three hours. Prerequisite, Geology 317. Assistant Professor BURFOOT. Lectures, T Th 10. Laboratory, F 9-11:30. Mineralogy Laboratory, McGraw. Given in alternate years, not in 1937-38.]

A consideration of the commoner kinds of igneous rocks, of various classifications used, and of the general principles of petrology including the origin of and the conditions under which igneous rocks are formed. In the laboratory, rock types are studied in thin-section under the petrographic microscope.

319. **Sedimentary Petrography.** Second term. Credit three hours. Lectures, T Th 10. Prerequisite, Geology 317. Assistant Professor BURFOOT. Laboratory, F 9-11:30. McGraw. Given in alternate years.

The methods of investigating the mineral composition, texture, and other physical characteristics of sedimentary rocks; some of the applications of these methods to geological problems.

320. **Advanced or Special Work in Mineralogy, Crystallography, or Petrography.** Throughout the year. Credit variable. Prerequisite, variable. Assistant Professor BURFOOT. Day and hour to be arranged. McGraw.

Adapted to the needs of the individual student.

321. **Seminar.** Throughout the year. Credit one hour a term. Assistant Professor BURFOOT. M 4:15. Mineralogy Laboratory. McGraw. Given if desired by sufficient students.

PALEONTOLOGY AND STRATIGRAPHIC GEOLOGY

Doctor MERRIAM.

The University is so situated that excellent exposures of Devonian formations are at its very door, and the typical sections of New York State which are of fundamental importance in American Paleozoic geology are within short excursion range. The most important of these are the Rochester and Niagara

gorges, Trenton Falls and the Helderberg escarpments, the Chemung Valley, and the coal fields of northern Pennsylvania.

Facilities are afforded to those desiring to study the later formations, since the department has collections made in the West Indies, Central and South America, as well as different parts of the United States and Europe. There is also the Newcomb collection (10,000 species) of recent shells; and a wealth of conchological literature in the geological and the general library.

400. *Historic Geology.* Three hours a week. Second term.

401. *Ancient Life.* Three hours a week. First term.

402. **Principles of Stratigraphy.** Second term. Credit two hours. Prerequisite, Geology 400. Dr. MERRIAM. Lectures, M W 11.

Consideration of the fundamental factors upon which stratigraphic correlation and nomenclature are based.

403. **Introductory Paleontology.** Dr. MERRIAM. Three hours a week. Throughout the year. Prerequisite, Geology 400. Lectures, T Th 11. Laboratory, Th 1:40.

405. **Invertebrate Paleontology—Foraminifera.** Second term. Three hours to be arranged. Prerequisite, Geology 403. Dr. MERRIAM.

406. **Paleontologic and Stratigraphic Problems.** Throughout the year. Prerequisite, 403. Dr. MERRIAM. Conferences and reports to be arranged. Credit variable. McGraw 28.

An informal study course arranged to fit the needs of the student.

407. **Paleobotany.** Second term. One hour a week. Dr. MERRIAM. Lecture, W 10.

ECONOMIC GEOLOGY

Professor RIES.

The work in economic geology is designed to familiarize the student with the origin, occurrence, and distribution of the mineral products of economic value, and also with the practical application of geological principles. The laboratory contains an excellent study collection of economic materials from the United States, Canada, Mexico, Europe, and Africa, including ores, fuels, clays, abrasives, building stones, etc., most of these representing suites of material collected by members of the staff of instruction on geological trips. This collection is supplemented by maps and models.

In addition to the collections, the economic geology laboratory has facilities for general work and research on economic materials; the equipment for metallographic work on ores and for clay investigation is excellent.

The work of graduate instruction consists in part of lectures and in part of special work arranged to suit the needs of the individual student. Students who are registered for a major subject in economic geology are expected to engage in research, which should preferably be based on field work.

Excursions may readily be taken to the anthracite regions of Pennsylvania; to the iron, slate, cement, and talc region near Easton, Pa.; to the metal mines of the Adirondacks, etc. Field trips of greater or less length are taken to some of these localities every year.

500. **General Economic Geology.** Throughout the year. Credit three hours a term. Professor Ries and Dr. EDMUNDSON. Lectures, M W 10. Laboratory or field trip F, 1:40. MCGRAW.

502. **Petroleum Geology.** Second term. Credit three hours. Professor NEVIN.

503. **Petroleum Technology.** First term. Credit two hours. Professor NEVIN.

510. **Clay Investigation.** Second term. Credit three hours. Prerequisite, Geology A or 501, and Chemistry 101, and permission of the instructor. Professor RIES. One lecture and two laboratory periods to be arranged. McGraw.

511. **Advanced or Special Work in Economic Geology.** Throughout the year. Credit variable. Prerequisite, dependent on the nature of the work. Professor RIES. Day and hour to be arranged. McGraw.

512. **Economic Geology Seminary.** Every two weeks throughout the year Professor RIES.

MATHEMATICS

Professors VIRGIL SNYDER, F. R. SHARPE, W. A. HURWITZ, W. B. CARVER, B. W. JONES, R. P. AGNEW, V. S. LAWRENCE, jr., and W. W. FLEXNER; *Doctors* J. H. CURTISS, D. C. LEWIS, JR., J. K. L. MACDONALD, J. B. ROSSER, and R. J. WALKER.

Approved Major and Minor Subjects (key to symbols on p. 29)

Algebra **1, 2, 3**
Mathematical Analysis **1, 2, 3**
Geometry **1, 2, 3**
Applied Mathematics **1, 2, 3**
Mathematics **1, 2, 4**

If mathematics (as distinct from one of its subdivisions) is chosen as major subject, the minor subject or subjects must be chosen from some other field or fields of study.

It is recommended that when the major subject for the degree of Ph.D. is in the field of mathematics, at least one minor subject be chosen from some other field.

The graduate work provides instruction in the principal branches of mathematics and furnishes preparation and material for independent investigation. Only a portion of the whole field can be covered by the courses given in a single year. The courses are changed, therefore, from year to year in order to meet the needs of students.

In addition to the regular instruction, individual guidance and advice are offered to any student who wishes to follow a particular line of inquiry.

Students who take mathematics as a major subject for an advanced degree must have completed previously the equivalent of the elementary course in analytic geometry and calculus, and further study in at least one more advanced subject, as for example, differential equations, advanced calculus, modern algebra, or projective or advanced analytic geometry.

The Oliver Mathematical Club, composed of teachers and advanced students, meets weekly, and has for its object the systematic presentation by the members of some specified mathematical theory of recent development, and of reports on articles in current journals and on results of special reading and investigations. Discussion and reading groups or seminars are also frequently organized to meet other special interests, sometimes with the cooperation of teachers and students in other fields than Mathematics.

The equipment consists of a collection of about three hundred surfaces, including the various forms of the cyclides, the Kummer surface, the surface of centers, and minimum surfaces; plaster models illustrating positive, negative, and parabolic curvature, and constant measure of curvature; plaster models illustrating the theory of functions, among them models of simply and multiply connected surfaces, and of several forms of Riemann surfaces, and models representing the real parts of algebraic, exponential, logarithmic, and elliptic functions; wooden and glass models of crystals and polyhedra, wire and thread models of twisted curves and ruled surfaces, and skeleton frames for minimum surfaces.

The library has a large collection of books on pure and applied mathematics, including collected works of mathematicians, complete sets of all the important mathematical journals, transactions and other publications of scientific societies, and doctoral theses from the leading American and European universities.

The Erastus Brooks Fellowship of $600 is awarded annually in the field of Mathematics. The fellowship is ordinarily awarded only to applicants who have had one year or more of graduate study.

The following courses are offered. The courses mentioned in brackets will not be given in 1937-38, but are given from time to time.

1. *Solid Geometry.* Three hours a week, either term.
2. *College Algebra.* Three hours a week, either term.
3. *Plane Trigonometry.* Three hours a week, either term.
4, 5. *Analytic Geometry and Calculus.* Five hours a week, either term.

15. *Elementary Course in Higher Mathematics.* Three hours a week, throughout the year.

[20. *Teachers' Course.* Three hours a week, first term. Not given in 1937-38; to be given in 1938-39.]

ALGEBRA

19. **Symbolic Logic.** Second term. Dr. ROSSER. T Th S 10. White 1.

A careful study of the most satisfactory system of symbolic logic; its value in furnishing a test for the validity of any instance of mathematical reasoning will be stressed.

21. **Theory of Numbers.** First term. Prerequisite, Mathematics 4b. Assistant Professor JONES. T Th S 9. White 2.

Linear and quadratic congruences, primitive roots, and continued fractions.

23. **Modern Algebra.** First term. Prerequisite, Mathematics 4b. Dr. ROSSER. T Th S 11. White 1.

Determinants, matrices, linear dependence, linear transformations, quadratic and bilinear forms.

26. **Theory of Finite Groups.** Second term. Prerequisite, Mathematics 4b. Professor CARVER. M W F 9. White 10.

An elementary course dealing with groups of motions, permutations, and transformations; and treating such abstract group topics as simple and multiple isomorphism, Sylow's theorem, Abelian and prime-power groups.

29. **Advanced Theory of Numbers.** Second term. Prerequisite, Mathematics 21. Assistant Professor JONES. T Th S 9. White 2.

Topics from the theory of quadratic forms and its applications, the class number of binary quadratic forms, continued fractions. If time permits, other topics of general interest will be considered.

[**Foundations of Mathematics.** Not given in 1937-38.]

[**Theory of Equations.** Not given in 1937-38.]

[**Algebraic Invariants.** Not given in 1937-38.]

[**Algebraic Numbers.** Not given in 1937-38.]

[**Galois Fields.** Not given in 1937- 38.]

[**Linear Algebras.** Not given in 1937-38.]

ANALYSIS

41. **Elementary Differential Equations.** Each term. Prerequisite, Mathematics 4b. Assistant Professor Lawrence, first term. M W F 9. White 1. Dr. MACDONALD, second term. T Th S 11. White 27.

42. **Advanced Calculus.** Throughout the year. Prerequisite, Mathematics 4b. Assistant Professor AGNEW. M W F 11. White 6.

A study of the processes of the calculus, their meanings and applications. The course is designed to furnish a necessary preparation for advanced work in analysis and applied mathematics.

44. **Infinite Series.** Throughout the year. Prerequisite, Mathematics 42. Professor HURWITZ. M W F 11. White 9.

An introductory study of convergence; the modern theory of divergent series, with some account of recent research and outstanding problems.

45. **Functions of a Complex Variable.** Throughout the year. Prerequisite, Mathematics 42 or evidence of high ability in Mathematics 4b. Dr. CURTISS. M W F 10. White 9.

The complex number system; linear transformation; the elementary functions; complex integrals and Cauchy's theorem; the Taylor series; singularities of analytic functions; the principle of the maximum; analytic continuation; the Riemann surfaces; conformal mapping; integral functions; harmonic functions.

[**Topics in Applied Mathematics.** Not given in 1937-38.]

[**Functions of Real Variables.** Not given in 1937-38.]

[**Integral Equations.** Not given in 1937-38.]

[**Calculus of Variations.** Not given in 1937-38.]

Geometry

61. **Projective Geometry.** Throughout the year. Prerequisite, Mathematics 4b. Assistant Professor Flexner. M W F 9. White 2.
The elements of projective geometry treated synthetically.

62. **Analytic Projective Geometry.** Throughout the year. Prerequisite, Mathematics 4b. Dr. Walker. M W F 10. White 24.
Projective geometry of one, two, and three dimensions treated by means of homogeneous coordinates.

65. **Algebraic Geometry.** Throughout the year. Prerequisite, Mathematics 61, 62. Professor Snyder. T Th S 11. White 24.
The theory of linear, Cremona, and birational transformations of algebraic curves, surfaces, and varieties in two, three and more dimensions.

[**Analytic Geometry of Space.** Not given in 1937-38.]

[**Cremona Transformations.** Not given in 1937-38.]

[**Non-Euclidean Geometry.** Not given in 1937-38.]

[**Geometry of Hyperspace.** Not given in 1937-38.]

[**Differential Geometry.** Not given in 1937-38.]

[**Metric Geometry.** Not given in 1937-38.]

[**Analysis Situs.** Not given in 1937-38.]

Applied Mathematics

85. **Vector Analysis.** First term. Prerequisite, Mathematics 4b. Dr. MacDonald. T Th S 10. White 27.
The algebra and calculus of vectors with applications.

86. **Series of Orthogonal Functions.** Second term. Prerequisite, Mathematics 4b. Dr. Lewis. T Th S 9. White 21.
A formal elementary treatment of Fourier series, Bessel functions and Legendre polynomials will be accompanied by a discussion of convergence and completeness in simple cases, and by applications to physics.

89. **Hydrodynamics and Elasticity.** First term. Prerequisite, Mathematics 4b. Dr. Lewis. T Th S 9. White 21.
Derivation of the fundamental partial differential equations with applications to simple problems.

[**Differential Equations of Mathematical Physics.** Not given in 1937-38.]

[**Theory of Potential Functions.** Not given in 1937-38.]

[**Probability and Statistics.** Not given in 1937-38.]

[**Mechanics.** Not given in 1937-38.]

[**Relativity.** Not given in 1937-38.]

METEOROLOGY

Professor R. A. Mordoff.

Approved Major and Minor Subjects (key to symbols on p. 29)

Meteorology **1, 2, 4**

A broad field for investigation and research is offered in meteorology. The weather and climatic factors, in their relation to crop distribution and production and to engineering, transportation, economic and social problems, are suitable subjects for graduate study.

A graduate student in meteorology should have completed the elementary courses in meteorology and climatology, physics, mathematics, geology, and preferably elementary statistics.

1. *Elementary Meteorology.* Three hours a week, either term.

2. **Climatology.** Second term. Prerequisite, Meteorology 1 or the equivalent. Professor MORDOFF. M W 9. Plant Science 114.

A course covering general climatology and the various climates of the United States with emphasis on those of New York State.

211. **Research.** First or second term. Prerequisite, Climatology 2, or the equivalent. Professor MORDOFF. Hours by appointment.

Original investigations in meteorology and climatology.

212. **Seminar.** First term. Prerequisite, Climatology 2, or the equivalent. Professor MORDOFF. Hours to be arranged. Plant Science 114.

Preparation and reading of reports on special topics. Abstracts and discussions of papers dealing with the current literature of meteorology and climatology.

PHYSICS

Professors R. C. GIBBS, FREDERICK BEDELL, H. A. BETHE, J. R. COLLINS, G. E. GRANTHAM, H. E. HOWE, E. H. KENNARD, M. S. LIVINGSTON, C. C. MURDOCK, F. K. RICHTMYER, and L. P. SMITH; *Doctors* R. F. BACHER, L. L. BARNES, W. M. CADY, C. W. GARTLEIN, L. G. PARRATT, and R. W. SHAW.

Approved Major and Minor Subjects (key to symbols on p. 29)

Physics **1, 2, 3, 4**
Applied Physics **1, 2, 3, 4**

Note. Applied Physics as a major for the Ph.D. must be accompanied by a minor subject in the field of physics.

Experimental Physics **1, 2, 3, 4**
Theoretical Physics **1, 2, 3, 4**
Mathematical Physics **3**

Note. The major subject for the Ph.D. may be called Experimental Physics only if accompanied by Theoretical or Mathematical Physics as a minor, and Theoretical Physics only if accompanied by Experimental Physics as a minor.

Any other subdivision of physics (e. g. heat, x-rays, optics) may be named as a minor for the master's degree when one of the above subjects is named as the major.

All three subjects for the Ph.D. should not be chosen inside the field of physics.

Opportunities are offered for study and investigation by a limited number of students in both theoretical and experimental physics. About forty rooms in Rockefeller Hall are set aside for research. This work is organized separately with its own equipment, stock and apparatus room, special workshop for the use of graduate students, and liquid air plant; shops with an experienced staff of mechanics are maintained for instrument construction, glass blowing, and carpentry.

Members of the staff will be especially interested in directing research as follows: Professor BETHE, in quantum mechanics, particularly in the theory of nuclei and of solids; Professor COLLINS, in spectroscopy, particularly in the infrared; Professor GIBBS, in atomic spectroscopy; Professor KENNARD, in theoretical physics, particularly in the theory of radiation and quantum mechanics; Professor LIVINGSTON, in ionic and nuclear physics; Professor MURDOCK, in x-ray and electron diffraction; Professor RICHTMYER, in x-rays; Professor SMITH, in quantum mechanics, and experimental work in ionization of gases and photo-electricity; Dr. BACHER, in nuclear physics, particularly as related to effects in atomic spectra; Dr. PARRATT, in x-ray spectroscopy; Dr. SHAW, in molecular spectroscopy.

A weekly meeting of staff and students is held for the discussion of research in progress and of current literature, supplemented frequently by similar meetings confined to particular fields.

Members of the staff who are in residence in Ithaca during the summer often stand ready to consult with investigators.

Important Notice. Since only a limited number of graduate students can be accommodated in physics, arrangement for admission must be made by application to the Dean of the Graduate School before coming to Ithaca.

3, 4. *Introductory Physics.* Three hours a week.

11, 12. *Introductory Physics.* Four hours a week.

21, 22. *General Physics.* Three hours a week.

41, 42. *Special Topics in Modern Physics.* Two hours a week.

55. *Introductory Physical Experiments.* Either term, three hours a week. For pre-medical students.

60. *Physical Experiments.* Both terms, three hours a week. Laboratory to accompany Physics 61-62.

61, 62. *General Physics.* Throughout the year, three hours a week. Prerequisite, Physics 4, 3 or the equivalent.

91. *Teaching of Physics in Secondary Schools.* Second term, two hours a week.

105. *Advanced Laboratory Practice.* Two laboratory periods and a seminar each week, either term.

[110. **Mechanics.** Throughout the year. Prerequisite, Physics 60, 61, 62 and Mathematics 4 or their equivalents. Professor MURDOCK. T Th S 9. Given in alternate years, not in 1937-38.]

Introductory analytical mechanics, oscillations, kinetic theory, deformable bodies, mechanics of fluids, surface phenomena, wave motion, and sound.

120. **Electricity and Magnetism.** Throughout the year. Prerequisite, Physics 60, 61, 62 and Mathematics 4, or their equivalents. Professor MURDOCK. T Th S 9. Given in alternate years.

A study of the laws of electrostatic and magnetic fields; electromagnetism and variable current phenomena; thermal and chemical electromotive forces; metallic, electrolytic, and gaseous conduction.

132. **Light.** Second term. Prerequisite, Physics 60 and 61 and Mathematics 4, or their equivalents. Assistant Professor HOWE. T Th S 8. Given in alternate years.

An introductory study of lens systems, diffraction, interference, double refraction and polarization.

[142. **Heat.** Second term. Prerequisite, Physics 60 and 62 and Mathematics 4, or their equivalents. Professor GIBBS. T Th S 8. Given in alternate years, not in 1937-38.]

Temperature scales, specific heats, thermal conductivity, thermodynamics, thermal radiation, high-temperature measurement, and kinetic theory.

170. **Introduction to Modern Physical Theories.** Throughout the year. Prerequisite, six hours from Physics 105 to 142 inclusive, or the equivalent. Professor RICHTMYER. T Th S 10. For seniors and first-year graduate students.

Early theories, a brief survey of the electromagnetic theory, photo-electricity, radiation and the quantum theory, atomic structure and atomic spectra including x-rays, the nucleus and nuclear disintegrations, radioactivity, matter waves, and other problems of modern physics.

200. **Introduction to Theoretical Physics.** Throughout the year. Must be preceded or accompanied by one term of Physics 110 and by Physics 120 or their equivalents in informal study. Part A, Assistant Professor BETHE. M W F 12. Part B, Professor KENNARD.

Part A, lectures and problem work on certain fundamental and generally useful phases of theoretical physics, such as electrodynamics, relativity, optics, thermodynamics, analytical and statistical mechanics, kinetic theory, hydrodynamics; Part B, additional individual study of some of these topics equivalent to a two-hour course. The two parts should not be separated.

213. **Theoretical Mechanics.** Second term. Prerequisite, Physics 200 or the equivalent. Professor KENNARD. M W F 8. Given in alternate years.

Hamilton's Principle, Hamilton-Jacobi equation; elements of Hydrodynamics and Elasticity.

[222. **Electrodynamics.** Second term. Prerequisite, Physics 200 or the equivalent. Professor KENNARD. M W F 9. Given in alternate years, not in 1937-38.]

A more thorough study of selected topics.

[233. **Theoretical Optics.** First term. Prerequisite, Physics 200 or the equivalent. Assistant Professor COLLINS. Given in alternate years, not in 1937-38.]

Electromagnetic theory, dispersion, absorption, optical properties of metals, diffraction, propagation in crystals.

271. **Introductory Quantum Mechanics.** First term. Prerequisite, Physics 200 or the equivalent. Professor KENNARD. M W F 9.

300. **Advanced Laboratory.** First and second terms. Prerequisite, Physics 105 or the equivalent. Assistant Professor COLLINS, Drs. CADY and PARRATT, and Mr. KRASIK. Two laboratory periods per week with outside work in reading and computation. Laboratory open T W Th F afternoons. Rockefeller 301.

A course of experiments designed to broaden the student's acquaintance with the methods of physical measurements and to afford training in the use of modern physical equipment.

310. **Survey of Experimental Methods.** First or second term. Prerequisite Physics 105 or the equivalent. May not precede Physics 300. Assistant Professor COLLINS and other members of the Staff.

Individual reading on the principal experimental methods of Physics in addition to that done in Physics 300.

315. **Special Topics in Physics.** Reading or laboratory work in any branch of physics under the direction of some member of the staff.

320. **Special Topics Laboratory.** Prerequisites, Physics 105, or the equivalent and consent of the instructor. Two laboratory periods a week and discussion periods as arranged.

Systematic laboratory work together with appropriate lectures and discussions will be offered in the following fields:

(a) Nuclear Physics. Throughout the year. Assistant Professor LIVINGSTON. Given in alternate years. Introductory experimental procedure in: properties of neutrons, alpha particles and gamma rays, induced radioactivity, disintegration, high-voltage apparatus.

(b) Spectroscopy. Throughout the year. Dr. CADY. Spectra of simple atoms will be studied in the first term and molecular spectra and special topics in atomic spectra in the second term.

(c) X-rays. First term. Dr. PARRATT. Given in alternate years. Operation of x-ray tubes, photographic and ionization-intensity measurements, absorption, Compton effect, emission and absorption spectra, polarization, refraction and dosage measurements.

(d) Electronics and Ionics. Second term. Dr. PARRATT. Given in alternate years. Vacuum technique and low pressure measurements, ionization and resonance potentials, e and e/m for electrons, work functions, Schottky effect, secondary emission, photo-electric effects, and construction of special tubes.

[(e) Crystal Structure by X-ray and Electron Diffraction. Second term. Professor MURDOCK. Given in alternate years, not in 1937-38.] A study of the experimental techniques and methods of computation involved in the determination of structure by diffraction.

[(f) High Temperature Measurements. Assistant Professor COLLINS. Given in alternate years, not in 1937-38.] Application of radiation methods to the measurements of temperature.

Special Topic Courses

405. **Mathematical Methods in Physics.** Throughout the year. Prerequisite, Mathematics 4 or the equivalent. Professor SMITH. T Th S 11. Lectures and problem work designed to give the student a working knowledge of the principal mathematical methods used in advanced physics.

431. **The Physics of Soil Phenomena.** First term. Prerequisite, Physics 11 and 12, or the equivalent, and course work covering Calculus and Mechanics. Professor MURDOCK and Dr. BARNES. Two lectures and one laboratory or problem period a week. Designed primarily for students in Civil Engineering.

Surface phenomena at fluid-fluid and fluid-solid interfaces, vapor pressure, osmotic pressure, electrolytes, electric double layers, electrokinetic phenomena, colloids, viscous flow in porous materials, capillary potential and hysteresis in finely divided materials.

451. **Hydrodynamics.** First term. Prerequisite, Mathematics 5, or the equivalent, and suitable course work in Physics and Mechanics. Assistant Professor COLLINS. M W F 8. Primarily for engineering students.

Properties of ideal and viscous fluids; the fundamental laws of fluid motion, their development and application to such problems as the motion of solids through fluids, steady flow in tubes, surface and compressional waves, and simple rotational motion.

452. **Hydrodynamics.** Second term. Prerequisite, Physics 451 or the equivalent. Professor SMITH. M W F 8. Primarily for engineering students.

The general analytical theory of the motion of fluids; its development and application to such phenomena as the flow of perfect fluids, of viscous incompressible fluids, and of fluids subject to boundary conditions; discussion of vortex and turbulent flow.

472. **Quantum Mechanics of Spectra and Radiation.** Second term. Prerequisite, Physics 271. Professor KENNARD. T Th S 10. Given in alternate years.

Atomic and molecular spectra. Transition probabilities. Dirac's theory of radiation.

[476. **Quantum Mechanics of Solids.** Second term. Prerequisite, Physics 271. Assistant Professor BETHE. T Th S 10. Given in alternate years, not in 1937-38.]

Quantum theory of crystals with particular reference to metals. Quantum statistics.

477. **Quantum Mechanics of Collisions.** First term. Prerequisite, Physics 271. Assistant Professor BETHE. Three hours a week. Given in alternate years.

The general quantum theory of atomic and nuclear collision phenomena such as scattering, excitation, ionization, and the stopping power of matter.

[481. **Advanced Quantum Mechanics.** First term. Prerequisites, Physics 271 and at least one of the courses 472, 476, 477, or their equivalents. Assistant Professor BETHE. Three hours a week. Given on sufficient demand in alternate years, not in 1937-38.]

Lectures on the more theoretical aspects of quantum mechanics including the matrix and transformation theory, the application of the theory of groups, the Dirac relativistic theory, the theory of the positron, and quantum electrodynamics.

571. **Spectroscopy.** Throughout the year. Prerequisite, Physics 132 or its equivalent. Professor GIBBS and Dr. SHAW. T Th S 12. Given in alternate years.

The nature, origin, and structure of atomic, molecular, and Raman spectra, and their interpretation according to current theories.

[581. **Atomic Structure.** First term. Prerequisite, nine hours from Physics 105, 120, 132 and 170 or their equivalents. Professor GIBBS and Assistant Professor LIVINGSTON. M W F 10. Given in alternate years, not in 1937-38.]

The development of modern atomic theory and its application in the explanation of spectral series, resonance, ionizing potentials, and fine structure; the structure of the nucleus as revealed by radioactive and isotopic phenomena and the effects of high-speed bombardment, including the most recent developments in nuclear physics.

591. **X-rays and the Structure of Matter.** First term. Professor RICHTMYER. M W F 10. Given in alternate years.

Lectures and assigned readings on the production and measurement of x-rays; laws of emission, scattering and absorption; the relation of these laws to atomic structure, quantum theory and similar problems.

592. **X-Rays and the Structure of Matter.** Second term. Professor MURDOCK. M W F 10. Given in alternate years.

A continuation of Physics 591 dealing with the laws of diffraction of x-rays and electrons and their application to the study of the structure of matter.

[640. **Alternating Currents and Electronics.** Throughout the year. Prerequisites, Mathematics 41 and Physics 300 (3 hrs.) and 320d, or their equivalents. Professors SMITH and BEDELL, and Mr. KRASIK. Lectures and laboratory work. Not given in 1937-38.]

The analytical theory and measurement of alternating currents in linear and non-linear circuits, discussion of high frequency problems; the theory and measurement of electrical phenomena in gases at low pressure with applications to vacuum tube operation.

AGRICULTURE, INCLUDING FORESTRY

AGRICULTURAL ECONOMICS AND FARM MANAGEMENT

(Business Management, Farm Management, History of Agriculture, Marketing, Prices and Statistics, Public Finance, Rural Economy.)

Professors G. F. Warren, G. N. Lauman, J. E. Boyle, G. P. Scoville, E. G. Misner, W. I. Myers, F. A. Pearson, Leland Spencer, V. B. Hart, M. P. Rasmussen, F. F. Hill, M. S. Kendrick, M. C. Bond, Whiton Powell, M. P. Catherwood, S. W. Warren, T. E. LaMont, F. A. Harper, L. C. Cunningham, and P. S. Williamson; *Doctor* A. Van Wagenen.

Approved Major and Minor Subjects (key to symbols on p. 29)

Business Management **1, 2, 3, 4**
Farm Management **1, 2, 3, 4**
History of Agriculture **1, 2, 3, 4**
Marketing **1, 2, 3, 4**
Prices and Statistics **1, 2, 3, 4**
Public Finance **1, 2, 3, 4**
Rural Economy **1, 2, 3, 4**

Business Management

121. **Financial Statements.** Second term. (Returns to first term in 1938-39.) Professor Powell. Lectures, T Th 8. Agricultural Economics Building 225. Discussion period to be arranged. Agricultural Economics Building 201.

The purpose, content, interrelationships, analysis, and interpretation of balance sheet, operating statement, and statement of surplus.

[122. **Accounting Method.** Second term. Professor Powell. Lectures, T Th 8. Agricultural Economics Building 225. Practice period or discussion period to be arranged. Agricultural Economics Building 201. Not given in 1937-38.]

Recording ordinary business transactions in journals and ledgers, adjusting and closing the records, cost analysis, and budgets.

[125. **Business Management.** First term. Professor Powell. Not given in 1937-38.]

Factors affecting costs of operation, measures of efficiency, control of inventory and credit, sales, selection and compensation of employees, administrative structure, forms of ownership.

126. **Farmers' Cooperatives.** Second term. Professor Powell. Lectures, W F 8. Agricultural Economics Building 225. Discussion period to be arranged. Agricultural Economics Building 201.

Agricultural cooperation as a form of business organization. The nature, extent, and legal background of agricultural cooperation; policies and practices involved in the organization, finance, and operation of effective cooperative associations.

127. *Business Law.* Two hours a week.

[229. **Agricultural Credit.** First term. Professor ————. Lectures, W F 8. Agricultural Economics Building 125. Not given in 1937-38.]

A study of the credit institutions which serve agriculture.

Farm Management

102. **Farm Management.** Second term. Assistant Professor S. W. Warren. Lectures, M W F 10. Agricultural Economics Building 25. Laboratory, F 4–6. Agricultural Economics Building 101. Four half-day trips and one all-day trip are taken during April and May to visit farms in near-by regions. These trips are taken on the day of the regular laboratory period.

103. **Farm Records and Accounts.** First term. Assistant Professor WILLIAMSON. Lectures, T Th 8. Agricultural Economics Building 25. Laboratory, W 1:40-4. Agricultural Economics Building 340.

Farm inventories; cash account; single-enterprise cost accounts; income-tax reports; complete farm cost accounts; interpretation of results of cost accounts and their application in the organization and management of farms.

[203. **Business Organization and Management of Successful New York Farms.** First term. Professor SCOVILLE. F 1:40-4, S 8-10. Agricultural Economics Building 101. During October and November all-day trips are usually taken on Saturdays. Two two-day trips are taken, leaving Friday morning and returning Saturday night. Not given in 1937–38.]

[205. **The Appraisal of Farm Land.** First term. Professor ————————. Lecture, Th 11. Agricultural Economics Building 125. Laboratory, T 1:40-4. Agricultural Economics Building 101. Not given in 1937-38.]

A study of factors governing the price of land; and the appraisal of land for use, for sale, for purposes of making loans, and for taxation.

[206. **Land Economics.** Second term. Professor ————————. Lecture, T 8. Agricultural Economics Building 125. Laboratory, T 1:40-4. Agricultural Economics Building 140. Not given in 1937-38.]

The uses and classification of land; land policy.

207. **Research Methods in Farm Management.** First term. Professor G. F. WARREN. T 11. Agricultural Economics Building 101.

Attention is given to the more important methods of determining the principles of farm management and the preparation of results for publication.

208. **Research Methods in Farm Management.** Second term. Professor MISNER. Th 2-4. Agricultural Economics Building 140.

Experience is given in the tabulation and the study of farm management data and in preparing the results for publication. During the spring vacation several days are spent in taking farm-management survey records.

299. **Seminar.** First and second terms. Departmental Staff. M 4. Agricultural Economics Building 401.

HISTORY OF AGRICULTURE

171. **History of Agriculture.** First term. Professor LAUMAN. Lectures, M W F 11. Agricultural Economics Building 325.

The important phases of the development of agriculture are considered historically. Stress is laid on the development of the agricultural classes, on rational agriculture, and on modern agrarian problems.

172. **History of Agriculture in the United States.** Second term. Professor LAUMAN. M W F 11. Agricultural Economics Building 325.

This course deals with the land, its settlement, and its settlers in their economic, social, and political aspects; the technical development of agriculture; the beginnings of permanent agriculture; the rise of marketing problems and of the agrarian movements.

278. **Research in Rural Economy or History of Agriculture.** First and second terms. Professor LAUMAN. Agricultural Economics Building 316.

279. **Agricultural History Seminar.** First and second terms. Professor LAUMAN. Th 2:30. Agricultural Economics Building 316.

MARKETING

141. **Marketing.** First term. Professor BOYLE. Lectures, M W F 8. Agricultural Economics Building 325. Discussion groups one hour a week.

Present organization, functions, and operations of the market structure, with particular reference to agriculture.

142. **Marketing Fruits and Vegetables.** First term. Professor RASMUSSEN. Lectures, M W F 9. Agricultural Economics Building 225. Laboratory, Th 4-6. Agricultural Economics Building 140.

A study of the economic factors involved in the marketing of fruits and vegetables. Regional and seasonal competition; areas of distribution; methods of handling; costs of marketing; types of marketing organizations; sales methods; transportation and carrier services; produce law and methods of credit rating; terminal problems.

143. **Marketing Dairy Products.** Second term. Professor SPENCER. Lectures, M W F 9. Agricultural Economics Building 225. Laboratory, Th 4. Agricultural Economics Building 201. One all-day trip to visit milk plants is taken sometime in May.

A study of economic problems relating to the distribution of milk and other dairy products; also the factors affecting success in this branch of business enterprise.

144. **Marketing Poultry Products.** Second term. Dr. VAN WAGENEN. Lecture, T 10. Agricultural Economics Building 225. Laboratory, T 1:40-4. Agricultural Economics Building 140.

A study of the economic factors involved in the marketing of eggs and poultry, including: areas of production; distribution channels; sales methods; market costs; cold-storage operations; legislation; demand; terminal-market and consumption problems.

146. **The Organized Exchanges and Speculation.** First term. Professor BOYLE. Recitations, T Th 8. Agricultural Economics Building 325.

147. **Marketing Trip to New York City.** Second term. DR. VAN WAGENEN in charge. Representatives of other departments will cooperate in the course.

Five days of the spring vacation will be spent in New York City inspecting and studying the marketing of dairy products, eggs and poultry, fruits and vegetables, livestock and meat.

Total cost of trip need not exceed $30 in addition to railroad fare. This course will be given only if 20 or more students register at the beginning of the term.

148. **Research in Marketing.** First and second terms. Professor BOYLE.

242. **Methods and Results of Research in Marketing.** First term. Professor RASMUSSEN. W 4-6. Agricultural Economics Building 140.

A critical study of research projects in marketing fruits and vegetables, and practice in planning such research.

243. **Methods and Results of Research in Marketing.** Second term. Professor SPENCER. W 4-6. Agricultural Economics Building 201.

A critical study of research projects in marketing dairy products, and practice in planning such research.

246. **Collective Bargaining.** Second term. Professor BOYLE. Lectures, T Th 8. Agricultural Economics Building 330.

Collective bargaining and its use by labor, capital, and agriculture. The policy of collective bargaining. A study in price determination.

PRICES AND STATISTICS

Attention of students is directed to Mathematics 4a, Analytical Geometry and Calculus, and to Mathematics 83, Probability and Statistics.

111. **Statistics.** First term. Professor PEARSON. Lecture, M 8. Agricultural Economics Building 125. Laboratory, M 1:40-4. Agricultural Economics Building 140.

A study of the principles involved in the collection, tabulation, and interpretation of agricultural and marketing statistics. Analysis of statistical problems with an 80-column tabulating machine.

112. **Statistics.** Second term. Professor PEARSON. Lecture, M 8. Agricultural Economics Building 125. Laboratory, M 1:40-4. Agricultural Economics Building 140.

A continuation of course 111. A study of the application of probable error, sampling, gross, partial, and multiple correlation, curve fitting, to problems in this field. Methods of using 80-column tabulating equipment for multiple-correlation analysis.

115. **Prices.** Second term. Professor PEARSON. Lectures, T Th 9. Laboratory, W 1:40-4. Agricultural Economics Building 25.
A study of prices of farm products in relation to agricultural and industrial conditions.

PUBLIC FINANCE

[135. **Local Government.** First term. Professor CATHERWOOD. Lectures, W F 8. Agricultural Economics Building 225. Laboratory, Th 1:40-4. Agricultural Economics Building 201. Not given in 1937-38.]
Historical development, organization, and operation of local government. Particular attention will be given to the receipts, expenditures, and administration of counties, towns, and school districts in New York.

138. **Taxation.** Second term. Assistant Professor KENDRICK. Lectures, M W F 11. Agricultural Economics Building 25.
A study of the principles and practices of Public Finance with emphasis on taxation. Among the topics examined are: the growth of public expenditures; the changing pattern of federal, state, and local taxation; general property, personal income, inheritance, business, commodity, and motor vehicle taxation; the incidence of taxation; relations among taxing units; and the problem of developing a system of taxation.

RURAL ECONOMY

151. **Public Problems of Agriculture.** Second term. Professor G. F. WARREN. Lectures, T Th 11. Agricultural Economics Building 25.
A discussion of some of the more important problems of agriculture that involve collective or governmental action.

161. **Agricultural Economics.** Second term. Professor BOYLE. Lectures, M W F 8. Agricultural Economics Building 325. Discussion groups one hour a week.
A discussion of the major problems in the field of agricultural economics. A statement of these problems and the various solutions proposed.

262. **Rural Economy, Elementary Course.** First term. Professor LAUMAN. Lectures, M W F 9, and individual conferences. Agricultural Economics Building 325.
A study of the factors underlying the present conditions in rural communities at home and abroad, and of forces at work in shaping the agriculture of the world, chiefly along economic lines.

263. **Rural Economy.** Advanced Course. Second term. Professor LAUMAN. Lectures, M W F 9. Agricultural Economics Building 325.
A more extended study, primarily theoretical, of the general economic problems of agriculture.

264. **Planning for Agriculture.** Second term. Professor LAUMAN. Lectures, T Th 9. Agricultural Economics Building 325.
A study of agricultural policies and plans for the rehabilitating and redirecting of agriculture in various countries of the world.

269. **Rural Economy Seminar.** First and second terms. Professor LAUMAN. T 2:30. Agricultural Economics Building 316.

AGRICULTURAL ENGINEERING

Professors H. W. RILEY, B. B. ROBB, J. C. MCCURDY, F. H. RANDOLPH, F. L. FAIRBANKS, L. M. ROEHL, and F. B. WRIGHT.

Approved Major and Minor Subjects (key to symbols on p. 29)

Agricultural Engineering **1, 2, 4**
Students desiring to undertake graduate work in Agricultural Engineering

should have, first of all, first-hand knowledge of farm life and of rural conditions generally. Adequate grounding in the engineering fundamentals of the phase studied and ability to perceive the applications of these fundamentals are most essential, since the applications of engineering practices to agriculture, though of great economic importance, are usually successful in proportion as they are direct and simple. Whether a student's preparation is adequate for any given line of advanced study can be determined only by special consideration of each case.

Special Facilities

Farm Power Machinery. The laboratory equipment available consists of a 150-HP Froude Hydraulic Absorption Dynamometer, a Szekely Traction Dynamometer, with disc recording mechanism, tractors of many types, the usual farm power machines, and farm lands affording typical Eastern soils and topography.

Ventilation of Animal Shelters and Crop Storages. For this work the department is using a Leeds and Northrup Micro-Max resistance thermometer recorder giving an automatic continuous record of 64 thermometer stations in addition to an L. and N. portable resistance thermometer indicator with hand switch for 24 stations. Poultry houses and cattle, sheep, and hog barns, with natural and electric ventilation, are available.

Land Drainage. The University farms, being of rolling topography and of various soil types and formations, afford, in their extensive and well-mapped drainage systems, unusual opportunities for advanced study.

1. *Farm Mechanics.* Three hours a week, either term.

101. *Electricity on the Farm.* Three hours a week, second term.

102. *Farm Power Machinery.* Three hours a week, second term.

9. *Household Mechanics.* Two hours a week, second term. For women students.

10. *Household Mechanics.* Three hours a week, either term. For women students.

21. *Farm Engineering.* Three hours a week, either term.

121. *Farm Engineering, Advanced Course.* Two hours a week, second term. Given in alternate years.

[122. *Drainage and Irrigation.* Two hours a week, second term. Given in alternate years, not in 1937-38.]

24. *Farm Concrete.* Two hours a week, first term.

31. *Farm Structures.* Three hours a week, first term.

40. *Farm Shop Work.* Two hours a week, both terms.

41. *Shop Work for Rural High School Teachers.* Three hours a week, both terms.

46. *Household Carpentry, Furniture Repairing and Refinishing.* Two hours a week, second term. For women students.

47. *Farm Blacksmithing.* One hour a week, either term.

48. *Advanced Farm Blacksmithing.* One to two hours a week, either term.

251. **Research in Agricultural Engineering.** Prerequisite, permission to register. Professors RILEY, ROBB, MCCURDY, FAIRBANKS, ROEHL, and RANDOLPH and Assistant Professor F. B. WRIGHT. Hours as arranged. Investigations for which the student is prepared and for which adequate facilities can be provided.

252. **Seminary.** Required of graduate students. Both terms, credit one hour a term. Departmental staff. M 4:30-5:45. Presentation and discussion of papers on special problems in agricultural engineering.

161. *Mechanism of Hotel Machines.* Four hours a week, either term.

162. *Hotel Power Plants.* Three hours a week, second term.

163. *Hotel Auxiliary Equipment.* Three hours a week, first term.

164. *Hotel Planning.* Three hours a week, second term.

166. *Hotel Maintenance.* One hour a week, first term.

AGRONOMY

Professors J. A. BIZZELL, H. O. BUCKMAN, J. K. WILSON, B. D. WILSON, F. B. HOWE, H. B. HARTWIG, D. B. JOHNSTONE-WALLACE, and R. F. CHANDLER, JR.; at Geneva, *Professor* H. J. CONN.

Approved Major and Minor Subjects (key to symbols on p. 29)

Agronomy **4**
Field Crop Production **1, 2**
Soil Chemistry **1, 2**
Soil Microbiology **1, 2**
Forest Soils **1, 2**

Special laboratories are provided for graduate students; they are equipped for chemical and bacteriological investigations of soils and of crop production. Greenhouses provide opportunity for conducting crop and soil tests during the winter, and for experiments with nutrient solutions and sand cultures. A field for plant experiments gives ample facility for work on a larger scale. These and other facilities afford opportunity for students properly trained in any one or more of the several sciences to investigate soil or plant nutrition problems.

A graduate student who desires to make agronomy his major subject should have had sufficient training in analytical chemistry and in bacteriology to give him a command of the technique as well as the principles of the subject. It is also desirable that he should have had enough technical agriculture to enable him to see the agricultural bearing of the work.

1. *The Nature and Properties of Soils.* First or second term. Credit five hours.

3. *Practical Soil Management.* First term. Credit three hours. Given in alternate years.

7. *Soil Classification and Conservation.* Second term. Credit three hours.

11. *Production of Field Crops.* First term. Credit four hours.

107. **Soil Bacteriology.** Second term. Credit three hours. Prerequisite, course 1, Bacteriology 1, and Chemistry 201 or its equivalent. Professor J. K. WILSON. Lectures, M W 8. Caldwell 143. Laboratory, W or F 1:40-4. Caldwell 201.

A course in biological soil processes designed primarily for students specializing in soil technology and bacteriology. The laboratory work is supplemented by reports and by abstracts of important papers on the subject. Laboratory fee, $5.

115. **Forest Soils.** First term. Prerequisites, course 1 and Botany 31. Students must consult instructor before registering for the course. Assistant Professor CHANDLER. Hours to be arranged. Caldwell 492.

Assigned readings and semi-weekly discussions of the more important forest soils literature. There will be occasional field trips.

201. **Soils, Advanced Lecture Course.** First term. Prerequisite, course 1 and Chemistry 201 or its equivalent. Students must consult instructor before registering for this course. Professor BIZZELL. Lectures, T Th S 8. Caldwell 143.

The lectures are supplemented by reviews of literature and by the preparation of abstracts.

202. **Soils, Advanced Laboratory Course.** First term. Prerequisite, course 1 and Chemistry 201 or its equivalent. Professor BIZZELL. Laboratory, F 1:40-4. Caldwell 294. Laboratory fee, $3.

A course designed primarily for special training in methods used in soil investigation.

221. **Research in Agronomy.** Throughout the year. Professors BIZZELL, BUCKMAN, J. K. WILSON, B. D. WILSON, F. B. HOWE, H. B. HARTWIG, D. B. JOHNSTONE-WALLACE and R. F. CHANDLER, JR. Hours by appointment. Caldwell 350.

222. **Seminar.** Throughout the year. Required of graduate students taking work in the department. S 11-12:30. Caldwell 143.

ANIMAL BREEDING

See under ANIMAL SCIENCES, p. 59.

ANIMAL HUSBANDRY

Professors F. B. MORRISON, M. W. HARPER, E. S. SAVAGE, L. A. MAYNARD, C. M. MCCAY, E. S. HARRISON, S. A. ASDELL, R. B. HINMAN, G. W. SALISBURY, and J. P. WILLMAN.

Approved Major and Minor Subjects (key to symbols on p. 29)

Animal Husbandry **1, 2, 3, 4**
Animal Nutrition **1, 2, 3, 4** (See also under Animal Nutrition)
Animal Breeding **1, 2, 3, 4** (See also under Animal Breeding)

Note. If the major for the Ph.D. degree lies in one of these three fields, not more than one of the other two should be selected for a minor.

For the special facilities of the Animal Husbandry department in Animal Breeding and Animal Nutrition and detailed descriptions of the courses in these fields see the statements under these subjects.

The department is well equipped with herds and flocks of animals of the leading breeds of livestock and with modern barns adapted for experimental work. The livestock include a herd of over 150 dairy cattle, a herd of beef cattle, studs of draft horses, a flock of over 200 sheep, and a herd of breeding swine. The library includes a very full collection of the herd and flock registries of all of the breeds of domestic animals kept in this country, amounting to more than one thousand volumes, and affording excellent facilities in heredity and genetics.

The animals of the herds and flocks and their records provide opportunity for studying problems of nutrition, livestock feeding, breeding, and production.

Slaughter and meat laboratories are available for the study of the relation of breeding and nutrition to anatomical structure and to chemical composition and food value. The college animals are available for studies relating to the production and the processing, sale, grading, and measuring of their various products such as milk, meat, and horse power, including animal mechanics.

In order to enter upon graduate study in animal production, the student should have the equivalent of the following courses: elementary feeds and feeding, elementary breeding and the elementary production courses in dairy and beef cattle, horses, sheep, and swine.

1. *Livestock Production.* First term. Two lectures and one laboratory period a week.

10. *Livestock Feeding.* Second term. Three lectures and one laboratory period a week.

20. *Animal Breeding.* First term. Two lectures and one laboratory period a week.

40. *The Horse.* Second term. Two lectures and one laboratory period a week.

41. *Advanced Live Stock Judging, Beef, Cattle, Horses, Sheep, and Swine.* Second term. One lecture and one laboratory period.

50. *Dairy Cattle.* Second term. Two lectures and one laboratory period a week.

51. *Advanced Judging, Dairy Cattle.* Second term. Hours by appointment.

60. *Beef Cattle.* Second term. Two lectures and one laboratory period a week.

70. *Swine.* Second term. Two lectures and one laboratory period a week.

80. *Sheep.* First term. Two lectures and one laboratory period a week.

90. *Meat and Meat Products.* First or second term. One lecture and two laboratory periods a week.

93. *Meat Cutting.* First or second term. One period a week.

110. **Animal Nutrition.** First term. See **Animal Nutrition.**

111. **Animal Nutrition.** First term. Laboratory course. See **Animal Nutrition.**

120. **Problems in Animal Genetics.** First term. See **Animal Breeding.**

125. **Physiology of Reproduction.** Second term. See **Animal Breeding.**

[130. **Physiology of Lactation.** Second term. Not given in 1937-38. See **Animal Nutrition.**]

219. **Seminar in Animal Nutrition.** First and second terms. See **Animal Nutrition.**

229. **Seminar in Animal Breeding.** First and second terms. See **Animal Breeding.**

150. **Dairy Cattle, Advanced Course.** Second term. Credit two hours. Prerequisite, Course 50. Lecture, W 11. Practice, W 1:40-4. Animal Husbandry Building E. Professors SAVAGE and HARRISON.

Analysis of breeding operations in successful breeding establishments. Formulating a breeding program. Selection of foundation females and herd bulls and special problems in the feeding and management of the purebred dairy herd.

200. **Research.** First and second terms. Professors MORRISON, HARPER, SAVAGE, HARRISON, HINMAN, SALISBURY, and WILLMAN. Hours by arrangement.

201. **Seminary in Animal Husbandry.** First and second terms. Required of all graduate students taking either a major or minor subject in Animal Husbandry. Professor MORRISON and departmental staff. M 11.

ANIMAL NUTRITION

See under ANIMAL SCIENCES, p. 60.

BACTERIOLOGY

See under ANIMAL SCIENCES, p. 61, and NEW YORK STATE EXPERIMENT STATION AT GENEVA, p. 166.

DAIRY SCIENCE

Professors J. M. SHERMAN, H. E. ROSS, P. F. SHARP, B. L. HERRINGTON, E. S. GUTHRIE, W. E. AYRES, H. J. BRUECKNER, D. B. HAND, and *Doctor* V. N. KRUKOVSKY; at Geneva, *Professors* A. C. DAHLBERG and D. C. CARPENTER.

Approved Major and Minor Subjects (key to symbols on p. 29)

Dairy Science **1, 2, 3, 4**
Dairy Chemistry **1, 2, 3, 4**
Biochemistry **1, 2, 3, 4**

Before taking up graduate work in dairy science, it is desirable that the student have general chemistry, qualitative and quantitative analysis, organic chemistry, college physics, and general bacteriology, in addition to the elementary courses in the particular field in which he wishes to do his graduate work.

Formal courses open to undergraduate and graduate students are given in the following subjects:

1. *Introductory Dairy Science.* Credit three hours a week. Either term.

5. *Technical Control of Dairy Products.* One hour a week. Second term.

111. **Analytical Methods.** Second term. Credit three hours. Prerequisite, course 1 and quantitative analysis. Professor HERRINGTON and Dr. KRUKOVSKY. Lecture and laboratory practice, T 1-6. Dairy Industry Building 120.

An advanced course in the chemical analysis of products and materials important in the dairy industry. Laboratory fee, $10.

102. **Market Milk and Milk Inspection.** Second term. Credit five hours. Prerequisite, course 1, and Bacteriology 1 or its equivalent. Professor Ross and Assistant Professors AYRES and BRUECKNER. Lecture and laboratory practice, M W 1-6. Dairy Building 218 and 146.

The scientific, technical and sanitary aspects of the fluid milk industry. Laboratory fee, $10.

103. **Milk-Products Manufacturing.** First term. Credit five hours. Prerequisite, course 1. Professor GUTHRIE and Assistant Professor AYRES. Lectures, recitations, and laboratory practice, T Th 1-6. Dairy Building 120.

The principles and practice of making butter, cheese, and casein, including a study of the physical, chemical, and biological factors involved. Laboratory fee, $10.

104. **Milk-Products Manufacturing.** Second term. Credit five hours. Prerequisite, course 1; should be preceded or accompanied by course 5. Assistant Professor AYRES. Lectures, recitation, and laboratory practice, F 1-6, S 8-1. Dairy Building 120.

The principles and practice of making condensed and evaporated milk, milk powders, ice cream, and by-products, including a study of the physical, chemical, and biological factors involved. Laboratory fee, $10.

112. **Chemistry and Physics of Biological Materials.** First term. Credit three hours. Prerequisite, analytical and organic chemistry, and college physics. Assistant Professor HAND. M W F 12. Dairy Building 119.

A fundamental treatment of the physico-chemical processes occurring in living cells and other biological materials.

113. **Dairy Chemistry.** First term. Credit two hours. Prerequisite, qualitative and quantitative analysis and organic chemistry; must be preceded or accompanied by course 106 or its equivalent. Professor P. F. SHARP. Lectures, M W 8. Dairy Building 119.

A consideration of milk and dairy products from the physico-chemical point of view.

Dairy Bacteriology. (See Bacteriology 103.)

200. **Milk Products.** Second term. Credit four hours. Must be preceded by course 107. Professor P. F. SHARP. Lectures, M T W Th 8. Dairy Building 218.

An advanced consideration of the scientific and technical aspects of milk products.

202. **Seminary.** Throughout the year. Without credit. Required of graduate students specializing in the department. Professor SHERMAN. Hours to be arranged. Dairy Building.

For Graduates

Graduate students may elect research problems in any of the various fields of dairy science and in related fields of bacteriology and biochemistry.

RESEARCH AT THE NEW YORK STATE EXPERIMENT STATION

Research work in dairying is also available to graduate students at Geneva. For further information see page 166.

FLORICULTURE AND ORNAMENTAL HORTICULTURE

Professors E. A. WHITE, R. W. CURTIS, J. P. PORTER, and C. J. HUNN.

Approved Major and Minor Subjects (key to symbols on p. 29)

Floriculture **1, 2, 3, 4**
Ornamental Horticulture **1, 2, 3, 4**

The field of investigation and research in floriculture and ornamental horticulture is a broad one, and there are excellent opportunities for original work in these subjects. Studies in variation, nutrition, or in regard to the culture and improvement of plants may be undertaken. Monographic studies on the various genera of ornamentals offer an important field of research. Summer work is of special importance in studying plant materials, and it is desirable that candidates for the Master's degree spend at least one summer at the University. This is required of all candidates for the Doctor's degree.

Every candidate for an advanced degree must have had a thorough training in chemistry, general biology, botany, economic entomology, soils, fertilizers, and genetics. A student who takes his major subject in the department must already have had the courses noted below or their equivalent, excepting only the advanced courses. A student who takes his minor subject for the Master's degree in this department of study may register for these courses. Each student is required to deposit a typewritten copy of his thesis with the department.

In addition to the classroom and laboratory equipment, a range of greenhouses, aggregating sixteen thousand square feet of glass, is now available for instructional purposes. The department has about thirty acres of land devoted to nurseries of ornamental plants and to field experiments with peonies, gladioli, irises, roses, asters, and other perennial plants. This area also furnishes material for laboratory exercises.

The library equipment consists of a large and steadily increasing collection of works of reference, comprising a number of the rarer books of the ancients, and an unusually full assortment of the garden herbals of the sixteenth, seventeenth, and eighteenth centuries, and the leading monographs and manuals of modern times, supplemented by complete sets of a large number of the horticultural journals of Europe and America. The largest bound collection of seed, plant and nursery catalogues in the United States is in the library of the department. This collection is very useful to students monographing horticultural plants.

The University Campus affords an excellent collection of woody plants in mature condition, and an arboretum is rapidly being developed which exhibits all the useful plant forms in arrangement for type study and also in their grouping for various uses.

Graduate students who have been trained in general horticulture and who have not had specialized courses in Floriculture and Ornamental Horticulture may be required to take certain undergraduate courses, which are as follows:

1. *Principles and Methods of the Propagation and Management of Greenhouse Crops.* Three hours a week, first term.
2. *Amateur Floriculture.* Three hours a week, second term.
3. *Herbaceous Plant Materials.* Three hours a week, second term.
5. *Flower Arrangement.* One hour a week, second term.
7. *Plant Propagation.* Three hours a week, first term.
8. *Woody-Plant Materials.* Four hours a week, both terms and summer session.
10. *A Brief Introduction to Landscape Design and Ornamental Horticulture.* Three hours a week, second term.
101. *Commercial Floriculture.* Four hours a week, both terms.
103. *Wholesaling and Retailing Flowers.* Two hours a week, second term.
[104. *Conservatory Plants.* Two hours a week, first term. Given in alternate years, not in 1937-38.]
109. *Commercial Practice in Woody-Plant Propagation.* Two hours a week, both terms.
112. *Lawn Making and Greenkeeping.* Two hours a week, second term.
113. *Landscape Work on Small Properties.* Three hours a week, first term.
114. *Landscape Work on Small Properties.* Six hours a week, second term.
115. *Planting Design.* Two hours a week, first term.
116. *Planting Design, Advanced Course.* Three hours a week, second term.
117. *The Construction of Small Gardens.* Three hours a week, first term.
171. *Tree and Shrub Management.* Two hours a week, second term.

Seminary. First term. Required of all graduate students.

FORESTRY

Professors R. S. HOSMER, A. B. RECKNAGEL and J. N. SPAETH.

Approved Major and Minor Subjects (key to symbols on p. 29)

Forest Ecology **1, 2, 4**
Forest Conservation **2, 4**
Forest Products **2, 4**

Graduate Work in Forestry

Instruction and research in forestry on the graduate level leading to advanced professional degrees in forestry have been discontinued.

Graduate students, candidates for the degrees Master of Science, or Doctor of Philosophy may elect to do work of non-professional character in forestry. Prospective graduate students should correspond with the Dean of the Graduate School in order to ascertain the availability of work desired.

Cornell University owns or controls various properties which offer exceptional opportunities for graduate study in all natural science fields. Among these are the following forest properties: The Arnot Forest of 1880 acres, twenty miles southwest of Ithaca; other parcels of wooded and open land aggregating approximately 670 acres in the vicinity of Ithaca; and 640 acres of typical Adirondack timber land in Essex and Hamilton counties.

Advanced Work and Research

Advanced work and research of a non-professional character may be done in the following:

Forest Conservation (History and Policy)—Professor HOSMER.
Forest Products—Professor RECKNAGEL.
Forest Ecology—Assistant Professor SPAETH.

General Forestry

1. *The Farm Woodlot.* Three hours a week, first term.
3. *Conservation of Natural Resources.* Two hours a week, second term.
4. *The Field of Forestry.* Two hours a week, first term.
23. *The Establishment and Development of Farm Woodlands.* Three hours a week, second term.
54. *The Measurement and Management of Farm Woodlands.* Three hours a week, first term.
106. *Wild-life Conservation in Relation to Forestry.* For graduate and undergraduate students. Two hours a week, first term.
261. **Seminar.** Both terms. Without credit. Professors HOSMER, RECKNAGEL, and Assistant Professor SPAETH. Hours to be arranged. Field and classroom conferences.

POMOLOGY

Professors A. J. HEINICKE, L. H. MACDANIELS, JOSEPH OSKAMP, M. B. HOFFMAN, and R. M. SMOCK; at Geneva, *Professors* RICHARD WELLINGTON, H. B. TUKEY, R. C. COLLISON, B. R. NEBEL, and G. P. VAN ESELTINE.

Approved Major and Minor Subjects (key to symbols on p. 29)

Pomology **1, 2, 4**

The large experimental and varietal orchards of different fruits at Ithaca and at Geneva are available for graduate use. Representative varieties of all domesticated species that grow in this climate may be found in these orchards. Each year a large collection of exotic fruit is brought together at the College; herbarium and preserved material is also available. The important pomological literature required for research is found in the libraries at Cornell and at the State Station. Modern apparatus for research work on pomological problems involving chemical, histological and physiological technique is available in the departmental laboratories. Opportunity for investigation of fruit storage problems is afforded by a modern cold storage plant which is equipped for experimental purposes.

Special facilities for research work in fruit breeding, nursery stock investigations and other phases of pomology are also available to graduate students at Geneva. For further information, see page 168.

In order to enter upon graduate work in Pomology, the student should have the equivalent of the following courses: General Botany, Elementary Plant Physiology, Economic Entomology, Elementary Plant Pathology, Introductory Inorganic and Elementary Organic Chemistry, Elementary Pomology and Systematic Pomology. In addition, students are required as part of their graduate work in Pomology to take advanced courses in Plant Physiology and Chemistry, unless minors are chosen in those subjects. They are urged, however, to choose a minor in some phase of Botany, particularly Plant Physiology.

On account of the nature of the work, it is very desirable that graduates studying for the Master's degree should spend one summer at Ithaca or in the field investigating their special subject. This is expected of graduates working for a Doctor's degree.

1. *General Pomology.* Second term. Credit three hours.

2. *Fruit Varieties.* First term. Credit two hours.

111. *Packing and Storage of Fruit for Market.* First term. Credit two hours.

112. *Advanced Laboratory Course.* Second term. Credit two hours.

121. **Economic Fruits of the World.** First term. Professor MACDANIELS. Given in alternate years. Lectures, T Th 12. Laboratory, F 1:40-4. Plant Science 107.

A study of all species of fruit-bearing plants of economic importance, such as the date, the banana, the citrus fruits, the nut-bearing trees, and the newly introduced fruits, with special reference to their cultural requirements in the United States and its insular possessions. All fruits not considered in other courses are considered here. The course is designed to give a broad view of world pomology and its relationships with the fruit industry of New York State.

131. **Advanced Pomology.** Second term. Professor HEINICKE. Discussion, M W F 8. Plant Science 141.

A systematic study of the sources of knowledge and opinion as to practices in pomology; methods and difficulties in experimental work in pomology, and results of experiments that have been concluded or are being conducted.

202. **Special Topics in Pomology.** Throughout the year. Professors HEINICKE, MACDANIELS, OSKAMP, HOFFMAN or SMOCK. Conference periods to be arranged. Plant Science 141.

Different topics will be considered each term,the aim being to cover the entire field in two years. In this course the student is expected to review critically and evaluate the more important original papers relating to pomological practice and research. Interpretation of the literature will be made on the basis of the fundamental principles of plant biology and recent experimental methods.

201. **Research Problems in Pomology.** Throughout the year. Professors HEINICKE, MACDANIELS, OSKAMP, HOFFMAN, and SMOCK.

200. **Seminary.** First and second terms. Members of the staff. M 11. Plant Science 404.

POULTRY HUSBANDRY

Professors F. B. HUTT, G. F. HEUSER, G. O. HALL, L. C. NORRIS, A. L. ROMANOFF, and J. H. BRUCKNER.

Approved Major and Minor Subjects (key to symbols on p. 29)

Poultry Husbandry **2, 4**

The department provides excellent facilities for research in the genetics, physiology, incubation, embryology, nutrition, and behavior of domestic birds. A flock of over 2000 birds of various breeds of the domestic fowl is maintained, and turkeys, ducks, geese and game birds can be obtained when needed. The equipment includes the usual facilities for hatching, brooding and rearing poultry, together with laying houses and pens for experimental work. There is a well-equipped chemical laboratory and complete facilities for work in poultry nutrition, equipment for studies of incubation and facilities for various kinds of histological and physiological work.

The accumulated records of the department are available for study and other extensive data are provided by two laying tests conducted under the supervision of the department.

Students for the Ph.D. degree in this department may elect either Animal Breeding or Animal Nutrition as the major field of study. For requirements and courses in these fields see pp. 107 and 60 of this publication. Animal Breeding and Animal Nutrition may also be elected as major or minor fields of study for the M. S. degree.

Poultry Husbandry may be elected as a major for the M.S. degree and as a minor for the M.S. or Ph.D. degree when the major is taken in a field of study other than Animal Breeding or Animal Nutrition.

The prerequisites for graduate students electing a major subject in this department include some undergraduate training in poultry husbandry, some experience in that field, courses in Zoology or Animal Biology, physiology and chemistry, as well as permission of the major adviser.

1. *Farm Poultry.* First term. Credit three hours.

20. *Poultry Breeds, Breeding and Judging.* First term. Credit three hours.

30. *Poultry Incubation and Brooding.* Second term. Credit two hours.

50. *Marketing Poultry Products.* Second term. Credit two hours.

109. *Special Problems.* First or second term, or throughout the year. Credit one or two hours a term.

110. *Poultry Nutrition.* Second term. Credit three hours.

170. *Poultry Hygiene and Disease.* First term. Credit two hours.

120. **Poultry Genetics.** Second term. For details see Animal Breeding.

130. **Advanced Incubation.** Second term. For details see Animal Breeding.

205. **Research.** Throughout the year. Professors HUTT, HEUSER, and NORRIS, and Assistant Professors BRUCKNER, HALL, and ROMANOFF.

209. **Seminar in Poultry Biology.** Throughout the year. Professors HUTT, HEUSER, and NORRIS, and Assistant Professors BRUCKNER, HALL, and ROMANOFF. T 4:15. Poultry Husbandry Building 201. Required of all graduate students in the department.

A survey of recent literature and research in poultry biology.

219. **Animal Nutrition Seminar.** First and second terms. For details see Animal Nutrition.

210. **Experimental Methods in Poultry Nutrition.** First term. For details see Animal Nutrition.

220. **Animal Genetics.** First term. For details see Animal Breeding.

229. **Seminar in Animal Breeding.** First and second terms. For details see Animal Breeding.

RURAL SOCIAL ORGANIZATION

Professors DWIGHT SANDERSON, W. A. ANDERSON, and L. S. COTTRELL, JR.

Approved Major and Minor Subjects (key to symbols on p. 29)

Rural Social Organization **1, 2, 4**

Graduate students who desire to register in Rural Social Organization as a major subject should have had a considerable personal experience with rural life and rural institutions, and a general knowledge of sociology, psychology, and economics. Elementary courses in general sociology, rural sociology, and economics are prerequisite to graduate courses.

1. *General Sociology.* First or second term. Credit three hours.

12. *Rural Sociology.* First term. Credit three hours.

111. *Rural Community Organization.* Second term. Credit two hours. Prerequisite, courses 1 and 12 or the permission of the instructor. Professor SANDERSON. Lectures and discussions, W F 8. Agricultural Economics Building 340.

The application of sociology to the practical problems of rural community organization. The course covers three main divisions: the use of community or-

ganization as a tool for guiding social change; a critical study of rural community organizations; methods of making organizations effective through developing rural leadership, analyzing community needs, building community programs, and coordinating programs.

121. **The Family.** First or second term. Credit three hours. Prerequisite, course 1 or its equivalent. Lectures, discussions, and reports. Assistant Professor COTTRELL. T Th S 8. Agricultural Economics Building 340.

This course considers the family as a social institution with a history and with contrasting forms and functions in different cultures. Attempt is made to understand the effects of contemporary social change on the modern family and in turn the results in society of a changing family. As a basis for understanding the central importance of the family, considerable attention is devoted to the social-psychology of marriage and family relations.

122. *Social Problems and Public Welfare Organization.* Second term. Credit three hours. Prerequisite, Course 1. Assistant Professor COTTRELL. M W F 11. Agricultural Economics Building 340.

A study of the underlying factors in social phenomena usually regarded as symptomatic of personal and social mal-functioning, such as dependence, delinquency, crime, insanity, community disorganization, etc. Consideration is given to the methods by which our society attempts to deal with the problems involved.

123. *Social-Work Practice.* Throughout the year.

131. *The Social Psychology of Rural Life.* First term. Credit three hours. Prerequisite, course 1 and one course in psychology. Assistant Professor COTTRELL. T Th S 10. Agricultural Economics Building 340.

An outline of social-psychological principles which can serve as a basis for understanding the dynamics of the social behavior of persons and of groups. Application is made to problems of social attitudes, public opinion and collective behavior in rural life.

132. **Rural Leadership.** Second term. Credit two hours. Prerequisite, permission to register. Professor SANDERSON. F 2-4. Agricultural Economics Building 302.

A seminary course in which a descriptive account of leadership is given from both sociological and psychological points of view. General principles are discussed, with special case references to studies of rural leaders in New York and other States.

207. **Sociological Theory and Research.** First term. Credit three hours. Prerequisite, permission to register. Professor ANDERSON. T Th S 9. Agricultural Economics Building 302.

A course devoted to the critical analysis of recent and contemporary sociological theory.

208. **Systematic Sociology.** Second term. Credit three hours. Professor ANDERSON. T Th S 9. Agricultural Economics Building 302.

This course is designed to present in a systematic way the whole field of sociology, with special emphasis on sociological theory. The work is divided between discussions concerning the essential aspects of the subject, and reports on special topics.

[209. **Seminary.** Second term. Professor SANDERSON. Not given in 1937-38.]

The structural characteristics and classification of different types of social groups as related to their functions are studied.

[211. **The Rural Community.** First term. Credit two hours. Prerequisite, courses 1 and 12 or their equivalents. Professor SANDERSON. Not given in 1937-38.]

A study of the historical development of the rural community; a comparative study of types of rural communities; the rural community as a sociological group and its place in society; methods of community development and organization.

213. **Research in Rural Social Organization.** Throughout the year. Hours and credit to be arranged. Professors SANDERSON and ANDERSON, and Assistant Professor COTTRELL.

217. **The Rural Church and the Community.** Second term. Credit two hours. Prerequisites, course 1 and permission to register. Not given for less than six students. Professor ANDERSON. Hours to be arranged. Agricultural Economics Building 302.

The church as a social institution; its functions in present-day rural life; problems and programs of work.

219. **Seminary.** First term. Credit two hours. Professors SANDERSON, ANDERSON and COTTRELL. F 2-4. Agricultural Economics Building 302.

A study of research methods in rural sociology.

221. **Seminar—The Family.** First and second terms. Credit two hours. Professor ROCKWOOD and Assistant Professor COTTRELL. T 2-4. Agricultural Economics Building 302.

Open to graduate students with some background in Family Life, Sociology and Psychology.

[231. **Social Psychology of Rural Life.** First term. Credit three hours. Assistant Professor COTTRELL. W 2-4. Not given in 1937-38. Graduate students may substitute 131.]

The same plan as that outlined in 131 is followed except that more background on the part of the student is assumed and more attention will be given to theoretical aspects.

232. **Social Psychology of Rural Life.** Second term. Credit three hours. Prerequisite 231 or consent of instructor. Assistant Professor COTTRELL. W 2-4.

A continuation of 231. Special attention is devoted to practical application of social-psychological principles to problems of research and practice in the field of social attitudes, public opinion and propaganda, and collective behavior.

VEGETABLE CROPS

Professors H. C. THOMPSON, PAUL WORK, E. V. HARDENBURG, J. E. KNOTT, ORA SMITH, HANS PLATENIUS, and G. J. RALEIGH; at Geneva, *Professors* C. B. SAYRE, W. T. TAPLEY, and W. D. ENZIE.

Approved Major and Minor Subjects (key to symbols on p. 29)

Vegetable Crops **1, 2, 4**

Opportunity is offered for research in such lines of vegetable growing and handling as the student may select. There are excellent opportunities for original work on this subject.

The facilities available include the regular classrooms and laboratories; research laboratories, with the necessary equipment for chemical and physiological work; cold storage and common storage rooms; greenhouse space of approximately 7,500 square feet; hotbeds and cold frames, and about 25 acres of land devoted to teaching and research work. Special equipment is obtained as needed for students majoring in this field.

In order to enter upon graduate work in this field, the student should have the equivalent of the following courses: Botany 1 and 31, Plant Pathology 1, Entomology 12, Agronomy 1, Vegetable Crops 1, 2, 12. These courses are outlined in the Announcement of the College of Agriculture. In case a student has not had all of these courses, he should take them early in his period of graduate study. Students taking either a major or a minor in vegetable crops are required to take the courses 101, 113, 121, and to attend the seminar.

Students majoring in vegetable crops will ordinarily find it necessary to spend one summer in Ithaca, in order to grow and study plant materials used in their research work.

1. *Vegetable Crops.* Second term. Credit three hours.

2. *Special Cash Crops.* Second term. Credit three hours. Botany 1 should precede or accompany this course.

12. *Grading and Handling Vegetable Crops.* First term. Credit three hours.

101. **Advanced Vegetable Crops.** Second term. Credit four hours. Prerequisite, course 1 and Botany 31. Professor THOMPSON. Lectures, M W F 9. One conference period to be arranged. East Roberts 223.

This course is devoted to a systematic study of the sources of knowledge and opinions as to practices in vegetable production and handling. Results of experiments that have been concluded or are being conducted are studied and their application to the solution of practical problems is discussed.

113. **Types and Varieties of Vegetables.** First term. Credit three hours. Prerequisite, course 1 or 2 or permission to register. Professor WORK. Lecture and laboratory, M 1:40-4. East Ithaca gardens or East Roberts 223.

One week of laboratory work preceding the beginning of regular instruction is required, from September 23 to 29, 1937. Report at East Ithaca at 9 a. m., September 23. The department should be notified of intention to register in this course.

This course deals with the taxonomy, origin, history, characteristics, adaptation, identification, classification, exhibition, and judging of kinds and varieties of vegetables; the characteristics, production, and handling of vegetable seeds. The leading varieties of the vegetable crops are grown each year. The value of the course depends to a great extent upon gaining an acquaintance with the plant material as it grows. For this reason part of the laboratory work is done in the gardens prior to and during registration week. Laboratory fee, $2.

121. **Morphology and Anatomy of Vegetable Crop Plants.** First term. Credit two hours. Prerequisite, course 1 and Botany 1. Assistant Professor SMITH. Lecture and laboratory, Th 1:40-5. East Roberts 225.

A study of the anatomy and development of the roots, stems, leaves, flowers, fruits, and seeds, and of the reproductive processes of vegetable-crop plants.

221. **Research.** Members of the staff are prepared to direct investigations in the various lines of vegetable production and handling.

222. **Seminar.** Members of the department staff. Recent literature is taken up for general study and discussion. All graduate students in vegetable crops are required to take part in this seminar. Time to be arranged. East Roberts 223.

RESEARCH AT THE NEW YORK STATE EXPERIMENT STATION

Research work in vegetable crops is also available at Geneva. For further information see page 168.

GRADUATE SCHOOL OF EDUCATION

EDUCATION AND RURAL EDUCATION

Professors BAYNE, BINZEL, BUTTERWORTH, EATON, FERRISS, FREEMAN, HOSKINS, HULSE, JOHNSON, JORDAN, KRUSE, MOORE, OGDEN, PALMER, STEWART, WINSOR.

Approved Major and Minor Subjects (key to symbols on p. 29)

Agricultural Education **1, 2, 3, 4**
Curriculum **1, 2, 3, 4**
Education **3, 4**
Educational Administration **1, 2, 3, 4**
Educational and Mental Measurement (including Statistics) **2, 3, 4**
Educational Method **3, 4**
Educational Psychology **1, 2, 3, 4**
History of Education **2, 3, 4**
Home Economics Education **3, 4**
Nature Study **1, 2, 3, 4**
Rural Education **1, 3, 4**
Rural Secondary Education **1**
Secondary Education **1**
Supervision **1, 2, 3, 4**
Vocational Education **1**
Theory and Philosophy of Education **1, 2, 3, 4**

Standards in the teaching profession have made considerable advance during the last several years. Although the possession of a Bachelor's degree has, in the past, usually been regarded as sufficient for secondary school teaching, those who have training beyond such a degree are likely, during the next few years, to find themselves in a preferred situation with regard to securing such positions. Although Cornell will not, for the present at least, discontinue its four-year program for training secondary school teachers, it is advisable that as many as possible plan to take five years for this purpose. Under the five-year program some of the professional courses in Education should be postponed to the fifth year, but the student should give particular attention early in his course to making certain that he shall have taken, by the end of this period, a combination of subjects that will enable him to fit into a secondary school situation. Under certain conditions those taking this fifth year of training may secure a Master's degree as described below. Whether the student receives his training in four years or five, it is important that he confer as early as possible with some member of the Education staff who is familiar with secondary school conditions.

A separate Announcement listing the offerings in Education may be obtained by writing to the Director.

There are two types of advanced degrees for students of education, as follows:

1. The degrees of *Master of Arts, Master of Science,* and *Doctor of Philosophy* are administered directly by the Graduate School of Cornell University.

2. The degree of *Master of Science in Education* is administered directly by the Graduate School of Education, subject to the regulations of the Graduate School of Cornell University.

A graduate student in the field of Education may become a candidate for a degree in either of these categories.

Admission

Students may be admitted to candidacy for the degrees of Master of Arts, Master of Science, or for the degree of Doctor of Philosophy with a major or minor or both in some phase of Education. For details of admission see page 9.

Admission to candidacy for the degree Master of Science in Education is the same as for other advanced degrees, except that for M.S. in Ed. the requirement in foreign language is omitted.

Persons interested in becoming candidates for this degree should address inquiries either to the Dean of the Graduate School or to the Director of the Graduate School of Education or to both. Formal application for admission should be sent to the Dean of the Graduate School.

The Master's Degree in Education

The degree of Master of Science in Education is conferred upon a candidate who, after completing not less than one year of residence devoted to study in a field in which Education constitutes the major portion, has given satisfactory evidence of ability to carry graduate work, and has met such other requirements as his Special Committee with the approval of the Graduate School of Education may have established. Every candidate must pass a final comprehensive examination.

This degree is designed for school executive officers and teachers who wish to enter upon a course of professional study involving neither close restriction nor intensive research. This course of study is both comprehensive and critical. It has, however, a distinctly professional emphasis. The amount of prescribed work will be adjusted to the particular preparation and experience of the candidate. In general these candidates are expected to fall into one of three classes:

Class I. Men and women, graduates of standard colleges, of approved experience in educational positions, who are seeking professional preparation on the graduate level.

Class II. Men and women, graduates of standard colleges, who wish to qualify as school principals or as supervisors in special fields in accord with professional requirements of various states.

Class III. Men and women, graduates of standard colleges, qualified for graduate work, but who have not included in their undergraduate programs courses in the field of Education sufficient for certification as teachers.

1. With the approval of the Director of the Graduate School of Education the candidate shall choose three members of the graduate faculty to serve as a special committee to direct his work. At least two of these shall be from the staff in Education, one of the two being selected by the candidate to act as chairman. This committee is empowered to determine the special qualifications of the candidate to undertake a program proper to his particular professional interest. An approved program must have unity, in terms both of purpose and of sequential development. The candidate is not required to present a formal thesis; but, if he does not do so, he is expected to complete an expository or critical essay or a problem in research to the satisfaction of his committee. Within an approved program are included such courses, seminars, projects, investigations and examinations as the committee may require. These provisions may have the consequence of extending the residence requirements for students of Class III beyond the minimum of one year.

2. The office of the Director of the Graduate School of Education acts as an office of record, and the candidate for one of these degrees shall, within ten days of his registration, file in writing a statement approved by his committee, showing his plan of work and course of study.

3. The student's special committee, not later than the middle of the third summer of study (or the end of the first term of graduate study), shall determine the fitness of the candidate to continue his candidacy for this degree through examination or such other suitable means as the committee may elect. The action of the committee shall be recorded in the office of the Graduate School of Education.

4. Upon the satisfactory completion of the work outlined by the Special Committee and the passing of a final comprehensive examination, the Faculty of the Graduate School of Education will recommend to the Faculty of the Graduate School that the candidate be granted the appropriate degree. The maximal period allowed for the completion of all requirements conforms to the regulations of the Graduate School of Cornell University.

5. Prior to scheduling the final examination, all members of the staff under whom the candidate has carried his course work or who have acted in any advi-

sory or similar capacity with him will be informed of his proposed examination, will be asked to express an opinion regarding his fitness for such examination, and will be invited to be present and to take part in the examination.

The courses expected of the candidate will fall into three groups designated as A, B, C. The determination of the particular groups into which particular courses will fall will depend upon the main professional purpose of the candidate in his graduate study and an integration of courses to such purpose.

Group A. This group includes courses of a special nature and of immediate interest, such as the technical courses in English, in the languages (or a language), history, sciences (or a science), agriculture (or a division thereof), etc., and the professional studies appropriate to the special field. It is expected that at least a third of the candidate's program will fall in this group.

Group B. This group includes courses in the theory and science of education which will furnish the several types of background that are warranted by the nature of courses in Group A. Courses to the extent of one-third of the total may be chosen in this group. Educational Psychology, including Measurement, History and Philosophy of Education and other courses necessary to integration, such as general studies appropriate to the organization and administration of schools at the several educational levels, are representative of this group.

Group C. This group includes courses intended to meet the particular needs of the candidate not adequately met in Groups A and B. In certain cases as much as a third of the candidate's program should be taken in this group.

For the selection of courses in all the above groups, the candidate should consult his special committee, whose approval is necessary.

For further information regarding the degree of Master of Science in Education address the Director of the Graduate School of Education.

COURSES OF INSTRUCTION. In the statement of courses given below, "Ed. 20," "Ed. 21," etc., indicate that the courses are offered in the Department of Education. "R.E. 111," "R.E.114," etc., indicate that the courses are offered in the Department of Rural Education.

All courses offered by the Graduate School of Education are listed below. The undergraduate courses are included as suggestive to graduate students, who do not have all the requirements for graduate study, of the nature of the work that may be expected of them in meeting deficiencies.

GENERAL COURSES

[R.E. 1. *Introduction to Problems of Public Education.* First term. Credit two hours. Not given in 1937-38.]

Ed. 20. **Seminary in Education.** First term. Credit two hours. Professor FREEMAN. T 4-6. Goldwin Smith 248.

Topics relevant to educational theory.

Ed. 21. **Seminary in Education.** Second term. Credit two hours. Admission by permission of the instructor. Professor JORDAN. M 4-6. Goldwin Smith 248.

Topics developing from historical and current problems of educational practice, especially as related to administration and conduct of the public school system and of the university. Primarily for graduate students.

[R. E. 234. **Seminary.** First term. Credit two hours. Professor BUTTERWORTH. M 2-3:30. Stone 309. Not given in 1937-38.]

PSYCHOLOGY

Ed. 1. *Educational Psychology.* Either term. Credit three hours.

R.E. 110. *Psychology: An Introductory Course.* First term. Credit three hours.

R.E. 111. *Psychology for Students of Education.* Either term. Credit three hours.

R.E. 112. *Psychology for Students of Education.* Either term. Credit three hours.

R.E. 114. *Psychology for Students of Hotel Administration.* First term. Credit three hours.

R.E. 117. *Psychology of Childhood and Adolescence.* Either term. Credit three hours.

[R.E. 119. *Personnel Administration.* Second term. Credit three hours. Not given in 1937-38.]

R.E. 211a. **Psychology for Students of Education.** First term. Credit three hours. For mature students with teaching experience. Professor KRUSE. Lectures, M F 11-12:20. Stone 309.

[R.E. 212. **Psychology of Learning.** First term. Credit two hours. Professor KRUSE. Th 4:15-6. Stone 309. Not given in 1937-38.]

R.E. 213. **Psychology of Learning in the School Subjects.** First term. Credit two hours. Assistant Professor BAYNE.

R.E. 216. **The Physically Handicapped Child.** Second term. Credit three hours. Prerequisite, R.E. 111 or 112 or equivalent. Dr. GARDNER. M W F 10. Stone 102.

Study of the techniques for discovery and training of children with various types of physical handicaps, such as visual, auditory, motor, etc.

R.E. 218. **Seminary in Educational Psychology.** Second term. Credit two hours. Professor KRUSE. Th 4:15-6. Stone 309.

[R.E. 219. **Seminary in Personnel Administration.** Second term. Credit two hours. Assistant Professor WINSOR. Th 4:15-6. Stone 203. Not given in 1937-38.]

Ed. 8. **Experimental Education.** Either term. Professor FREEMAN. Credit and hours to be arranged. Consent of the instructor is required. Education 7 should normally precede this course.

Problems of experimental education; the application of psychological and statistical methods to problems in educational psychology; chief results and bearings.

Ed. 17. **Mental Development.** First term. Credit two hours. Prerequisite, Education 1 or its equivalent. Professor FREEMAN. W 2-4. Goldwin Smith 248.

A course in child psychology, dealing with the facts of mental growth and their interpretations.

Ed. 18. **Individual Differences.** Second term. Credit three hours. Prerequisite, Education 1 or its equivalent. It is desirable, though not required, that Education 7 precede this course. Professor FREEMAN. M 2-4, and a third hour to be arranged. Goldwin Smith 236.

The nature, causes and implications of individual differences in abilities, interests, and achievement. Graduate students desiring to do so will be given an opportunity to make a special study of problem cases.

METHOD

R.E. 121. *Method and Procedure in Secondary School Teaching.* First term. Credit three hours.

Ed. 4. *Methods, Practice and Extra-instructional Problems.* Credit nine hours.

R.E. 126. *The Teaching of Science in the Secondary School.* Either term. Credit two hours.

R.E. 131. *Introduction to the Teaching of Agriculture in the Public Schools.* First term. Credit three hours.

R.E. 132. *The Teaching of Agriculture in the Secondary Schools.* First and second terms. Credit three hours each term.

R.E. 133. *Apprentice Teaching in Agriculture.* First or second term. Credit to be arranged.

R.E. 134. *Adult Education.* First term. Credit three hours.

[R.E. 134a. *Adult Education.* Second term. Credit two hours. Not given in 1937-38.]

R.E. 135. *The Teaching of Home Economics in the Secondary School.* Either term. Credit three hours.

R.E. 136. *Directed Teaching of Home Economics in the Secondary School.* Either term. Credit two or four hours.

R.E. 137. *Extra-instructional Problems.* First term. Credit two hours.

[R.E. 222. **Principles of Method.** Second term. Credit three hours. Professor STEWART. Not given in 1937-38.]

R.E. 226. **Research in Science Teaching.** Either term. Credit one or two hours. Professor PALMER and Assistant Professor JOHNSON. M or W at 9. Fernow 8.

Special problems in science teaching.

[R.E. 227. **Seminary in Elementary Education.** First term. Credit two hours. Professor MOORE. M 4-6. Stone 309. Not given in 1937-38.]

[R.E. 228. **Seminary in Child Guidance.** Second term. Credit two hours. Professor WARING. F 4-6. Nursery School. Not given in 1937-38.]

[R. E. 232. **Special Problems in Program Planning for the Teaching of Agriculture.** Second term. Credit two hours. Open to undergraduates by permission only. Assistant Professor HOSKINS. T Th 11. Not given in 1937-38.]

R.E. 240. **Cooperative Extension Work.** Second term. Credit three hours. Open to graduate students qualified in agriculture or home economics. Professor EATON. M W F 10. Stone 309.

A study of the educational aims, content and methods of the cooperative extension work in agriculture and home economics.

PREPARATION OF TEACHERS FOR NORMAL SCHOOLS AND COLLEGES

R.E. 241. **The Preparation of Teachers for Normal Schools and Colleges.** Second term. Credit three hours. Professor BUTTERWORTH. M W F 10. Stone 211.

To meet the needs of those responsible for the training of teachers for rural elementary and secondary schools.

[R.E. 243. **Problems of College Teaching.** Throughout the year. Credit one hour each term. Professor EATON. Open to college students intending to teach in colleges. Given provisionally upon enrollment of not less than six students. Hours of meeting two or three times a week will be arranged after enrollment and consideration of student's schedules. Not given in 1937-38.]

[R.E. 245. **The College Preparation of Teachers of Agriculture for the Secondary School.** Second term. Credit three hours. Professor STEWART. Given in 1938-39.]

[R.E. 248. **The Preparation of Teachers of Home Economics for the Secondary Schools.** Second term. Credit three hours. Professor BINZEL. Given in alternate years. Not given in 1937-38.]

R.E. 249. **Seminary in Home Economics Education.** First term. Credit two hours. Professor BINZEL. Time to be arranged.

Course content to be adapted to personnel of class.

R.E. 250. **Seminary in Agricultural Education.** First term. Credit two hours. Open only to graduate students whose progress in graduate study is satisfactory. Professor STEWART. T 4-5:30. Stone 309.

Typical pieces of research in agriculture related primarily to agriculture in secondary schools. Individual problems will furnish the basis of approach.

MEASUREMENT AND STATISTICS

Ed. 7. **Mental Measurements.** First term. Credit three hours. By permission of the instructor candidates for the principal's certificate may enroll for two hours credit. Prerequisite, Education 1 or equivalent. Professor FREEMAN. T Th S 9. Goldwin Smith 225.

The nature of intelligence. History of the development of individual and group tests of intelligence; principles underlying their formation and application; the use of tests of intelligence with atypical children, in school problems and in fields outside the school. Use of educational tests. Demonstration in administering tests.

R.E. 251. **Educational Measurement.** Second term. Credit three hours. Candidates for the principal's certificate may register for two hours. Prerequisite, a course in educational psychology. Assistant Professor BAYNE. T Th 8 and an hour to be arranged. Stone 309.

Educational measurement in relation to the classification of pupils, determination of the progress of pupils, and other problems of the teacher, supervisor, and administrator.

253. **Statistics for students of Education.** Second term. Credit three hours. Primarily for graduate students in education. Open to a limited number of other students upon approval of instructor. Assistant Professor BAYNE. T Th 10 and an hour to be arranged. Stone 309.

ADMINISTRATION AND SUPERVISION

Ed. 10. **High School Administration.** Second term. Credit two hours. Professor JORDAN. W F 3. Goldwin Smith 236.

Principles relevant to administration of the senior and junior high school; classification of pupils; program making; curriculum problems; the principal as supervisor; pupil guidance; duties of the principal in both large and small schools.

Ed. 11. **Extra-classroom Activities.** First term. Credit two hours. Professor JORDAN. M 4-6. Goldwin Smith 236.

A study of the place extra-classroom activities should assume in the school program. General principles involved, with special attention given to athletics, dramatics, publications, school finance, music, debate, and school clubs.

Ed. 12. **The Junior High School.** First term. Credit three hours. Professor JORDAN. M W F 9. Goldwin Smith 248.

Psychological, biological, and pedagogical bases for the Junior High School; fundamental principles, organization and administration; curricular content in detail; methods of instruction.

R.E. 261. **The Administration of Rural Schools.** First term. Credit three hours. Candidates for a principal's certificate may register for two hours credit. Professor BUTTERWORTH. T Th 11 and third hour to be arranged. Stone 102.

A course for students of experience dealing with the problems of organizing and administering education in the elementary and secondary schools in country and village districts.

R.E. 262a. **School Finance.** Second term. Credit two hours. Professor BUTTERWORTH. S 10–11:30. Stone 309.

Typical problems; how local school funds are levied, collected, and disbursed; cost accounting; budget making; bonding; sources of state funds and their distribution. The discussion will be based upon actual problems; prospective members of the class are urged, therefore, to bring with them financial data regarding their schools.

[R.E. 262c. **The School Plant.** Second term. Credit two hours. Professor BUTTERWORTH. M 4-6. Stone 309. Not given in 1937-38.]

R.E. 263. **Procedures and Techniques in Supervision.** First term. Credit three hours. Candidates for the principal's certificate may register for two hours credit. Professor MOORE. M W F 10. Stone 309.

Designed for superintendents, supervisors, and principals. Students who have not had experience in these fields will be admitted only upon permission of the instructor. Students taking this course must be prepared to spend four full days or more in observing supervisory procedures in various school systems.

[R.E. 264. **Seminar in Rural School Administration.** Second term. Credit two hours. Professor BUTTERWORTH. S 10. Stone 309. Not given in 1937-38.]

R.E. 265. **Seminary for Principals.** Second term. Credit three hours. Designed for all graduate students who are candidates for a principal's certificate. Professor MOORE. W 4-6 and additional time in field work. Stone 309.

R.E. 266. **The Supervision of the Elementary School Subjects.** Second term. Credit three hours. Candidates for a principal's certificate may register for two hours credit. Professor MOORE. M W F 9. Stone 309.

A course designed for supervisors, elementary school principals, and superintendents. It includes a consideration of important research studies which have a direct bearing upon the teaching and supervision of the elementary school subjects.

R.E. 267. **The Organization and Administration of Agricultural Education.** Second term. Credit three hours. Should follow course 261 or its equivalent. Professor STEWART. T Th 11-12:20. Stone 309.

Designed primarily for persons preparing to organize, administer, and supervise agricultural education. Participation in field experience, field study, and supervision make up a part of the program of study.

[R.E. 269. **The Administration and Supervision of Home Economics Education.** First term. Credit three hours. Professor BINZEL. Not given in 1937-38.]

R.E. 276. **Principles of Curriculum Building.** Second term. Credit three or four hours. Professor FERRISS. T Th 2-3:20 and an additional hour to be arranged for those wishing to carry further the study of special curriculum problems. Stone 309.

A consideration of the major problems, principles, and techniques in determining educational objectives, and curriculum content and organization.

R.E. 277. **Vocational Courses of Study in Agriculture.** Credit two hours. Assistant Professor HOSKINS. T Th 10. Stone 102.

A study of the making of vocational courses in agriculture for secondary schools, as based upon the agricultural part of the curriculum and as correlated with teaching units and supervised teaching programs.

R.E. 278. **Seminary in Rural Secondary Education.** Second term. Credit two hours. Professor FERRISS. M 4-6. Stone 102. Given in alternate years.

HISTORY OF EDUCATION

[Ed. 3. **History of Education.** (a) (Greek, Roman, and Early Medieval.) First term. Credit two hours. Professor LAISTNER. (See History 7.) (b) (Late Medieval and Modern.) Second term. Credit two hours. Professor SMITH. (See History 36.) Not given in 1937-38.]

Ed. 13. **History of American Education.** First term. Credit three hours. Prerequisite, Education 1, or its equivalent. Dr. HULSE. T Th S 10. Goldwin Smith 236.

A survey of educational change in the United States from the beginning of the seventeenth century to the present, with special emphasis on public schools, and consideration of the religious, economic, political, and social factors affecting education. European influences throughout the period will also be considered briefly.

EDUCATIONAL THEORY

Ed. 2. **Principles of Secondary Education.** Either term. Credit three hours. Prerequisite, Education 1 or its equivalent. First term, Professor JORDAN. M W F 2. Goldwin Smith 234. Second term, Professor FREEMAN. T Th S 9. Goldwin Smith 234.

The nature and significance of Education; biological and psychological foundations; the secondary school as a social institution; educational ideas and values; the curriculum.

Ed. 5. **Theory of Education.** Second term. Credit two hours. Prerequisite, Education 1 or the equivalent. Professor OGDEN. T Th 11. Goldwin Smith 248.

Behavior, learning, insight, personality and character as foundations of educational theory.

R.E. 181. *Principles of Education.* First or second term. Credit three hours.

R.E. 194. *Philosophy of Vocational Education.* First term. Credit three hours.

R.E. 281. **Rural Secondary Education.** First term. Credit three hours. Professor FERRISS. M W F 9. Stone 309.

A course to consider some of the more basic problems in the nature, organization, curriculum, and extension of secondary education in its adaptation to rural needs and conditions.

R.E. 294. **Philosophy of Education.** Second term. Credit three hours. Open to graduate students whose studies in education are well advanced. Professor EATON. M W F 11. Stone 309.

An examination of the concepts of education, and of the bearing of several major theories of life upon education.

R.E. 295. **Comparative Education.** First term. Credit two hours. Professors BUTTERWORTH, FERRISS, and MOORE. S 11-12:30. Stone 309.

A consideration of the educational systems of certain European countries.

NATURE STUDY

R.E. 107. *The Teaching of Nature Study and Elementary-School Science.* Second term. Credit three hours.

R.E. 108. *Field Natural History.* First term. Credit two hours.

[R.E. 202. **Nature Literature.** First term. Credit two hours. Open to students who will have completed their preparation for certification as science teachers by the end of the current year. Professor PALMER. M W 10. Fernow 8. Not given in 1937-38.]

R.E. 209. **The Nature Movement and Its Makers.** First term. Credit two hours. Professor PALMER and Miss GORDON. M W 10. Fernow 8.

Discussion of the history of the nature movement, with special consideration of its influence on, and its relation to, the teaching of science in elementary and secondary schools. Studies are made of the present and past status of nature and science education.

RESEARCH

300. **Special Studies.** Credit as arranged. Members of the staff.

Students working on theses or other research projects may register for this course. The staff members concerned must be consulted before registration.

THE ENGINEERING DIVISION

HERMAN DIEDERICHS, *Chairman.* W. RODNEY CORNELL, *Secretary.*

THE ENGINEERING DIVISION of the Graduate School consists of all professors and assistant professors of the College of Engineering, the Dean of the Graduate School, and such other members of the Faculty of the University as have supervision of the work of Graduate Students in the Division.

Each of the main branches (C.E., E.E., and M.E.) of the Division has a COMMITTEE ON GRADUATE WORK which has direct charge of the following: examining engineering credentials of applicants for admission, which, however, must first be sent to the Dean of the Graduate School; corresponding with applicants for the purpose of giving or receiving information or of giving advice concerning the availability of facilities for the graduate work desired in Engineering; the registration of students in the subdivision, after they have registered in the Graduate School; giving advice and approval regarding the student's program and the selection of his Special Committee, which has direct charge of his work; looking after the completion of language and undergraduate shortages; and making final review of the students' records to check the fulfillment of all scholastic requirements for the degrees. The membership of the Committees on Graduate Work in the three subdivisions is as follows:

COMMITTEES ON GRADUATE WORK IN THE ENGINEERING DIVISION

CIVIL ENGINEERING.—S. C. Hollister, *Chairman*, 11 Lincoln Hall; R. Y. Thatcher, *Secretary*, 33-B Lincoln Hall; E. W. Rettger, 33-C Lincoln Hall.

ELECTRICAL ENGINEERING.—P. M. Lincoln, *Chairman*, Franklin Hall; W. C. Ballard, jr., *Secretary*, Franklin Hall; Vladimir Karapetoff, 17 Franklin Hall.

MECHANICAL ENGINEERING.—W. N. BARNARD, *Chairman*, 5 West Sibley; W. R. CORNELL, *Secretary*, 305 West Sibley; G. B. Upton, Mechanical Laboratory.

GRADUATE STUDY IN ENGINEERING

The instructing staffs and the laboratories, libraries, and other facilities of the various departments of the College of Engineering and those of the other departments of the University are available for students desiring to pursue graduate study and research in engineering and allied fields. Graduate students in engineering will also find among the regular and elective courses given in the College and in mathematics, physics, chemistry, and in other departments of the University, many suitable for advanced study. For the courses offered, and for the laboratory, library, and other facilities in Engineering, see the Announcement of the College of Engineering.

ADVANCED DEGREES OFFERED

The degrees of Master of Civil Engineering (M.C.E.), Master of Electrical Engineering (M.E.E.), Master of Mechanical Engineering (M.M.E.), Master of Science in Engineering (M.S. in Engineering), and Doctor of Philosophy (Ph.D.), are granted in the field of engineering.

THE DEGREES OF M.C.E., M.E.E., M.M.E., AND M.S. IN ENGINEERING

Subject to certain general regulations of the Graduate School,[1] the rules governing admission to candidacy for and for graduation with

[1]See page 9.

one of the engineering degrees (Master of Civil Engineering, M.C.E., Master of Electrical Engineering, M.E.E., Master of Mechanical Engineering, M.M.E. and Master of Science in Engineering, M.S. in Engineering), are established and administered by the Engineering Division of the Graduate School.

The Degree of Ph.D.

The rules governing admission to candidacy for, and those for graduating with, the degree of Doctor of Philosophy (Ph.D.) are established and administered by the Faculty of the Graduate School.[2] For further information concerning this degree, see p. 11.

ADMISSION TO GRADUATE STUDY IN ENGINEERING

(1) All applications for admission to the Graduate School and all applications for Graduate Fellowships and Scholarships must be sent to the *Office of the Graduate School*. Obtain the necessary blanks and instructions from that office.

(2) If the applicant wishes to become a candidate for one of the advanced Engineering Degrees his credentials should include not only information requested on page 9, but in addition, (a) a catalogue of the institution from which he graduated, with each subject that he has completed clearly marked therein, and (b) a detailed statement concerning his practical experience, together with letters from his employers.

(3) In all cases, the applicant should designate as definitely as possible his chosen fields of study, both major and minor, so that he may be advised concerning the facilities and personnel available in those fields.

(4) A prospective graduate student may write to the office concerned (Civil Engineering, Electrical Engineering, or Mechanical Engineering) for advice or information concerning graduate work in Engineering.

(5) Candidacy for the Advanced Engineering Degrees, M.C.E., M.E.E., or M.M.E., presupposes the substantial equivalent of the corresponding first degree at Cornell University. In the evaluation of a candidate's credits, however, the quality of his previous work, his practical experience, and his chosen field of advanced study will be considered in making adjustments for candidates whose undergraduate course has not been the exact equivalent of the corresponding undergraduate courses at Cornell. For language requirements, see page 10.

(6) Candidacy for the advanced Engineering degree M.S. in Engineering presupposes graduation from a school or college of recognized standing and thorough and adequate training in the par-

[2]Although not under the supervision of the Engineering Division, it is to the advantage of candidates for non-professional degrees in Engineering who have registered in the Graduate School to register also in the appropriate branch of the Engineering Division.

ticular field chosen for advanced work. For language requirements, see page 10.

(7) Applicants who desire to work in engineering subjects without becoming a candidate for any degree should refer to page 11.

REGISTRATION

All graduate students must first register in the Graduate School at the beginning of each term. In addition, a graduate student in engineering must, at the beginning of each term of residence, register at the office of the Engineering School of whose faculty his major professor is a member.

A student shall select his program of study as well as his Special Committee (see page 10) with the advice and approval of the Committee on Graduate Work in that subdivision (C.E., E.E., or M.E.) in which his major subject falls. No change in the program of study nor in the personnel of the Special Committee shall be made without the written approval of the appropriate Committee on Graduate Work and the advice of the student's Special Committee.

FIELDS OF GRADUATE INSTRUCTION IN ENGINEERING

A candidate for a master's degree in Engineering must present a *thesis* on a subject in his major field. The thesis must show initiative and originality and must conform to the general requirements of the Graduate School. It may take one of the following forms:

(a) An analytical or interpretative discussion of results already in existence.

(b) A design or construction or both, of sufficient importance and originality to demonstrate thoroughly a knowledge of the principles involved and of their applications.

(c) A dissertation based upon his own original investigation, analytical or experimental.

In the following pages are outlined, (1) the special facilities, and (2) the opportunities for graduate study in the various engineering subjects which may be chosen as Major or Minor Subjects.

The work of a graduate student in Engineering will be limited presumably to one field. This may be chosen in any one of the three larger branches of Engineering, i.e., Civil, Mechanical, or Electrical, although further sub-division will always be required. It is, however, always possible to elect work and to pursue research in two or more schools, provided one field only is involved, as, for example, in hydro-electric power.

For better teaching facilities, some duplication exists, both in subject matter and in equipment, and a student should therefore select in such a case the branch naturally making the same applications that he himself desires to make. For example, in Mechanical Engineering, hydraulics naturally leads towards, and is developed with a

view to, turbine or pump design or hydraulic power plants. In Civil Engineering, on the other hand, hydraulics looks forward to water power installations, to canal and harbor construction, to sewerage and waterworks.

In some cases, as for example in studies on cement or steel specifications, further training in chemistry might be found imperative, though that might involve work in still another branch. Such additional study is desirable, sometimes essential, for successful pursuit of many kinds of graduate work in Engineering.

It is particularly desirable that a thorough knowledge of all fundamental theory be in hand before any attempt is made to carry out its applications into engineering design, construction, analysis, laboratory research, or interpretative investigation of results already in existence.

The facilities and opportunities offered for graduate work in engineering are discussed in the following pages.

Approved Major and Minor Subjects (key to symbols on p. 29)

In Civil Engineering

Astronomy
  Geodetic Astronomy **2, 3, 4**
  Geodesy **1, 2, 3, 4**
Highway Engineering **1, 2, 3, 4**
Hydraulic Engineering **1, 2, 3, 4**
Hydraulics
  Theoretical **1, 2, 3, 4**
  Experimental **1, 2, 3, 4**
Management Engineering **1, 2, 3, 4**
Materials of Engineering **2, 3, 4**
Mechanics **1, 2, 3, 4**
Railroad Engineering
  Railroad Maintenance **1, 2, 3, 4**
  Railroad Location **1, 2, 3, 4**
  Railroad Operation and Management **1, 2, 3, 4**
Sanitary Engineering **1, 2, 3, 4**
Sewage Treatment **2, 3, 4**
Soil Mechanics **2, 3, 4**
Structural Engineering
  Structural Engineering **1, 2, 3, 4**
  Theory of Structures **1, 2, 3, 4**
Surveying
  Geodetic Engineering **1, 2, 3, 4**
  Topographic Engineering **1, 2, 3, 4**
Water Purification **2, 3, 4**

In Electrical Engineering

Economics of Public Utilities **1, 2, 3, 4**
Electrical Communications **1, 2, 3, 4**
Electrical Design **1, 2, 3, 4**
Electric Power Generation, Transmission and Distribution **1, 2, 3, 4**
Electric Circuit Analysis **1, 2, 3, 4**
Electrical Conduction through Gases **1, 2, 3, 4**
Electrical Machinery **1, 2, 3, 4**
Electrical Measurements **1, 2, 3, 4**
Electric Power Applications **1, 2, 3, 4**
Experimental Electrical Engineering **1, 2, 3, 4**
Materials of Engineering (In Electrical Engineering) **1, 2, 3, 4**

In Mechanical Engineering

Administrative Engineering
Industrial Accounting **2, 3, 4**
Industrial Marketing **1, 2, 3, 4**
Industrial Statistics **3, 4**
Aeronautical Engineering **2, 4**
Automotive Engineering **1, 2, 4**
Experimental Mechanical Engineering **1, 2, 3, 4**
Heat-Power Engineering **1, 2, 3, 4**
Hydraulic Engineering **1, 2, 3, 4**
Industrial Engineering **1, 2, 3, 4**
Machine Design **1, 2, 3, 4**
Materials of Engineering **1, 2, 3, 4**
Mechanic Arts **1, 2, 3, 4**
Mechanics **1, 2, 3, 4**
Metallography **1, 2, 4**

ADMINISTRATIVE ENGINEERING

Professors J. R. BANGS, jr., S. S. GARRETT, and G. R. HANSELMAN.

3A21. *Economic Organization.* Credit 3 hours. First term.

3A23. *Business and Industrial Management.* Credit 4 hours. Second term.

3A31. *Accounting for Engineers.* Credit 3 hours. Either term.

3A32. **Accounting for Engineers.** Second term. Credit three hours. Prerequisite 3A31.

The accounting of industrial corporations: bond and stock issues and valuation; good will; depreciation; reserves; sinking funds; income tax returns; flexible budget; consolidated statements; statement analysis; unsettled questions in accounting practice.

3A34. **Corporation Finance.** Either term. Credit three hours. Prerequisites, 3A21 and 3A31. Assistant Professor O'LEARY.

A study of the financial problems of the corporation from the points of view of the management, the investor, and the public.

3A41. **Business Statistics and Forecasts.** First or second term. Credit three hours. Prerequisite course 3A21. Two recitations and one two and a half hour laboratory period a week.

Elements of the technique of statistical analysis. The collection, preparation, and use of business statistics. The sources of information. Business indices and business barometers.

3A44. **Industrial Marketing.** First term. Credit three hours. Prerequisite courses 3A21, 3A23, and 3A41. Two recitations and one lecture a week.

A study of the field of industrial marketing using the case method of instruction. The scope of the course includes product planning, policy, and research; sales and market analysis; distribution channels; pricing and terms of sale; sales promotion; management and organization of sales force; sales control.

3A45. **Industrial Marketing.** Second term. Credit two hours. Prerequisite, course 3A44. One recitation and one two and a half hour laboratory period a week.

The application of the principles of marketing to specific problems. Each student will develop a complete market study and analysis for given industrial products.

3A51. **Business and Industrial Research.** Either or both terms. Credit one hour for forty hours of actual work. Open to a very limited number of seniors and graduate students who have shown by training and aptitude their ability to carry on original investigations in business and industrial subjects.

NOTE:—Only a limited number of graduate students can be taken in this department. Those contemplating graduate work in Administrative Engineering are advised to make advance arrangements with the department.

AERONAUTICAL ENGINEERING

Professor G. B. UPTON.

Problems related to the design and performance of airplanes may be carried on in this field. The laboratories of the department of Experimental Engineering are available for studies on airplane engines. Arrangements may be made with the authorities of the Ithaca airport for flight experiments. Most of the technical reports and notes of the National Advisory Committee for Aeronautics and the Aeronautical Research Committee are available in the library.

3B35. *Aerodynamics.* Either term. Two recitations a week.

3B46. *Airplane Design.* Either term. Two recitations a week.

3B47, 3B48. **Airplane Design.** Throughout the year. Prerequisite, course 3B35. Two computing periods a week.

Calculations and drawings similar to those required by the Department of Commerce for approval of the design of an airplane. Factory and airport inspection trips.

AGRICULTURAL ENGINEERING

See under AGRICULTURE, p. 104.

AUTOMOTIVE ENGINEERING

Professors G. B. UPTON, V. R. GAGE, and A. C. DAVIS.

Special problems relating to Automotive Engineering may be selected for advanced study. Laboratory facilities of the Department of Experimental Engineering are available for research on internal combustion engines, and arrangements may be made for investigations on other automotive topics. Students desiring to take a minor in this field may find courses 3B41, 42, 43 and 44 suitable as a foundation.

3B41, 3B42. **Automotive Design.** First term. Professor UPTON. Two lectures and two computing periods a week.

General study of automotive road vehicles and their functioning; driving, braking, steering, springing, power required for operation.

3B43, 3B44. **Automotive Design.** Second term. Professor UPTON. Two lectures and two computing periods a week.

Power plants of automotive field, particularly internal combustion types. General design and functioning, lubrication, mechanical efficiency, volumetric efficiency, valving, balancing, carburation, ignition, performance.

DESCRIPTIVE GEOMETRY AND DRAWING

(In Civil Engineering)

Professors J. T. PARSON and H. T. JENKINS.

200. *Drawing.* Freshman. First term. Credit three hours.

201. *Drawing.* Freshman. Second term. Credit three hours.

202. *Drawing.* Sophomore. First term. Credit one hour.

203. *Drawing.* Sophomore. Second term. Credit two hours.

204. *Descriptive Geometry.* First term. Credit three hours.

205. **Advanced Drawing.** Either term. Credit, one to three hours. Professor PARSON.

Perspective drawings (rendered in pencil, ink, and washes) of buildings, bridges, dams, and other engineering works; building details of window frames, cornices, molding, and other simple details; Old English lettering.

207. **Advanced Descriptive Geometry.** Either term. Credit, one to three hours. Assistant Professor JENKINS.

A continuation of course 204. Problems in intersections, developments, warped surfaces, shade, shadows, perspective, and stereotomy.

ELECTRICAL ENGINEERING

Professors P. M. LINCOLN, V. KARAPETOFF, W. C. BALLARD, R. F. CHAMBERLAIN, B. K. NORTHROP, E. M. STRONG, L. A. BURCKMYER, M. G. MALTI, TRUE MCLEAN, and M. G. NORTHROP.

RESEARCH: Research in Electrical Engineering may be divided into two general classes (a) theoretical and (b) experimental. Whenever possible the student is required to prove his theoretical deductions by experiment and conversely he is required to explain his experimental results by theoretical considerations.

For theoretical research the facilities of a well-equipped library are available.

For experimental research special equipment and shop facilities are required. The College of Engineering maintains several mechanics and has machine shops fully equipped to provide shop facilities. The available special equipment required for experimental work along specific lines is given under the general topics outlined below:

GRADUATE COURSES AND TOPICS: Unless otherwise specified graduate courses offered in the School of Electrical Engineering are given either term or both terms as needed. Members of the faculty are prepared to guide students in the *graduate topics* given below. Several seminars are regularly conducted by members of the faculty for groups of graduate students interested in closely related lines of research.

ELECTRIC CIRCUIT THEORY

405-406. *Fundamentals of Electrical Engineering.*
410-411. *Elements of Electrical Engineering.*
415-416. *Principles of Electrical Engineering.*
417. *Essentials of Electrical Engineering.*
420. *Applied Mathematics.*

421-422. **Advanced Electrical Theory.** Throughout the year. Prerequisites, 411, 420 and 450. Professor KARAPETOFF. Two hours a term.

Laws of electric and dielectric circuits; electric networks, polyphase circuits, transients, magnetic circuit and electrical conduction through gases.

481-2. **Engineering Mathematics.** Throughout the year. Prerequisites, elements of electric circuit analysis. Professor KARAPETOFF. Two recitations a week.

General methods by which engineering problems are expressed in mathematical form. The course consists of problems taken from mechanical, civil, or electrical engineering, involving analytic geometry, elements of differential and integral calculus, vector analysis, operational analysis, differential equations, and the theory of probabilities. The topic will be selected to suit the class.

493. **Electric Circuit Analysis.** First term. Prerequisite, 420 or its equivalent. Assistant Professor MALTI. Four lecture-recitations and one computing period a week.

Analysis of circuits with lumped and distributed parameters, the generalized 2n-terminal network, filter circuits and polyphase circuits subjected to sine and non-sine e.m.f's.

486-487. **Heaviside's Operational Calculus.** Throughout the year. Prerequisite, 420 or its equivalent. Assistant Professor MALTI. Two lecture-recitations and one computing period a week.

Mathematical introduction covering functions of real variables, functions of complex variables, infinite series, some special functions and Laplace and Fourier transformations. The classical solution of differential equations. Generalized expansion theorems for differential and difference equations. Application to transient problems in circuits with lumped and distributed parameters, and to ladder networks.

Graduate Topics: General Theory of Circuits and Networks, skin effect, eddy currents in metallic masses, transient phenomena, electro-magnetic oscillations and waves, electric wave filters.

ELECTRICAL MACHINERY

412. *Elements of Electrical Engineering.*
431. *Electrical Laboratory.*
435-36. *Electrical Laboratory.*
450. *Electronics.*

423-424. **Advanced Electrical Theory.** Throughout the year. Credit three hours per term. Prerequisites, 421, 423. Professor KARAPETOFF.

Laws of the magnetic circuit with application to machine design.

442. **Electrical Design.** Second term. Credit four hours. Prerequisites, 421 and 423. Professor LINCOLN and Assistant Professor NORTHROP.

Fundamental principles underlying the design of direct and alternating current machinery.

433-434. **Advanced Electrical Laboratory.** Throughout the year. Credit three hours first term and four hours second term. Prerequisites, 412, 420, 431, and 450. Professor CHAMBERLAIN and Assistant Professor BURCKMYER. One recitation and laboratory period with a report each week.

494. **Analysis of Machine Circuits.** Second term. Prerequisites, 420, 493 or their equivalent. Assistant Professor MALTI. Four lecture-recitations and one computing period per week.

Analysis of the performance and design of electric machines covering transformers, and synchronous, induction, and commutating machines.

Theory and Characteristics of Electrical Machinery. Prerequisites, General knowledge of the theory and testing of electrical machinery. Professor KARAPETOFF. Advanced theory of electric and magnetic circuits. Mathematical treatment of the physical laws involved in the performance of continuous and alternating current machines. Transient behavior of high-voltage apparatus. Relationship between proportions and operating characteristics. The theory underlying special tests for the determination of machine constants.

Graduate Topics. Advanced study of the *parameters* of revolving machines, special design problems, hunting and stability problems, short circuit phenomena, commutation, armature reaction.

SPECIAL EQUIPMENT. A great variety of direct and alternating current machines is available, so selected as to afford at least one machine of every type ordinarily encountered in practice. Most of these represent modern construction and are of such size and design as to give typical performance, but at the same time provision is made for great flexibility of operation. For example, in five of the synchronous machines the coil terminals are brought out to an external connecting board. One 15-kva. synchronous machine is, in addition, provided with a phase-wound rotor and a squirrel-cage rotor, either of which may be readily used to replace the synchronous rotor. A modern type of synchronous converter is arranged for direct or inverted operation, either single-phase, two-phase, or three-phase, with metering and control boards which permit very rapid change of operating conditions. There are three types of commutating alternating-current motors, four types of fractional-horsepower alternating-current motors, and a large number of direct-current machines.

Typical examples of automatic starters for alternating and direct current motors are provided, including time-element, counter-e.m.f., and series lock-out types, in addition to drum controllers and a complete Sprague multiple-unit railway control system.

The non-rotating apparatus also includes constant-potential transformers of standard and special construction, constant-current transformers, induction regulators, storage batteries and a small mercury-arc rectifier.

THE ELECTRONIC LABORATORY contains various types of high vacuum thermionic devices, gas conduction devices, photo-electric cells, mercury tubes, and a modern 6-phase steel case mercury rectifier with grid control and complete vacuum apparatus, which may also be operated as an inverter.

The facilities for testing are well-planned and very complete. For machine

testing, there are numerous Prony brakes, an electric dynamometer, and a special apparatus for determining the complete characteristics of fractional-horsepower motors.

Electrical Communication

451. **Electrical Communication Engineering.** First term. Credit three hours. Prerequisites, 412, 420, 450. Professor Ballard and Assistant Professor McLean.

Theory of alternating currents as applied to telegraph, telephone and radio communication. Theory and application of thermionic devices.

452. **Electrical Communication Engineering.** Second term. Credit four hours. Prerequisite, 451. Professor Ballard and Assistant Professor McLean.

452a. **Theory of Communication Networks.** Second term. Credit two hours. Prerequisite, 451. Must be accompanied by 452. Assistant Professor McLean.

Foundation laws of elements and circuits with variable frequency. General network theorems. Two and four terminal structures. Recurrent networks and wave filters. Equalizers. Distributed circuits including continuous and concentrated loading of long lines. Special networks for very high frequencies.

452b. **Elements of Broadcast Engineering.** Second term. Credit two hours. Prerequisite, 451. Must be accompanied by 452. Professor Ballard.

Critical analysis and design of equipment used for radio telephone transmission. The laws of acoustics as applied to studio construction and equipment.

Graduate Topics. Electro-mechanical vibrating systems, propagation of electromagnetic waves, thermionic tubes and their applications, design of radio circuits, sound recording and reproduction, electric wave filters, carrier current telephony.

Special Equipment. Broadcast transmitter, 1 Kw., complete and up to date in separate building with antenna towers. Complete studio and control equipment. Available to advanced students for special problems. Primary frequency standard, consisting of 100 k.c. temperature controlled quartz crystal oscillator with multivibrator and harmonic amplifier. Laboratory is equipped with 2.5 Kw., 2,000 volt, D.C. power supply and large assortment of power tubes and parts for experimental work on radio transmitters.

Complete type D carrier current telephone equipment, with signalling auxiliaries.

Audible and carrier frequency oscillator, with complete set of resistance, inductance, and capacitance standards for impedance bridge measurements.

Vacuum tube voltmeter-milliammeter and transmission measuring set.

Complete laboratory model 100 line step-by-step dial telephone exchange.

Large assortment of small meters and equipment for studying characteristics of receiving tubes, audio transformers, and telephone equipment.

Standard Signal Generator.

Electrical Measurements

431. *Electrical Laboratory.*

433-4. **Advanced Electrical Laboratory.**

Graduate Topics. Design of special types of meters and the characteristics of the exponential response meter, development of methods of measurement, characteristics of measuring instruments.

Special Equipment. The Standardizing Laboratory includes standard precision ammeters and voltmeters. A Silsbee current-transformer test set, and primary standards of voltage and resistance with the necessary potentiometers and auxiliary equipment arranged for convenient checking of secondary standards and of other meters.

Power Generation, Distribution, and Rate Making

441. **Electric Power Plant Design.** First term. Credit three hours. Prerequisites, 412, 420, and 450. Professor Lincoln.

Selection and arrangement of Power Plant Equipment.

464. **Electrical Power Transmission and Distribution.** Second term. Credit three hours. Prerequisites, E.E. 421-423 or 493-494 and 433. Professor LINCOLN and Assistant Professor M. G. NORTHROP.

444. **The Economics of Public Utilities.** Second term. Credit two hours. Professor LINCOLN.

A study of the origin and development of Public Utilities, Regulation, Rates and Rate Structures, and Public Relations.

Stability of Electric Power Systems. Prerequisites, general theoretical and experimental study of alternating current circuits and machines. Professor KARAPETOFF.

The method of symmetrical components, positive, negative, and zero-sequence, impedance of stationary apparatus and revolving machines; theoretical and experimental determination of such impedances. Static and dynamic stability of simple and complex aggregates; methods of computation. Means for increasing stability.

Graduate Topics. Circuit breakers and reactor problems.

Sag stress in transmission lines, corona, regulation of long lines, insulator stresses. Valuations, rate structures, accounting methods, rate of return, public ownership, holding companies, depreciation, public regulation, capitalization.

SPECIAL EQUIPMENT. The University Hydroelectric Power Plant, which contains large three-phase alternators, direct-driven by both impulse and reaction water-wheels. This plant is complete in every respect and is used for tests and inspection.

APPLICATIONS OF ELECTRIC POWER

461. **Elements of Electric Railway Practice.** First term. Credit two hours. Prerequisites, 412, 450. Professor CHAMBERLAIN.

A study of the application of electric power to transportation.

462. **Industrial Application and Control of Electricity.** Second term. Credit two hours. Prerequisites, 423 or 493 and 433. Professor CHAMBERLAIN.

Study and selection of motor drives and control, electric welding, and electric heating.

466. *Illumination.*

MATERIALS OF ELECTRICAL ENGINEERING

Solid Dielectrics. Throughout the year. Credit two hours a term. Prerequisites, 421-2-3-4, or 493-494. Assistant Professor MALTI.

A study of anomalous behavior of solid dielectrics under varying conditions of e.m.f., time, frequency, temperature, pressure, humidity and ionizing radiation.

Magnetic Materials. Throughout the year. Credit two hours a term. Prerequisites, 421-2-3-4, or 493-494. Assistant Professor MALTI.

A study of the properties of magnetic materials such as hysteresis, permeability, the effect of crystal structure and heat treatment on the magnetic properties of materials and magnetic analysis (i.e. the correlation of magnetic and mechanical properties).

Structure of Matter, and Applied Electronics. Prerequisites, Physics and Chemistry in the usual scope of undergraduate courses for engineers. Professor KARAPETOFF.

The electron, its charge, mass, diameter, and velocity. Cathode rays. Elements of kinetic theory of gases. Periodic system in terms of orbital electrons. The structure of the nucleus. Photons and electro-magnetic radiation. Ionization and excitation of gases. Applications to gaseous conduction, spark-over, arcs, mercury-vapor apparatus, etc.

Electrical Testing. Prerequisites, 421-2-3-4 or 493-494 and 433. Assistant Professor BURCKMYER.

The testing of the materials of construction for determining their magnetic and electrical properties.

SPECIAL EQUIPMENT. The magnetic testing apparatus includes a Fahy permeameter, an Epstein apparatus and a large motor-generator set comprising two sine-wave generators and a third-harmonic generator on the same shaft, with provision for adjusting phase displacement and for measuring form factor. The dielectric testing apparatus includes an 80,000-volt testing transformer together with full-wave rectifying equipment and an electrostatic voltmeter. Among the general pieces of test equipment are a very complete assortment of meters and three oscillographs. For the study of discharge of electricity through gas a vacuum system is available, and specially designed tubes to show special discharge phenomena.

EXPERIMENTAL MECHANICAL ENGINEERING

Professors A. C. DAVIS, W. M. SAWDON, G. B. UPTON, V. R. GAGE, W. C. ANDRAE, J. O. JEFFREY, and J. R. MOYNIHAN.

THE STEAM LABORATORY. The boiler section of this laboratory supplies steam for routine and research testing. There are a number of representative types of steam engines, several small steam turbines, a two-stage air compressor, together with auxiliary equipment consisting of surface and jet condensers, indicators, gages, calorimeters, flue gas apparatus, pyrometers, etc.

THE GAS ENGINE LABORATORY. There is a variety of gasoline, oil and gas engines in the smaller sizes, as well as a number of high speed automotive engines, and a Diesel engine. Testing equipment includes indicators (high speed and other types) pyrometers, three electric dynamometers and two absorption dynamometers. A recent addition to the equipment is a single-cylinder, variable compression experimental gasoline engine designed for basic research work.

THE BELT TESTING LABORATORY. This laboratory contains a belt testing machine which consists of two 75-HP electric dynamometers capable of operating at any speed up to 1,000 r.p.m. and of carrying pulleys up to 36 inches in diameter. The belt tension, power transmitted by the belt, and the slip of the belt may be observed. Belts can be tested in widths up to 10 inches and the pulley center distance may be varied from 4½ feet to 20 feet.

THE HYDRAULIC LABORATORY. In addition to the usual equipment for undergraduate instruction there is a vertical shaft hydraulic turbine with governor, arranged for research work. There is also a complete test stand for research and testing of pumps in capacities up to 1,000 G.P.M. and 230 ft. head at speeds up to 4,000 r.p.m., including an electric dynamometer of 13-HP rating with independent motor-generator power supply and control, a 3-inch motor-driven centrifugal booster pump and 1½-inch motor-driven centrifugal priming pump, 2-inch, 3-inch and 4-inch calibrated Venturi tubes; precision platform scales with tank for the collection and weighing of water in amounts up to 6,500 lbs.

THE OIL TESTING LABORATORY. This laboratory contains a Cornell oil-testing machine, a Thurston standard railway-testing machine, and several smaller testing machines. The small equipment consists of several viscosimeters of different types, flash and burning test apparatus, together with the necessary hydrometers and thermometers.

THE REFRIGERATION LABORATORY. For the study of refrigeration the mechanical laboratory possesses a York absorption machine and a very complete York refrigerating compression plant.

THE CEMENT LABORATORY. This laboratory contains apparatus for the testing of cement and concrete.

THE FUEL TESTING LABORATORY. This laboratory contains equipment of fuel calorimeters and other apparatus needed for the determination of the composition and heat value of gas, liquid, or solid fuels.

For the major work in this department the graduate student is required to select a subject in the field of experimental research. This work is in charge of officers of instruction who devote a considerable portion of their entire time to it and give advice and assistance to graduate students who are carrying on investigations in this department.

The laboratories of this department are available for use by graduate students who are carrying on theoretical investigations in any other department and who wish to do experimental work in parallel with the theoretical work.

Students contemplating experimental research should communicate with the department as far as possible in advance of beginning work in order to arrange for the use of available equipment.

3X32. *Introductory Experimental Engineering.* Second term. One laboratory period a week and a written report of the work.

3X41, 3X42. *Experimental Engineering.* Throughout the year. One laboratory period a week and a written report of the work.

3X43. *Experimental Engineering.* First term. Selected experiments from 3X41.

3X51. **Experimental Engineering Research.** Either or both terms. Prerequisites dependent upon field of investigation selected. Professors DAVIS, SAWDON, UPTON, GAGE.

Open to a limited number of seniors and graduates who have available at least two laboratory periods a week and who have shown proficiency in engineering subjects. Special problems and investigations which are in general carried on in the laboratories under the immediate direction of the members of this department, but which may be carried on in any department of engineering under the general supervision of this department. The work done may be reported upon in a thesis.

TOPICS SUGGESTED FOR ADVANCED WORK

Mechanical Laboratory Practice.
Instrumentation.
Experimental Research along various lines.
Heat Transfer.
Ventilation.
Refrigeration.
Air Conditioning.
Flow of Fluids.
Fuels.
Power Transmission.
Insulating Materials

HEAT-POWER ENGINEERING

Professors W. N. BARNARD, F. O. ELLENWOOD, R. E. CLARK, W. H. HOOK, and C. O. MACKEY.

In each of the many branches of this very extensive field are innumerable opportunities for making advanced studies of interest and value. This advanced work includes such studies as original investigations in engineering thermodynamics; interpretative studies of available data and other material; investigations in power plant economics; the design, selection, and arrangement of apparatus, and plant layout, to meet specific requirements; analytical and experimental research; to mention but a few of the possibilities. The department and college libraries are liberally provided with reference books, periodicals, transactions of engineering societies, reports, and other material relating to this field.

As prerequisite for this graduate work the student should have had the equivalent of the fundamental courses in heat-power engineering that are required of undergraduates in mechanical engineering at Cornell. These courses are described in the Announcement of the College of Engineering. Those lacking the full equivalent of this training may be required to take one or more of these undergraduate courses or to do specially assigned work to make up the deficiency.

The following courses, which are described in the Announcement of the College of Engineering, are open to both undergraduate and graduate students:

3P31, 3P32. *Heat-Power Engineering.* Throughout the year. Three hours a week.

3P41, 3P42. *Heat-Power Engineering.* Throughout the year. Three hours a week.

3P44, 3P45. **Steam Power-Plants.** Throughout the year. Prerequisites, 3D31, 3D32, 3D33, 3P31 and 3P32 and must be accompanied or preceded by 3P41 and 3P42. Professor BARNARD. Two hours a week.

Load curves; station factors; power-plant economics; cost of plants and of their equipment and output; principles of economic selection of plant equipment with respect to the load curve, cost factors and local conditions; steam prime movers, steam generators, condensers, and other plant apparatus; performance characteristics and design features of this apparatus; piping; coal and ash storage and conveying machinery; plant location; plant layout; and similar topics.

3P46, 3P47. **Computing and Design.** Throughout the year. Must be accompanied by 3P44 and 3P45. Professor BARNARD. Two three-hour periods a week.

The practical solution of problems discussed in 3P44 and 3P45.

[3P48. **Air Conditioning.** First term. Prerequisites, 3P31 and 3P32, or 3P33 and 3P34. Professor MACKEY. Two hours a week. Not given in 1937-38.]

Properties of mixtures of air and water vapor and the principles of air conditioning, including the heating, cooling, humidifying, dehumidifying, filtering, and distribution of air in enclosures for improving human comfort or for the control of the properties of hygroscopic materials.

3P49. **Refrigeration.** Second term. Prerequisite, 3P32, or 3P34. Professor ELLENWOOD. Two hours a week.

General principles, applications, and economic and commercial factors involved in various forms of modern refrigeration as applied to both domestic and industrial installations, including those pertaining to air conditioning.

3P50. **Power Plant Economics; Equipment Selection.** First term. Prerequisite, 3P32, or 3P34. Professor BARNARD. Two hours a week.

Costs of equipment and plants; energy costs; load curves, station factors; determining characteristics of equipment; selection of best working pressures, temperatures and cycles; economic number and size of units. Selection of equipment based on these and other determining considerations. Economic operation. Applications to central stations and to industrial power and heating plants. By-product power. Other similar topics.

3P51. **Steam Turbines.** Second term. Prerequisites, 3P32 or 3P34. Assistant Professor CLARK. Two hours a week.

Classification of turbines and description of leading features of the various types; mechanical and thermal considerations underlying the action of steam in turbines; calculations involved in turbine design; discussion of building, erecting, and testing; adaptability to special conditions of service; economic results of the use of turbines in engineering practice.

3P52. **Internal Combustion Engines.** First term. Prerequisites, 3D31, 3D32, 3D33, and 3P32 or 3P34. Assistant Professor CLARK. Two hours a week.

Fuels; general theory and salient points in the design and operation of internal combustion engines; study of existing commercial types, relative advantages, and questions of economy; current developments.

3P53. **Steam Boilers and Related Apparatus.** Second term. Prerequisites, 3D31, 3D32, 3D33, and 3P32 or 3P34. Professor BARNARD. Two hours a week.

Fuels, combustion, combustion apparatus; furnaces and boiler types, proportions, materials, design of details; superheaters, economizers, air heaters; accessories; equipment, arrangement and operation of steam generating plants.

3P55. **Graphical Computations and Representations.** Either term. Prerequisites, 3D31, 3D32, 3D33 and 3P32 or 3P34. Professor MACKEY. Two hours a week.

Slide rules; construction of net work charts and alignment charts for the solution of equations; representation of statistics; and derivation of empirical equations from experimental curve.

3P56. **Advanced Heat-Power Engineering and Research.** Prerequisites

dependent upon the work to be done. Professors BARNARD, ELLENWOOD, and others. Hours and work to meet the individual needs of each student.

3P57, 3P58. **Heat Engineering.** Throughout the year. Prerequisite, 3P32. Must be accompanied or preceded by 3P41 and 3P42. Professor MACKEY. Two lectures and two computation periods a week.

Properties of mixtures, dimensional analysis, fluid flow, heat transmission, selection of fans and pumps and refrigeration; applications to problems in air conditioning.

The following group offerings for seniors may be used as minors by graduate students: **Option A**—Power-Plant Engineering: 3P44, 3P45, 3P46, 3P47, 3P50.

Option B—Heat Engineering: 3P57, 3P58, 3P49.

TOPICS SUGGESTED FOR ADVANCED WORK

Advanced Engineering Thermodynamics.
Steam Engineering.
Internal Combustion Engineering.
Economic Studies.
Heat Transmission.
Fuels, Combustion, Burners, Furnaces.
Flow of Fluids through Closed Conduits; Power Plant Piping.
Refrigeration.
Compressors and Pneumatic Machinery.
Air Conditioning.
Power and Heating Projects.

HIGHWAY ENGINEERING

Professor W. L. CONWELL.

The laboratories for the examination of non-bituminous and bituminous materials and their utilization, soils, subgrade stabilization problems, etc., are located in the School of Civil Engineering. The other laboratories of the School of Civil Engineering, equipped for examining the properties of engineering materials, and the Ceramic Laboratory of the Department of Geology are also available for graduate work in Highway Engineering.

Additional graduate work is offered which requires independent work by the student with frequent conferences with members of the staff. Occasional field trips are also made.

Note: For courses in design of highway structures such as large bridges, see Structural Engineering.

265. *Highway Engineering.* Credit three hours. Either term.

265-A. **Low Cost Roads.** Either term. Credit three hours. Prerequisite, course 265 or its equivalent. Professor CONWELL. Elective for seniors and graduate students.

Study of economic importance of routes and selection of farm to market roads to be improved; location and design; subgrade soils and stabilization of subgrade soils by use of admixtures, chemicals, and bituminous materials; drainage and drainage structures; bituminous treatments and bituminous mats for stabilized subgrades. Survey of the experimental work in the use of materials and design and construction of low cost roads. Design, construction and maintenance of road mixes, plant mixes, etc.

266. **Highway Laboratory.** Either term. Credit three hours. Prerequisite, Course 265 or its equivalent; may be taken concurrently with Course 265. Professor CONWELL.

Examination of the properties and use of non-bituminous and bituminous materials, soils, bituminous mixtures; also problems in subgrade stabilization.

266-A. **Advanced Highway Laboratory.** Either term. Credit three hours. Prerequisites, Courses 265 and 266. Professor CONWELL. Hours to be arranged.

Special investigations of materials and their use; special problems in design

of paving mixtures and their properties; research in subgrade soils and subgrade stabilization, etc.

267. **Advanced Highway Engineering.** Second term. Credit three hours. Prerequisite, Course 265 or its equivalent. Professor CONWELL. This course is conducted as a seminar, meeting once a week.

Students are assigned topics in the field of Highway Engineering. Reports are written on the assigned topics; the student is required to speak at the seminar on the assignment.

268. **Modern Highway Planning and Design.** Second term. Credit three hours. Prerequisite, course 265 or its equivalent. Professors CLARKE and CONWELL. Elective for seniors and graduate students.

Study of geographical, political, and economic divisions of communities with particular reference to highway transportation requirements; analysis of regional plans chiefly concerning the classification of roads and the selection of routes to be abandoned or improved, based upon their economic justification. Design of regional systems of highways, freeways, and parkways, including the consideration of the economic, safety, and aesthetic aspects. Traffic studies, legislation, financing, and zoning. Design of intersections and grade separations. Problems and reports required.

291. (g) **Design in Highway Engineering.** Either term. Credit three or more hours. Prerequisites, Courses 265, 270, 271, and 280. Professor CONWELL. Conferences to be arranged.

Economic selection of routes, location, design of highways and highway structures, etc.

297. (g) **Research in Highway Engineering.** Either term. Credit three or more hours. Prerequisites, Courses 265 and 266. Professor CONWELL. Hours to be arranged.

Traffic investigations and analyses, economics of highway engineering including contracting, etc.; laboratory investigations of soils, subgrade stabilization, highway materials and their use, etc.

HYDRAULICS AND HYDRAULIC ENGINEERING

In Civil Engineering

Major work in Experimental Hydraulics, Theoretical Hydraulics, or Hydraulic Engineering may consist in part (subject to the thesis requirement) of advanced courses selected from the subjoined list, or, the entire minor work may consist of such courses accompanied by such special work and reports as may be arranged with the faculty members of the special committee.

A candidate for the Master's or Doctor's degree who desires to take either a major or a minor subject in these fields of study must ordinarily have completed, preliminary to graduate work, courses in Hydraulics (including laboratory), Municipal Sanitation (including sewer design and construction and sewage disposal), and Water Supply, substantially equivalent to these courses as required of all undergraduates in the School of Civil Engineering. If a graduate student lacks one or more of these preliminary courses or considerable portions of any of them, more than the minimum period of residence may be necessary.

Ordinarily for major work in Hydraulic Engineering the thesis requirement of the Graduate School must be satisfied by work involving original designs, estimates or analyses based on actual engineering data, these to be gathered by the student himself as an essential part of advanced work in this field, and the requirement may not be satisfied by the so-called descriptive type of thesis with only rather vague design based on assumed data. Candidates for the Ph.D. degree in Hydraulic Engineering will write their theses in the field of Hydraulics.

For major work in Experimental (or Theoretical) Hydraulics the thesis requirement may be satisfied by individual experimental (or theoretical) investigation and a thesis based thereon. The tendency is to underestimate the time required for preliminary thesis work and that necessary for a thorough digestion of results. Consequently the work should be begun, if possible, early in the first term of residence.

Hydraulics

Professor E. W. Schoder.

240. *Hydraulics.* Either term. Credit four hours.

241. **Advanced Hydraulics.** Second term. Prerequisite, Hydraulics 240 or the equivalent. Professor Schoder. Three hours a week.

Broader theoretical treatment of some of the topics in elementary hydraulics; backwater and variable flow; the hydraulic pump; water hammer and surges; viscous flow; water wheels; centrifugal pumps.

242. **Hydraulic Measurements.** First term. Prerequisite, Hydraulics 240 (including the laboratory) or the equivalent. Professor Schoder. Three two and one half-hour periods a week.

Field and testing laboratory methods of measuring rates of flow, coefficients, slopes, characteristics, etc.; experimental studies on Pitot tubes in pipes; current meters and floats in open channels; ordinary water meters; special losses of head; fire hose and nozzles; Venturi meters; weirs. The determination of efficiency, capacity, and characteristics of hydraulic machinery by tests.

297 c. **Research in Hydraulics,** either theoretical or experimental.

Hydraulic Engineering

Professor F. J. Seery.

230. *Water Supply.* Either term. Credit three hours.

231. **Hydraulic Construction.** Second term. Credit three hours. Prerequisite, course 230 or the equivalent. Professor Seery. Computing and designing.

Problems in Water Storage including the design of structures associated with stream regulation; preliminary investigations; economics; estimates; design of dams, etc.

232. **Water Power Engineering.** Usually first term. Prerequisite, courses 240 and 230, or the equivalent. Professor Seery. Three hours a week. Given only if a sufficient number elect the course.

Hydraulic problems involved in the planning for and the design of water power developments.

233. **Hydraulic Engineering.** Either term if a sufficient number elect the course. Prerequisite, course 230 or the equivalent. Professor Seery. Three hours a week.

Problems in Water Supply not covered in Course 230; theory of groundwater flow, wells, methods of development, earthen dams, masonry dams, spillways and other appurtenances of dams.

234. **Conservancy and Reclamation Engineering.** Either term. Prerequisite, Courses 230 and 240, or the equivalent. Professor Seery. Three hours a week. Given only if a sufficient number elect the course.

Flood flow estimates; flood protection; irrigation and drainage.

236. **Hydraulic Power and Pumping Plant.** First term. Prerequisite, course 232. May be taken concurrently with 232. Professor Seery. Computing and designing. Credit three hours. Given only if a sufficient number elect the course.

Problems relating to power and pumping plants.

291c. **Design in Hydraulic Engineering.**

In Mechanical Engineering

Professor F. G. Switzer.

The hydraulic laboratory, under the direction of the Department of Experimental Engineering, is available for the investigation of turbine and draft tube problems, centrifugal pump performance, measurement of water, etc.

The libraries of the University have a very complete collection of treatises relating to mechanics, hydraulics, hydro-electric engineering, and to similar sub-

jects. In addition, these libraries contain the more representative engineering periodicals and the transactions of the leading engineering societies of the world.

3M41, 3M42. **Hydraulic Power Plants.** Throughout the year. Prerequisites, 3M21, 3M22a, 3M22b and 3M23, or 3M33. Professor SWITZER. Two hours a week. May not be given in 1937-38.

Power Developments, Hydraulic Turbines, Power study, water power legislation and the Federal Power Commission. Interconnection of power plants, hydraulic and thermal.

3M43, 3M44. **Hydraulic Power Plant Problems.** Throughout the year. Must be accompanied by courses 3M41, 3M42. Professor SWITZER. Two computing periods a week. May not be given in 1937-38.

Problems involving the principles taken up in courses 3M41, 3M42.

3M52. **Special Hydraulic Power Plant Problems.** Either term. Prerequisites, 3M41, 3M42, 3M43 and 3M44. Professor SWITZER.

Topics relating to design, operation, and economics of hydraulic power plants, selected to meet the individual needs of each student.

TOPICS SUGGESTED FOR ADVANCED WORK

Hydraulic Turbines.
Draft Tube Design and Performance.
Centrifugal Pumps.
Economics of Water Power Plants.

INDUSTRIAL ENGINEERING

Professor M. A. LEE.

The departmental library of literature on Industrial Engineering subjects is available for the use of graduate students. In the micro-motion laboratory 16 mm. motion picture cameras and projectors with the necessary auxiliary apparatus are available for motion and process studies as well as the necessary tools and work places for setting up and studying various operations.

The courses offered include a consideration of the organization, administration and selection and location of equipment for industrial enterprises.

No formal graduate courses are offered but facilities are available for original work in the field of Industrial Engineering.

To take advanced work in this department the student must have had the equivalent of the undergraduate courses 3I31, 41, 43 and 44. Students desiring to take a minor in this field may enroll for the following undergraduate courses.

3I31. *Industrial Organization.* Either term. Two lectures a week.

3I43, 3I44. *Industrial Engineering.* Throughout the year. Two computing periods and one lecture a week.

3I46. *Industrial Relations.* Second term. Two lectures a week.

3I47. *Cost Accounting.* First term. One lecture, one recitation, and one computing period a week.

3I48. *Industrial Engineering.* Second term. Two recitations a week.

TOPICS SUGGESTED FOR ADVANCED WORK.

Micro-motion analysis.
Investigations for motion and process economy.
Practical economic and production investigations in near-by industries.

MACHINE DESIGN AND DRAWING

Professors C. D. ALBERT, F. S. ROGERS, C. E. TOWNSEND, E. F. GARNER, S. F. CLEARY and C. CARMICHAEL.

Under this head is included advanced work in descriptive geometry, kinematics and dynamics, machine design and design methods, and special design problems and investigational work.

There are eight well-equipped drawing rooms and a very complete collection of Kinematic models. The Department Library, the Library of the School of Mechanical Engineering, and the University Library have a very complete collection of books on drawing, kinematics, machine design and construction, mechanical technology, structural design, and other books on related subjects.

120. *Descriptive Geometry.* First term. Credit three hours.

121. *Mechanical Working Drawing.* Second term. Credit three hours.

3D21. *Kinematics, Recitations.* First term. Credit two hours.

3D23. *Kinematic Drawing.* First term. Credit two hours.

3D24. *Kinematics, Recitations and Drawing.* Second term. Credit three hours.

3D25. *Kinematics, Recitations.* First term. Credit three hours.

3D26. *Kinematic Drawing.* First term. Credit two hours.

3D31. *Machine Design, Recitations.* First term. Credit two hours.

3D32. *Machine Design, Recitations.* Second term. Credit two hours.

3D33. *Machine Design, Drawing.* Second term. Credit three hours.

3D34. *Machine Design, Recitations.* First term. Credit two hours.

3D35. *Machine Design, Drawing.* Either term. Credit two hours.

3D36. *Machine Design, Drawing.* Second term. Credit one hour.

3D51. *Mechanical Technology.* Either term. Credit two hours.

3D52. **Advanced Kinematics and Kinetics.** Second term. Prerequisites, 3D21, 3D23, and 3D24 or 3D25 and 3D26. Two lecture and discussion periods and one laboratory period a week. Professor ROGERS or ————.

Graphical and semi-graphical treatment of linear and angular velocities and accelerations and of the resulting forces, stresses, and strains due to the form and mass of the moving parts of mechanisms and machines. Vibration and critical speeds and the theoretical basis and use of balancing machines for securing static and running balance of machine parts, will be treated so far as time permits.

3D53. **Materials Handling.** Second term. Prerequisites, 3D21, 3D23 and 3D24, or 3D25 and 3D26. Professor————————. Two lectures a week.

Treatment and analysis of the known methods of handling different kinds of materials and of the principles and considerations involved in a proper choice of the method of handling any given kind of material.

3D54. **Dynamics and Vibrations of Machinery.** First term. Credit three hours. Prerequisite courses 3D32 or 3D34 and 3M32. Assistant Professor CARMICHAEL. Two lecture and discussion periods and one laboratory period a week.

Balancing of engines. Flywheel design. Transverse and torsional vibrations and critical speeds. Control of vibration and noise in machinery.

3D55. **Advanced Machine Design.** Second term. Credit three hours. Prerequisite, courses 3D32 or 3D34 and 3M32. Assistant Professor CARMICHAEL. Two lecture and discussion periods and one laboratory period a week.

Advanced problems in stress analysis of machine parts and structures.

TOPICS SUGGESTED FOR ADVANCED WORK

Descriptive Geometry.
Kinematics and Dynamics.
Special Design Problems.
Vibrations and Critical Speeds.
Investigational Work.

MANAGEMENT ENGINEERING

Professors F. A. BARNES, J. E. PERRY, CARL CRANDALL, and R. Y. THATCHER.

The study of methods of construction is neglected in some colleges and the graduate student who is not familiar with them may well take course 264. Books and periodicals on construction methods for various types of work, on management of construction work and laws and practices governing it are available in the Library of the School of Civil Engineering.

264. *Engineering Construction.* Either term. Three hours a week.
290. *Engineering Law.* Either term. Three hours a week.
290-A. *Advanced Engineering Law.* Second term. Credit three hours.
293. *Engineering Management.* Either term. Three hours a week.
291 (e). **Design in Railroad Engineering.**
295. **Valuation Engineering.** Second term. Prerequisite, courses 264 and 290. Three hours a week. May be taken concurrently with 290.
Valuations and appraisals of properties for rate making, purchase or sale, condemnation, merger, assessment, investment or management purposes, with special attention to rulings and decisions of the courts in rate and valuation cases.
297 (e). **Research in Railroad Engineering.**

MATERIALS OF ENGINEERING

In Civil Engineering

Professor H. H. SCOFIELD.

The library of the School of Civil Engineering is well supplied with reference works of various kinds on the subject of structural materials, their properties, specifications and tests. Especial effort is made to add continually the most recent investigation and researches as the results find their way into print.
The laboratory equipment is selected to make all ordinary and many special tests and investigations of the materials of construction. The cement and concrete laboratories are equipped to make all the standard tests upon cement and the various other ingredients entering into concrete. A specialty is made in the tests and investigations of the finished concrete under various conditions as to proportion, manufacture and design.
225. *Materials of Construction.* Either term. Credit three hours.
226. *Materials Laboratory.* Either term. Credit three hours.
297b. **Engineering Research in Materials.**

In Mechanical Engineering

Professors A. C. DAVIS, H. DIEDERICHS and G. B. UPTON.

Experimental problems relating to the origins and control of the properties of ferrous and non-ferrous metals, cements, woods, etc., may be carried on in this department. For advanced work in this field the student must have had course 3X31 or its equivalent. Advanced work is also offered in Applied Metallography.
The Materials Testing Laboratory. This laboratory is equipped for tension and compression tests with an Olsen 300,000-lb. machine, a Riehlé 100,000-lb. machine, an Olsen 150,000-lb. three-screw machine, an Amsler 100,000-lb. hydraulic machine, together with several other machines varying in capacity from 10,000 to 100,000 pounds. For transverse test there is a Riehlé machine of 200,000 pounds capacity and a Fairbanks machine of 10,000 pounds capacity. There are one Olsen torsion machine of 200,000 inch-pounds capacity, two Upton-Lewis fatigue testing machines, and an Amsler-Charpy-Izod impact testing machine. The small equipment includes hardness testing machines, extensometers, a cathetometer, gas and electric furnaces, tempering baths, and other apparatus required for the determination of the physical qualities of engineering materials under tensile, compressive, transverse, and torsional stress, and under different kinds of heat treatment.
3X21, 3X22. *Metallurgy and Properties of Materials.* Throughout the year. Three lectures a week.
3X31. *Materials Testing Laboratory.* First term. One laboratory period a week and a written report of the work.
3X52. **Applied Metallography.** First term. Professor UPTON. Two lectures a week.
Theories and technique of metallography critically reviewed; applications to practice of control of properties of metals. This course will be modified to suit especially the interests of graduate students taking it.

TOPICS SUGGESTED FOR ADVANCED WORK

Properties of Engineering Materials.
Thermal Qualities of Quenching Liquids.
Control of Properties of Engineering Materials.

MECHANIC ARTS

Professors A. E. WELLS and W. E. MORDOFF.

The shops available for graduate research work include the following: forge shop, foundry, welding shop, pattern shop, and machine shop. The shops are also available for use in the building of equipment for research in any department. Arrangements for the construction of new equipment should be made in advance with the head of the department.

102. *Wood Work.* Either term. Three hours a week.
103. *Introductory Engineering Laboratory.* Either term. Three hours a week.
3S21. *Pattern-making.* Either term. Three hours a week.
3S22. *Foundry.* Either term. Three hours a week.
3S31. *Machine Shop.* Either term. Nine hours a week.
3S32. *Machine Shop.* Either term. Six hours a week.

TOPICS SUGGESTED FOR ADVANCED WORK

Melting of ferrous and non-ferrous metals.
Selection and testing of foundry sands.
Welding practice.
Foundry practice.
Machine shop practice.

MECHANICS

In Civil Engineering

Professors S. G. GEORGE, E. W. RETTGER, S. C. HOLLISTER, and E. V. HOWELL.

An extensive departmental library in Lincoln Hall, in addition to the University Library, affords facilities for advanced work in the field of applied mechanics especially in applications such as occur in structural engineering.

The prerequisite training for graduate work in this subject should cover the fundamental principles and applications in mathematics, physics, materials, mechanics and structural design required for graduation in civil engineering at Cornell University. Many of the advanced treatises are in French and German, and an ability to read technical works in these languages is extremely valuable.

220. *Mechanics of Engineering.* Either term. Credit five hours.
220A. *Mechanics Laboratory.* First term. Credit two hours.
221. *Mechanics of Materials.* Second term. Credit four hours.
221A. *Mechanics Laboratory.* Second term. Credit one hour.

222. **Advanced Mechanics.** First term. Prerequisite, Courses 220 and 221. Professor GEORGE or RETTGER. Three hours a week.

Advanced mechanics of materials; induced and combined stresses; Mohr's diagram; a survey of experimental methods for localized stresses; special cases of flexure; Castigliano's Theorem of Least Work, with applications.

223. *Engineering Problems.* Either term. Credit two hours. Prerequisite, Courses 220, 221 and 240. Two computing periods a week.

224-A. **Engineering Mathematics.** First term. Credit three hours. Prerequisite, Mathematics 5b. Professor RETTGER.

An elementary course in ordinary Differential Equations with applications to Engineering problems. The purpose of this course is to lay the foundation for the more advanced courses in Engineering Mathematics. Algebra, Trigonometry and the Calculus are dealt with insofar as this is necessary for a clear understanding of the treatment of Differential Equations.

224-B. **Advanced Engineering Mathematics.** Second term. Credit three hours. Prerequisite, Course 224-A. Professor RETTGER.

This course is an introduction to the mathematics used in the solution of advanced engineering problems. Partial differentiation. Fourier Series. Line integrals. Sector notation. Conformal representation.

224-C. **Advanced Differential Equations.** First term. Credit three hours. Prerequisites, Courses 224-A and 224-B or their equivalents. Professor RETTGER.

A systematic study of Differential Equations. Partial differential equations and their solutions are emphasized.

224-D. **Special Topics.** Second term. Credit three hours. Prerequisites, Courses 224-A and 224-B. Professor RETTGER.

The content of this course depends largely upon the needs and the interests of those enrolled. Generalized Coordinates and the Calculus of Variation are two subjects to be considered.

228. **Theory of Elasticity.** Second term. Prerequisite, 224-A. Professors HOLLISTER and RETTGER. Four hours a week.

Theory of elastic breakdown; fundamental relations of stress and strain, Airy stress function; problems in two-dimensional and three-dimensional stress and strain; Analogies and their applications to solutions of Engineering problems in elasticity.

229. **Experimental Elasticity.** Second term. Prerequisite, 228. May be taken concurrently with 228. Professor HOLLISTER. Credit depends upon approved work done.

Experimental study in applications of the theory of elasticity to engineering problems; investigations of stress concentrations and distributions by (a) photo-elastic analysis, (b) Model analysis based upon the membrane, electrical, slab, or other analogy, (c) Model tests.

297. **Research in the field of Advanced Mechanics.**

In Mechanical Engineering

Professors F. G. SWITZER, W. R. CORNELL, and H. C. PERKINS.

In addition to the regular laboratory equipment, there are also available facilities for the study of balancing problems, and for photo-elastic investigations. The equipment includes a Bausch and Lomb polariscope with five-inch diameter beam; bakelite; polishing tables; annealing oven; a 2,000-lb. Olsen Universal hydraulic testing machine arranged for tension, compression and transverse loading; mercury arc for monochromatic light source.

3M21. *Theoretical and Applied Mechanics.* Either term. Five hours a week.

3M22a. *Strength of Materials.* Five hours a week for nine weeks of second term.

3M22b. *Strength of Materials, continued.* Five hours a week for six weeks of second term.

3M23. *Hydraulics.* Five hours a week for six weeks of second term.

3M32. *Applied Mathematics.* First term. Three hours a week.

3M33. *Fluid Mechanics.* Second term, three recitations and one lecture a week.

3M55. **Photoelasticity.** Second term. Prerequisite, 3M22b. Professor SWITZER. Two lectures, one laboratory period and report a week.

The optics of photoelasticity, the stress-optical effect, plane and circularly polarized light, white and monochromatic. Elements of elasticity required for the analysis of observations and the determination of principal stresses.

TOPICS SUGGESTED FOR ADVANCED WORK

Vibration problems.
Theory of Elasticity.
Photo-elastic stress analysis.

RAILROAD ENGINEERING

Professors F. A. BARNES, W. L. CONWELL, J. E. PERRY, CARL CRANDALL, and R. Y. THATCHER.

The Library of the School of Civil Engineering contains an excellent collection of books, periodicals and publications of railway or other technical societies dealing with the location, construction, maintenance and operation of railroads. Books and other publications on transportation are available either in this collection or in the University Library. Maps and profiles are available for studies of the economics of location, and special plans provide for studies of signal layouts, interlocking and yard and terminal design. Instrumental equipment is available for securing data for special problems in relocation and for designs of structures.

260-A. *Location Surveying.* See Course 213. Credit one hour. One week during summer vacation.

260-B. *Route Surveying and Drawing.* Second term. Credit three hours.

261. **Railroad Maintenance of Way.** First term. Prerequisite, courses 260-A and 260-B. Professor PERRY. Three hours a week.

Drainage, track materials, design, track-laying and maintenance; separation of grades, and improvement in grades and alinement.

262. **Railroad Operation and Management.** Second term. Prerequisite, courses 260-A and 260-B. Professor BARNES. Three hours a week.

Railroad history and development. Principal departments and their interrelations, i.e., organization. Freight and passenger traffic, freight houses and yards, shops, car service, signaling, interlocking and train rules.

263. **Route Location.** Second term. Prerequisite, courses 260-A and 260-B. Professor BARNES. Three hours a week.

Transportation History and development. Economic principles governing the location of new railroads and highways and revision of existing ones to produce the most efficient transportation agencies.

269. **Transportation.** Second term. Professors BARNES and CONWELL.

A course covering travel and transport agencies with special reference to their facilities, ownership, financing, regulation and coordination. A brief review of the development of transportation throughout the world is used as a background for an intensive study of the present situation in the various countries and comparison of the policies and practices in use. Particular attention is given to the various proposals designed to promote more efficient use of the various transportation agencies in the United States by better coordination, pooling of facilities etc., and economic studies are made of some of the new projects which are under discussion.

291e. **Railroad Engineering Design.**

297e. **Railroad Engineering Research.**

In addition to the above courses, the student may take courses in other departments if time permits; such as courses in transportation in the College of Arts and Sciences, or in applications of electricity in transportation in the School of Electrical Engineering.

Note: For the larger railway structures see STRUCTURAL ENGINEERING.

SANITARY ENGINEERING

Professors C. L. WALKER, W. E. STANLEY, and H. N. OGDEN.

Courses offered to graduate students may be divided into two classes: those fundamental studies in Chemistry, Biology, and Bacteriology, which the undergraduate student in Civil Engineering has not had an opportunity of pursuing; and those dealing with the design, construction and operation of sewage treatment and water purification plants. The sewage treatment and water purification plants in the City of Ithaca and in neighboring communities offer opportunity for experimental study.

A well-equipped sanitary laboratory established in the School of Civil Engineering provides an opportunity for students to acquire laboratory technique in water and sewage analyses, and also a practical training in interpretation. The Kuichling Library for Hydraulic and Sanitary Engineering, and the main library of the School are well provided with the literature dealing with Sanitary Engineering topics.

250. *Sanitary Biology.* Second term. Credit three hours.

251. *Sanitary Biology.* First term. Credit two hours.

252. *Municipal Sanitation.* Either term. Credit four hours.

253. **Purification and Control of Water Supplies.** Second term. Credit three hours. Prerequisite, Water Supply, Course 230. Professors WALKER and STANLEY. Two recitations and one laboratory period a week.

254. **Sewerage Works.** First term. Credit three hours. Prerequisite, Course 252. Professors WALKER and STANLEY. Two recitations and one laboratory period a week.

255. **Treatment of Wastes.** Second term. Prerequisite, Course 252. Professor WALKER. Three hours a week.

256. **Municipal Engineering.** First term. Credit three hours. Professor OGDEN.

256A. **Public Health Engineering.** Second term. Credit three hours. Professor OGDEN.

257. **Purification of Water.** Either term. Prerequisite, Course 253. Professor STANLEY. Three hours a week.

258. **Conference on Present Methods of Sewage Disposal.** Either term. Prerequisite, Course 254. Professor STANLEY. Three hours a week.

259. **Laboratory Course.** Second term. Prerequisite, Courses 253 and 254. Professor WALKER.

291d. **Design in Sanitary Engineering.**

297d. **Research in Sanitary Engineering.**

SOIL MECHANICS

Professors C. E. O'ROURKE, and H. T. JENKINS.

The new and extensive field of soil mechanics offers the graduate student innumerable opportunities for advanced study. The mechanical and physical properties of soil as an engineering material are being investigated, and experimental problems relating to the physical characteristics are carried on in the Soil Mechanics Laboratory.

Earth pressures, stability, shear, elasticity and permeability are among the major divisions of a correlated study which is at present under way. Other investigations are being undertaken as the interest in them develops.

The Soil Mechanics Laboratory is fully equipped for work by graduate students. The freezing room and humid room are available for research work. There is also a shop for use in the building of new equipment.

As a prerequisite for work in this field, students should have had Physics of Soil Phenomena (Physics 431) as described on page 99, or its equivalent.

228. **Theory of Elasticity.**—See page 145.

229. **Experimental Elasticity.**—See page 145.

287. *Soil Mechanics.* Second term. Prerequisite, Physics 431. Two lectures and one laboratory period a week.

FIELDS OF ADVANCED WORK

Physical Properties of Soils.
Bearing Capacity of Soil.
Permeability of Soil.
Stability of Soil.
Flow of Water through Earth Dams.

STRUCTURAL ENGINEERING

Professors L. C. URQUHART, C. E. O'ROURKE, and E. N. BURROWS.

In this subject instruction is offered in the determination of loading and stresses and the design of roofs, buildings, bridges, arches, foundations, piers, retaining walls and other structures of timber, steel and concrete.

The department is equipped with a Beggs Deformeter for the Mechanical Analysis of Structures. The facilities of the testing laboratories are available to graduate students.

To qualify for graduate work in structural engineering a knowledge of theoretical mechanics, strength of materials, engineering construction, and elementary courses in stresses and design in timber, steel, and concrete are required.

270. *Bridge Stresses.* Either term. Credit four hours.

271. *Structural Design.* Either term. Credit three hours.

272. **Higher Structures.** Either term. Prerequisite, courses 270 and 271, or their equivalents. Professor URQUHART or O'ROURKE. Three hours a week. Required of all graduate students whose major or minor is in Structural Engineering.

Statically indeterminate structures; continuous beams and trusses; arches and rigid frames.

273. **Steel Buildings.** First term. Credit three hours. Prerequisite, courses 220, 221, and 271, or their equivalents. Assistant Professor BURROWS. Computing and Drawing, six hours a week.

Design of steel framework for buildings of the prevailing type used in power house or shop construction; provision is made for an electric crane moving the full length of the building.

274. **Bridge Design.** Second term. Credit three hours. Prerequisite, course 271 or the equivalent. Assistant Professor BURROWS. Computing and Drawing, six hours a week.

Computations and Drawings for the complete design of a railway bridge of six or seven panels, or a heavy highway bridge.

275. **Investigation of Existing Bridges.** Second term. Credit three hours. Prerequisite, course 271 or the equivalent. Assistant Professor BURROWS. Computing, six hours a week.

Inspection of an existing bridge for the determination of the sizes and condition of plates and shapes, followed by computations to determine either the unit stresses under a specified load or the safe load according to standard specifications.

280. *Concrete Construction.* Either term. Credit three hours.

281. *Foundations.* Either term. Credit three hours.

282. **Reinforced Concrete Building Design.** First term. Credit three hours. Prerequisite, course 280, or the equivalent. Professors URQUHART and O'ROURKE. Computing and drawing, six hours a week.

Complete design and detail drawings for a reinforced concrete flat-slab building including stairway, elevator shafts, penthouses, etc.; investigation of other types of floor systems.

283. **Fixed Arches.** First term. Credit three hours. Prerequisite, courses 270, 271, and 280. Professor URQUHART and Professor O'ROURKE.

Theory of the curved beam; the closed ring; the fixed arch; influence lines for arches of various forms; selection of curvature of axis for various loadings; effect of temperature and rib-shortening; effect of plastic flow on stresses in a reinforced concrete arch; design of a reinforced concrete arch and its abutments.

284. **Concrete Highway Bridges.** Second term. Credit three hours. Prerequisite, course 280, or the equivalent. Professors URQUHART and O'ROURKE. Computing and drawing, five hours a week.

Design of short span bridges; a slab bridge; a beam bridge; a through-girder bridge; abutments; complete detail drawing of one bridge.

285. **Reinforced Concrete Design.** Either term. Credit three hours. Pre-

requisite, course 280, or the equivalent. Professors URQUHART and O'ROURKE. Computing, six hours a week.

Theory and design of retaining walls, multiple column footings, bins, tanks, swimming pools, covered reservoirs.

286. **Building Construction.** First term. Professor URQUHART and non-resident lecturers. Three hours a week. Given in alternate years.

One lecture a week by a non-resident engineer or architect who is well known in the field of building construction; one lecture by a member of the University staff; followed by a quiz on the lectures.

291f. **Design in Structural Engineering.**

297f. **Research in Structural Engineering.**

TOPOGRAPHIC AND GEODETIC ENGINEERING

Professors P. H. UNDERWOOD and L. A. LAWRENCE.

The preliminary training as a qualification for work in this department should include the equivalent of the regular undergraduate course in civil engineering, including work in General and Practical Astronomy. A thorough training in Mathematics and Physics is desirable.

Graduate work for those interested in Topographic and Geodetic Engineering includes courses in Advanced Topographic Surveying, in Geodesy, Least Squares, Geodetic Astronomy, and in Photographic and Aerial Surveying. The Library of the School of Civil Engineering contains an extensive collection of reference books in the subjects mentioned. The surveying equipment of the School is also available for practice work.

For courses in Geodetic Astronomy and Geodesy see page 80.

110. *Elementary Surveying.* Either term. Credit three hours.

182. *Elements of Field Astronomy.* Either term. Credit two hours. (Given in Department of Astronomy.)

211. *Advanced Surveying.* First term. Credit two hours.

212. *Advanced Surveying.* Second term. Credit two hours.

213. *Summer Survey: Topographic, Hydrographic,* and *Geodetic Survey: Camp.* Five weeks during last of summer preceding first term. Credit four hours.

214. *Mapping.* Second term. Credit two hours.

215. *Problems in Adjustment of Observations.* Second term. Credit one hour.

216. **Least Squares: Adjustment of Observations.** Second term. Prerequisite, Calculus and Physics. Professor UNDERWOOD. Two hours a week.

Applications are made to problems in physics, astronomy, mechanics, hydraulics, surveying, etc., with some attention given to the derivation of empirical formulae.

217. **Advanced Topographic Surveying.** Second term. Prerequisite, course 213. Professor UNDERWOOD. Two hours a week.

Economics of surveying methods; surveys for special purposes: storage and distribution of water for irrigation, earthwork on a large scale, lines of communication, etc.; photographic surveying.

219. **Photographic and Aerial Surveying.** Second term. Prerequisite, Advanced Surveying, course 212. Professor UNDERWOOD. Three hours a week.

The principles of photographic surveying; surveys with camera stations on the ground; stereoscopic methods and apparatus; aerial surveys.

HOME ECONOMICS

ECONOMICS OF THE HOUSEHOLD AND HOUSEHOLD MANAGEMENT

Professors HELEN CANON and ELLA M. CUSHMAN.

Approved Major and Minor Subjects (key to symbols on p. 29)

Economics of the Household and Household Management **1, 2, 4**

As a basis for graduate work in economics of the household, elementary courses in the various divisions of home economics and in economics are usually required. For the Doctor's degree a minor in economics is usually required.

26. *Consumer Education for Buying.* Credit three hours. First or second term.

112. *Household Management in Relation to Family Living.* Credit three hours. First term.

130. *Economic Conditions as They Affect the Welfare of Families.* Credit two hours. First or second term.

145. *Management of Personal and Family Finances.* Credit three hours. First or second term.

160. *Marketing Problems from the Consumer's Viewpoint.* Credit two hours. First or second term.

212. **Management Problems in the Home.** First term. Credit one hour. Prerequisite or parallel, Economics of the Household 112. Department Staff. One two-hour period by arrangement. Room G-19A.

Research being conducted by members of the group is discussed, as well as findings and methods of other workers.

250. **Economic Problems of Families.** Second term. Credit two hours. Professor CANON. Hours to be arranged. Room 121. The instructor should be consulted before registering.

Attention is given to clarifying economic problems of families, tracing relationships, and reviewing the literature bearing on such problems. Two or three outstanding contributions to economic thought relating to this field are analyzed. Methods of research are examined.

290. **Seminar.** First and second terms. Department Staff. S 11-1. Room 114.

FAMILY LIFE

Professors MARIE B. FOWLER, ETHEL B. WARING, LEMO D. ROCKWOOD, HELEN D. BULL, and KATHERINE REEVES. From the department of Rural Social Organization, *Professors* DWIGHT SANDERSON and LEONARD COTTRELL.

Approved Major and Minor Subjects (key to symbols on p. 29)

Family Life **1, 2, 4**

Advanced study in family life may be built upon a background of teaching experience with young children, school children, youth or older young people, or adults; school supervision or administration; social or clinical work in a health, nutrition or behavior clinic; or extension teaching or administration. Previous training should include psychology, sociology and family life.

The selection of courses for a degree will vary with the previous background of the candidate but will fall largely within three groups:

Basic courses in biology, sociology, psychology and education;

Courses in other areas of the field of Home Economics—foods and nutrition, textiles and clothing, housing and furnishing, home finance and management, and institutional management;

Courses in Family Life—health of the family, the home and the family, behavior and guidance, family relationships, courtship and marriage, and the family as a social institution.

Graduate study involves course work to supplement and extend the student's undergraduate experience; field work with families in their homes; conference and discussion groups; and research. Laboratory experience is provided in the nursery school in Martha Van Rensselaer Hall. Following are the undergraduate and graduate courses in Family Life:

100. *The Home and Family Life, Orientation.* Two hours credit, either term.

101. *Behavior and Guidance.* Three hours credit, either term.

107. *Home and School Environment for Young Children.* Three hours credit, first term.

113. *Family Relationships.* Three hours credit, either term.

[125. *Infant and Child Hygiene.* Two hours credit, second term. Not given in 1937-38.]

126. *Home Nursing and Child Hygiene.* Three hours credit, either term.

The descriptions of the above courses are found in the Home Economics catalogue.

200. **The Home and Family Life.** Advanced Course. Three hours credit. Second term. Open to graduate students with adequate training in family life. Professor FOWLER. T Th 8. Martha Van Rensselaer Hall, Amphitheatre. Third hour by arrangement.

This course is planned to give advanced students some experience with less mature students in developing a simple organization of the various areas of home economics subject matter around the central theme of the life of the family in the home. Fee, $5.

205. **Behavior and Guidance.** Advanced Course. Three hours credit. Second term. Prerequisite Family Life 101. Professor WARING. T Th S 8. Martha Van Rensselaer Hall 121. Lectures and discussion. Two hours of observation weekly in the nursery school. Programs to be checked with instructor at registration. Laboratory to be arranged after the first lecture period.

The observation and the discussion in the class are based upon the behavior of young children in the Nursery School. Students are directed to observe what situations young children meet, how they meet them, and what adults do to help or to hinder the children in meeting them in desirable ways. The students undertake to study a child's behavior as a total experience; that is, to see what he is doing, feeling and thinking; to discover in which of these three aspects, if any, his experience is undesirable, and to determine what elements in the situation most influence his behavior, how he usually responds to them, and how adults may change the situations to improve his behavior. Effort is made to help the students apply to themselves the principles underlying personality development which they observe at work in the lives of the children. Fee, $7.50.

213. **Family Relationships.** Three hours credit, either term. Professor ROCKWOOD. First term, M W F 9, or M W F 11. Second term, M W F 9. Martha Van Rensselaer Hall.

This course aims to show the influence of cultural conditioning, of social and economic conditions, and of the material aspects of homemaking upon the everyday associations of husband and wife, parent and parent, parent and child, and child and child, and the effect of the family experiences on the individual's later adjustments and relationships. Fee, $5.

121. **The Family.** See Rural Social Organization 121.

215. **Studies in Family Life.** First and second terms. Prerequisite Family Life background for research. Professors WARING, ROCKWOOD and ————. Open to graduate students who are carrying on research or making special studies in the area of family life. At least four hours each of two terms for students majoring in the department for a master's degree or minoring for a doctorate. Th 1:40-3 is held provisionally for group activities. Fee, $3.

220a, 220b. **Participation in Nursery School.** Credit three or four hours. Either term. Prerequisite Family Life 101, and prerequisite or parallel Family Life 107. Professors FOWLER and REEVES and Miss DAVIS. A total of thirty hours of supervised participation with the children in the Nursery School for each hour of credit, and one hour in conference with the teaching staff each week.

Open to a limited number of seniors and graduate students with adequate personal and professional qualifications. Laboratory hours to be arranged. Conference: 220a, M 3; 220b, T 12.

Participation in the nursery school is designed to be an experience in group living, for adults and children. The dynamics of human relations are made meaningful to the students through their observation and study of child-child and child-adult relationships. Fee, $7.50.

223. **Marriage.** Credit three hours. Second term. Open to graduate and senior students. Prerequisite Family Life 113 or 213, or consent of instructor. Limited to thirty members. Professor ROCKWOOD. M W F 11. Martha Van Rensselaer Hall.

This course will deal with social and economic changes which today are influencing the relations of men and women before and after marriage; scientific information which has promoted the study of mate choice and marital adjustment; the development of affection in the individual and the achievement of heterosexuality; substitutes for mate love and the adjustment of the single person; the choice of a mate; courtship and engagement; the nature of the marriage relationship and factors which influence adjustment to this relationship; adjustments to parenthood. Fee, $5.

221. **Seminar—The Family.** See Rural Social Organization 221.

[228. **Seminar—Behavior and Guidance.** See Rural Education 228. Second term. Credit two hours. Prerequisite, some work in family life. Professor WARING. M 2-4. Martha Van Rensselaer G-58. Not given 1937-38.]

Also see related courses in other areas of home economics and in psychology and sociology. These courses are listed in the catalogues for the colleges of Home Economics, Agriculture and Arts and Sciences.

FOODS AND NUTRITION

Professors HELEN MONSCH, MARION PFUND, HAZEL HAUCK, FAITH FENTON, L. A. MAYNARD, and C. M. MCCAY.

Approved Major and Minor Subjects (key to symbols on p. 29)

Foods and Nutrition **1, 2, 3, 4**
Nutrition **1, 2, 3, 4**

The laboratories for graduate work in food and nutrition are situated in the new building of the College of Home Economics and in the Dairy Building. Six laboratories are available for graduate work: a child nutrition laboratory, equipped for nutrition work and the study of energy metabolism of infants and small children; an adult nutrition laboratory for dietary studies and experiments with energy metabolism; a nursery school for the study of feeding problems with preschool children; an animal laboratory, adequately equipped for nutrition work with small animals; and two chemical laboratories, provided with apparatus for work in the application of chemistry to the study of food and nutrition.

In order to undertake graduate work in the chemistry of food and nutrition, the student should have had the equivalent of the following courses: quantitative chemical analysis, biological chemistry, physiology or biology, nutrition and dietetics. In addition to the courses listed, a knowledge of physics and physical chemistry is highly desirable.

The facilities of the laboratory of Animal Nutrition are described on page 60.

2. *Science Related to Food Preparation.* Throughout the year.
9. *Food Preparation: Principles and Comparative Methods.* First term.
22. *Food Selection: Dietetics, Introductory Course.* First term.
109. *Food Preparation, Advanced Course.* First or second term.
111. *Meal Planning and Preparation.* First or second term.
121. *Food Selection: Nutrition and Dietetics.* Second term.
122. *Food Selection: Nutrition and Dietetics.* First or second term.

102a. **Science Related to Foods.** Throughout the year. Credit two hours a term. Professor PFUND. Attendance at F.N. 2 lectures required. One hour to be arranged.

This course is designed to help the more mature student make use of science in the study of foods, and to give her an opportunity to discuss the current literature. Fee for materials, $1 a term.

102b. **Science Related to Foods: Advanced Laboratory Course.** First or second term. Second term only 1937-38. Credit three hours. Professor PFUND. Limited to six students. Hours to be arranged before registration. Room 357.

An opportunity is given for independent laboratory work on special problems in which the student is interested. Laboratory fee, $10 as above, depending upon the special problem.

124. **Diet Therapy.** First term. Credit two hours. Advised for those specializing in hospital dietetics. Prerequisite, Foods and Nutrition 122. Professor HAUCK. Lecture, discussion and laboratory. T 11; Th 11-1. Martha Van Rensselaer Hall 426 and 358.

This course consists of a study of diet in those diseases in which choice of food is an important factor of treatment. Fee for materials, $6.

131. **Problems of Family Nutrition with Special Emphasis on Child Feeding.** First or second term. Credit 2, 3, 4, or 5 hours. May all be taken in one term or in two consecutive terms. Three hours advised for teachers; two hours advised for all students. Prerequisite, Foods and Nutrition 121, 122, or the equivalent. Professor MONSCH and Miss PITTMAN. Lectures and discussions, T 2-4. Martha Van Rensselaer Hall 339. Laboratory, Infant Feeding, Th 2-4:30. Homes in Ithaca and Well-baby clinic; Feeding of Pre-school Children, W 10:30-12:50 one section, Th 10:30-12:50 one section, Nursery School and homes in Ithaca; Feeding of School Children, F 2-4:30, Martha Van Rensselaer Hall 358, public schools and homes in Ithaca. Infant Feeding Laboratory limited to sixteen students. Pre-school Feeding Laboratory limited to six in each section. School Feeding Laboratory limited to ten students.

A study of family problems in nutrition with special emphasis on the nutritional needs of the child. It offers experience for the study of actual family situations provided by laboratory practice in a well-baby clinic, in private homes, in the nursery school, and in the public schools. The nutritional needs of children of all ages, the importance of proper feeding to the physical health of the child, and the relation between sound nutrition practice in feeding children and the community health and family income are considered. Laboratory fee, $8 for each laboratory credit hour.

150. **Special Problems.** First or second term. Credit and hours by arrangement. Directed by a member of the department concerned with the special problem selected. Fee determined by the problem.

[224. **Human Calorimetry.** First term. Credit two hours. Professor HAUCK. Class limited to six students. Hours to be arranged. Martha Van Rensselaer Hall. Given in alternate years. Not given in 1937-38.]

The laboratory work in this course consists of energy metabolism determinations using the Benedict portable respiration apparatus. Laboratory fee, $5.

229. **Research in Foods and Nutrition.** Throughout the year. For graduate students with training satisfactory to the instructor. Professors MONSCH, MAYNARD, MCCAY, PFUND, and HAUCK, and Assistant Professor FENTON. Hours to be arranged.

This course offers opportunity for individual research in animal nutrition, human nutrition, metabolism, food chemistry, and chemical changes taking place in the process of food preparation. Laboratory fee, from $5 to $25.

230. **Seminary in Foods and Nutrition.** Throughout the year. Credit one hour a term. Professors MONSCH, PFUND, and HAUCK, and Assistant Professor FENTON. Required of graduate students specializing in Foods and Nutrition. Hours to be arranged. Martha Van Rensselaer Hall 301. Fee for materials, $1.

In addition to the above, the following courses in Nutrition are offered in the Laboratory of Animal Nutrition (see page 60), and research at the New York State Experiment Station at Geneva (see page 166).

110. **Animal Nutrition.** Professor MAYNARD.

111. **Animal Nutrition, Laboratory Course.** Professor MCCAY.

219. **Special Topics and Animal Nutrition.** Professors MAYNARD and MCCAY.

TEXTILES AND CLOTHING AND HOUSEHOLD ART

Professors BEULAH BLACKMORE, MURIEL BRASIE, GRACE MORIN, DORA W. ERWAY, and ALMA SCIDMORE.

Approved Major and Minor Subjects (key to symbols on p. 29)

Textiles and Clothing and Household Art **2, 4**

Graduate work for the Master's degree is offered in Textiles and Clothing and Household Art. The work in Textiles and Clothing may emphasize either the economic side or the applied-art side of the subject. Candidates should have a background of thorough undergraduate work in this field.

TEXTILES AND CLOTHING

3. *Clothing Selection and Textile Study.* First or second term. Credit two hours.

5. *Clothing Construction.* Textiles and Construction. First or second term. Credit three hours.

10. *Clothing for Children.* First or second term. Credit two hours.

15. *Clothing Design and Modeling.* First or second term. Credit three hours. By permission of the department.

55. *Problems in Purchasing Household Textiles.* First or second term. Credit two hours. By permission of instructor.

103. *Clothing Problems and Shop Practice.* Credit three hours. First or second term.

115. *Commercial Clothing and Advanced Practice in Construction.* Credit three, four or five hours. First or second term.

120. **Seminary in Clothing.** Credit two hours. Prerequisite or parallel, Rural Education 135 or its equivalent. Assistant Professor BRASIE and other members of the Textile and Clothing Staff. Martha Van Rensselaer Hall 215.

150. **Special Problems.** First or second term. Credit and hours to be arranged. Professor BLACKMORE and Assistant Professor BRASIE. Martha Van Rensselaer Hall.

HOUSEHOLD ART

1. *Household Art, Introductory Course.* First or second term. Credit two hours.

11. *Advanced Color and Design.* First or second term. Credit two hours.

16 a, b, c, d. *Problems in Color and Design in the Studio for Handicrafts.* First or second term. Credit one to four hours a term. May be taken in consecutive terms.

25. *House Planning.* First or second term. Credit two hours.

31. *Home Furnishing.* First or second term. Credit two hours.

32. *Home Furnishing.* First or second term. Credit two hours.

150. **Special Problems.** First or second term. Credit and hours to be arranged. Professor MORIN and Assistant Professors ERWAY and SCIDMORE. Martha Van Rensselaer Hall.

HOTEL ADMINISTRATION

Professors H. B. MEEK, F. H. RANDOLPH, LOUIS TOTH, A. L. WINSOR, and JOHN COURTNEY.

Approved Major and Minor Subjects (key to symbols on p. 29)

Hotel Management **2, 4**
Hotel Accounting **2, 4**

Note. A major or minor subject may be selected in the field of Hotel Administration provided the other subject is taken outside the department of Hotel Management and has the approval of the Dean of the Graduate School.

Graduate work for the Master's degree is offered in Hotel Administration. A foundation knowledge of hotel management is required of graduate students majoring in the field. Such students will choose a minor in a related or underlying field such as accounting, statistics, engineering, or one of the social sciences. Students majoring in the latter fields may find in the problems of the hotel industry a fertile field for research.

Through its contacts with the American Hotel Association and its subsidiary associations and with member hotels the University has possession of and access to a wide range of research material.

81 and 82. *Accounting.* Credit six hours. Throughout the year.
181 and 182. *Hotel Accounting.* Credit six hours. Throughout the year.
183. *Hotel Accounting, Advanced.* Credit three hours. First term.
184. *Food and Beverage Control.* Credit two hours. Second term.
187. *Tax Computation.* Credit two hours. First term.
[151. *Hotel Operation.* Credit two hours. First term. Not given in 1937-38.]
160. *Introductory Hotel Engineering.* Credit four hours. First term.
161. *Mechanical Service Equipment.* Credit four hours. Second term.
162a. *Hotel Power Plants, Lectures.* Credit two hours. First term.
162b. *Hotel Power Plants, Laboratory.* Credit two hours. First term.
163a. *Hotel Auxiliary Equipment, Lectures.* Credit two hours. Second term.
163b. *Hotel Auxiliary Equipment, Laboratory.* Credit two hours. Second term.

164. **Hotel Planning.** Credit three hours. Must be preceded or accompanied by 163a. Open to a limited number of seniors and graduate students with the consent of the instructor. Professor RANDOLPH.

Planning the layout for a proposed hotel, emphasizing floor plans and selection and arrangement of engineering equipment in various departments. Determining different engineering costs; use of metering devices in promoting efficient operation. Materials fee, $3.

166. **Hotel Structures and Maintenance.** First term. Prerequisite, mechanical drawing. Credit two hours. Mr. SAYLES. Lectures, T Th 11. East Roberts 223.

Materials and methods of building construction; specification and repair of furniture; the usual methods employed by the trades in the alteration of hotel structures. Materials fee, $1.

167. **Building Costs.** Second term. Credit one hour. Hotel elective. Prerequisite, Hotel Engineering 166. Mr. SAYLES. T 1:40-4. Stone Hall 102.

The customary procedure in estimating various building costs for structures, alterations, repairs, and decorations, including the excavation, foundation, building, and finishing operations.

185. **Hotel Accounting Problems.** Second term. Credit two hours. Prerequisite, Hotel Accounting 183 or its equivalent. Assistant Professors TOTH and COURTNEY. W 11-1. Martha Van Rensselaer Hall 278.

Incorporating the hotel owning and operating companies. Financing bond issues and discounts. Accounting provisions in hotel leases and management contracts. Installation of hotel accounting systems.

186. **Interpretation of Hotel Financial Statements.** Second term. Credit two hours. Prerequisite, Hotel Accounting 183 or its equivalent. Assistant Professors TOTH and COURTNEY. W 1:40-4. Martha Van Rensselaer Hall 278.

Study and discussion of hotel balance sheets and profit and loss statements. Typical balance sheets and operating ratios of representative hotels.

189. **Problems in Hotel Analysis.** First or second term. Credit two or three hours, depending on work done. Registration limited. Assistant Professor COURTNEY. Martha Van Rensselaer Hall 227.

A seminar course for graduate students or seniors in hotel administration. Application of statistical methods to problems in hotel analysis. Each student will solve one or more problems.

[281. **Budgeting.** Second term. Credit two hours. Hotel elective. Mr. MAXFIELD. Not given in 1937-38.]

153. **Special Hotel Problems.** Second term. Credit two hours. Prerequisite, Hotel Administration 151 or its equivalent. Registration limited. Professor MEEK. Hours to be arranged.

A seminar course for graduate students and seniors in hotel administration. Devoted to the study of problems and management of hotels or in the relationship of the hotel as an institution to the community it serves.

119. **Personnel Administration in Hotels.** Second term. Credit three hours. Prerequisite, Rural Education 114 or its equivalent. Assistant Professor WINSOR. M W F 8. Stone 102.

Study of the problems of human relations in industry. Methods and problems of recruitment, selection, placement, maintenance, organization, and government of employees are analyzed with particular reference to the hotel industry.

219. **Seminary in Personnel Administration.** Second term. Credit two hours. Assistant Professor WINSOR. Th 4:15-6. Stone 203.

A study of current problems in personnel administration.

LAW

Professors of Law R. S. STEVENS, C. K. BURDICK, L. P. WILSON, G. J. THOMPSON, H. E. WHITESIDE, H. W. EDGERTON, G. H. ROBINSON, H. D. LAUBE, W. H. FARNHAM, J. W. MACDONALD, and L. W. MORSE.

The Division of Law consists of the members of the Faculty of Law, representatives of the associated departments of Economics, Government, History, and Philosophy in the College of Arts and Sciences, Professors DONALD ENGLISH, R. E. CUSHMAN, M. L. W. LAISTNER, and G. W. CUNNINGHAM, and such other members of the Graduate School Faculty as for the time being are serving on the special committees of candidates for the graduate degrees in law.

Approved Major and Minor Subjects (key to symbols on p. 29)

Jurisprudence **1, 2, 3, 4**
Legal History **1, 2, 3, 4**
Private Law **1, 2, 3, 4**
Procedure **1, 2, 3, 4**
Public Law **1, 2, 3, 4**

Graduate work in law is organized under the direction of the Division of Law of the Graduate School, in which is vested authority to establish and administer rules for admission to candidacy for, and graduation with, the degrees LL.M. and J.S.D.

This method of organizing graduate work in law is considered especially advantageous since it offers to graduate students in law an opportunity to correlate their work in law with work in allied fields in other departments of the University, such as those in philosophy, history, government, business and finance.

Candidates for either of the graduate degrees in law must be in residence not less than one academic year.

The Master's degree is intended primarily for those in practice or intending to enter practice who desire to increase their knowledge of the law by intensive work in special fields.

Work leading to the Doctor's degree is designed to train legal scholars and to stimulate original investigation which shall constitute a contribution to the scientific study of law and to the solution of problems in the fields of the history, content, administration, and progress of the law. It is expected that candidates for the Doctor's degree shall have had some practical or teaching experience after obtaining a first degree in law.

A number of furnished offices are provided in the new Law School building, Myron Taylor Hall, for graduate students in law.

For more detailed information regarding graduate work in law see the current Announcement of the Law School.

The Library of the Law School contains some 75,000 volumes. In reports of the Federal Courts, and of the several American State jurisdictions, and in the reports of the British Commonwealth of Nations, Scotch, Irish, Canadian, Australian, and English colonial reports, the law library is practically complete to date. The library also possesses a similarly adequate collection of text books, complete sets of substantially all law periodicals in English, digests, annotations and law encyclopedias, Railroad and Public Service Commission Reports and Bar Association Reports of the various States. It contains a rapidly growing collection of reports, statutes, periodicals, and texts in French, German, and Italian. The Earl J. Bennett collection of Statute Law and the Myron C. Taylor collection of League of Nations Publications are of special value and interest. Several hundred volumes of the records and briefs of cases in the Supreme Court of the United States and in the New York Court of Appeals and accounts of important foreign and domestic trials are also to be found in the library.

The University Library containing over 850,000 volumes (exclusive of the number of volumes in the Law Library) is accessible to law students in the same way as to students in the other colleges.

Seminar courses in law will be given when the election by suitable groups is indicated. Advanced courses in associated fields also may be required or approved. Directed research will be arranged with the approval of the faculty.

50. **Jurisprudence.** First term. Two hours. Required for all graduate students in law and elective for other graduate students and selected third year law students. Professor LAUBE. Assigned reading and selected cases.

An examination of the nature and end of law, its sources, its forms, its scope, its application and its growth.

50a. **Problems in Jurisprudence.** Second term. One hour. Professor LAUBE. Elective for graduate and selected third year students.

[51. **Administrative Law.** Second term. Two hours. Professor MACDONALD. Not given in 1937-38.]

A discussion of the law applicable to determinations involving private rights made by bodies other than the courts. This involves a study of the theory of the separation of powers, and of the functions of the three branches of government. The course centers upon the nature of the various powers over private rights granted to non-judicial bodies; the nature of the proceeding before such bodies; the manner of the determination of the issue, including executive discretion; and the nature of the control exercised by the courts over such determinations. Elective for graduate and third year students.

52. **Round Table on Damages.** First term. One hour. Professor WILSON. Fifteen class hours will be devoted to informal discussion. Elective for graduate students and for third year students with permission of the professor in charge.

A course of informal study covering the general principles of damages at law and contrasting these with other forms of relief which may be available in certain typical situations.

54. **Seminar in Corporations.** Second term. Prerequisite: Satisfactory completion of a course in Private Corporations. Professor STEVENS. Supervised individual study of particular problems, preparation of reports, and group conferences. Elective for graduate and for selected third year students with the consent of the instructor.

55. **Seminar in Legal History.** Time to be arranged. Professors WHITESIDE, THOMPSON, and FARNHAM. Elective for graduate and selected third year students.

56. **Seminar in International Law and International Relations.** Time to be arranged. Professors BURDICK and ROBINSON. Elective for graduate and selected third year students.

57. **Seminar in Modern Movements in Procedure.** Time to be arranged. Professors THOMPSON, MACDONALD, and WILSON. Elective for graduate and selected third year students.

60. **Problems in the Public Utility Field.** Second term. Prerequisite: A course in Constitutional Law or in the Law of Public Utilities. Professors THOMPSON and ROBINSON. Seminar based on research problems. Elective for graduate and selected third year students.

61. **Problems in Trusts and Estates.** Second term. Professor WHITESIDE. Elective for graduate and selected third year students.

VETERINARY MEDICINE

Approved Major and Minor Subjects (key to symbols on p. 29)

Animal Pathology **1, 2, 3, 4**
Animal Physiology **1, 2, 3, 4**
Diseases of Large Animals **1, 2, 3, 4**
Diseases of Small Animals **1, 2, 3, 4**
Immunology **1, 2, 3, 4**
Pathogenic Bacteriology **1, 2, 3, 4**
Pharmacology **1, 2, 3, 4**
Poultry Diseases **1, 2, 3, 4**
Veterinary Anatomy **1, 2, 3, 4**
Veterinary Obstetrics **1, 2, 3, 4**
Veterinary Parasitology **1, 2, 3, 4**
Veterinary Surgery **1, 2, 3, 4**

ANIMAL BREEDING, HUSBANDRY, NUTRITION

See under ANIMAL SCIENCES, p. 59.

VETERINARY ANATOMY

Professor EARL SUNDERVILLE.

The laboratories of the department are well equipped for classwork and research. In the regular courses offered, the anatomy of the domestic animals is given.

The following courses are open to graduate students. For details of subject matter, see the Announcement of the New York State Veterinary College.

1. **Comparative Osteology.** First term. Three hours.
2. **Arthrology.** First term. One hour.
3. **Myology and Viscera.** First term. Three hours.
4. **Myology, Thoracic, and Abdominal Viscera, Lymphatic System, and Organs of Special Sense.** Second term. Six hours.
5. **Blood Vessels and Nerves of the Arm, Leg, and Head.** First term. Five hours.
6. **Canine Anatomy.** Second term. One hour.

VETERINARY PHYSIOLOGY

Professors H. H. DUKES and C. E. HAYDEN; *Doctor* H. T. BATT.

The laboratories of the department are well equipped for research work in the physiology of the domestic animals. Adequate facilities are available for work in both the experimental and the applied chemical fields. The Flower Library, in James Law Hall, provides a good collection of periodicals and books on physiology and related subjects. These may be supplemented by the many works on physiology in the main library. The Veterinary Experiment Station, not far from the College, may be utilized for the study of those problems outside the scope of the laboratory.

Graduate students who plan to do their major work in veterinary physiology must have had the basic subjects of the department or their equivalents. Graduate students who plan to do minor work in veterinary physiology may undertake special problems or research work if they are qualified, or they may pursue work in the regularly scheduled courses of the department.

10. *Animal Physiology.* Either term. Credit three hours.
11. *Chemical Physiology.* Second term. Credit four hours.
12. *Physiology of the Domestic Animals.* Second term. Credit three hours.
13. *Physiology of the Domestic Animals.* First term. Credit three hours.
14. *Experimental Physiology.* First term. Credit three hours.
15. *Applied Chemical Physiology.* First term. Credit two hours.

16. **Advanced Experimental Physiology.** Second term. Credit two hours. Prerequisites, Course 12 or 13, or its equivalent, and Courses 14 and 15, or their equivalent. Registration by permission. Professors DUKES and HAYDEN, and Dr. BATT. Time to be arranged.

A laboratory course in mammalian and avian physiology. Laboratory fee, $10.

17. **Special Problems in Chemical Physiology.** Both terms. Registration by permission. Professor HAYDEN. Hours to be arranged.

This course will be adapted to the needs of students and will consist of laboratory work, conferences, collateral readings, and reports. Laboratory fee, $2 a credit hour.

18. **Research.** Both terms. Hours to be arranged. Professors DUKES and HAYDEN.

ANIMAL PATHOLOGY, BACTERIOLOGY AND IMMUNOLOGY

(See also under BACTERIOLOGY, p. 61)

Professors W. A. HAGAN, PETER OLAFSON, E. L. BRUNETT, and A. ZEISSIG.

The laboratories of pathology and bacteriology are well equipped with apparatus for research in pathological anatomy, pathogenic bacteriology, and immunity. The department operates two diagnostic laboratories to which a great deal of pathological material comes. A variety of fresh material is thus made available for study. In the Flower Library, which is housed in the same building with the department, a very complete set of current periodicals, and the more important books and monographs dealing with the work of the department is available.

Candidates for advanced degrees, electing pathology or bacteriology as their major subjects, must have had at least the corresponding general subjects given in this department, or their equivalents. Candidates electing a minor subject in this department may take up a research problem, if they possess sufficient preliminary training, or may pursue regular undergraduate course work, the courses taken being subject to the approval of the staff member who is in charge of the minor.

The following courses are open to graduate students. For additional information, see the Announcement of the New York State Veterinary College.

40. *General Pathology.* First term. Two hours.
40a. *General Pathology Laboratory.* First term. Two hours.
41. *Special Pathology.* Second term. Two hours.
41a. *Special Pathology Laboratory.* Second term. Two hours.
42. *Pathology of Infectious Diseases.* First term. Two hours.
43. *General Bacteriology.* First term. Two hours.
43a. *General Bacteriology Laboratory.* First term. Two hours.
46. *Diseases of Poultry.* Second term. Two hours.
48. *Food Hygiene.* Second term. Two hours.
49. *Pathogenic Bacteriology and Immunity.* Second term. Two hours.
49a. *Pathogenic Bacteriology Laboratory.* Second term. Three hours.
149. *Pathogenic Bacteriology Laboratory.* Second term. Two hours.

151. **Immunological Methods.** First term. Prerequisites, Courses 49, and 49a or 149. Professor ZEISSIG. Class limited to twelve students. Two laboratory periods on consecutive days. Hours to be arranged. Laboratory fee, $10.

152. **Advanced Work in Pathology and Bacteriology.** For students who have completed the undergraduate courses in pathology and bacteriology. Professors HAGAN and OLAFSON. Special problems or assignments will be given. Hours to be arranged. Laboratory fee, $2 a credit hour.

153. *Hematology.* Second term. One hour.

154. **Seminar.** First and second terms. One hour, time to be arranged. Required of all graduate students.

(For Dairy Bacteriology, see Dairy Bacteriology; for soil bacteriology, see Agronomy.)

DISEASES OF BREEDING CATTLE

(Also includes VETERINARY PARASITOLOGY)

Professors R. R. BIRCH, H. L. GILMAN, and D. W. BAKER.

The department maintains a herd of cattle to be used in research with diseases that interfere with reproduction. Ample facilities are at hand for the study of the clinical and laboratory aspects of this group of diseases, and special research problems are being worked out at all times. Excellent facilities are also available for investigation of parasitological problems.

The following courses are open to graduate students. For additional information, see the announcement of the Veterinary College.

62. *Animal Parasitology.* First term. Two hours.

62a. *Parasites Laboratory.* First term. One hour.

63. **Advanced Work in Animal Parasitology.** Either term. Professor BAKER. Hours by arrangement.

Special problems with the parasites of animals.

VETERINARY PHARMACOLOGY AND DISEASES OF SMALL ANIMALS

Professors H. J. MILKS and H. C. STEPHENSON.

The laboratories of the department are well equipped for research in veterinary pharmacology. The clinic supplies abundant material for research both in external and internal diseases of small animals.

There is an operating room with modern equipment and facilities for handling approximately sixty animals. The library facilities are good.

20. *Pharmacology.* Second term. Four hours.

21. *Materia Medica and Pharmacy.* Second term. Two hours.

22. *Diseases of Small Animals.* First term. Two hours.

22a. *Diseases of Small Animals.* First term. Two hours.

23. *Recitations in Materia Medica and Therapeutics.* First term. Two hours.

24. **Advanced Work.** This course will consist principally of the study of the action of drugs upon well and sick animals, and of the diseases of small animals. This will be supplemented by collateral reading and reports.

25. *Small Animal Clinic.* Six actual hours a week.

VETERINARY MEDICINE, AMBULATORY CLINIC, AND OBSTETRICS INCLUDING DISEASES OF THE GENITAL ORGANS

Professors D. H. UDALL and M. G. FINCHER.

Opportunity for the clinical study of internal diseases of animals is afforded by material in the ambulatory clinic. This clinic has gradually developed until it demands a large part of the time of two clinicians. Especially abundant are affections of dairy animals. Students are required to report their observations. Files of notes on completed cases are available for additional information. Special and research students will be given individual instruction to meet their requirements, and may supplement their clinical experience with further study in the various laboratories and museums of the College.

VETERINARY SURGERY

Professor J. N. FROST.

The laboratory in surgery is well equipped for research and special study along surgical lines especially in connection with diseases of bones, tendons, and tendon sheaths.

Candidates for advanced degrees should have as preliminary preparation, general pathology, physiology, general and special surgery.

32. *Special Surgery.* Second term. Five hours. Professor FROST.

Research in Surgical Diseases. Professor FROST.

THE MEDICAL SCIENCES

AS PRESENTED IN THE MEDICAL COLLEGE IN NEW YORK CITY

The Graduate Faculty of the Medical College (Group F of the Graduate School) at present consists of professors in the preclinical branches of medicine who accept properly qualified students as candidates for the higher academic degrees. The qualifications required of graduate students are in every particular those which are required of students in other divisions of the University. Students desiring to enter the Graduate School for work in the medical sciences can obtain application blanks at the office of the Dean of the Medical College. Professor C. V. Morrill, Chairman of the Group, may be consulted for additional information. For a description of the work in the Medical College in Ithaca and in New York City, see the Announcement of the Medical College.

The Medical College in New York City now occupies a portion of the plant of the New York Hospital-Cornell Medical College Association. This new medical center is located on the bank of the East River north of the Rockefeller Institute for Medical Research. It occupies several city blocks extending from the East River on the east to York Avenue on the west, and from Sixty-eighth Street on the south to Seventy-first Street on the north. All city streets within the area, except Seventieth Street, have been eliminated. Thus the buildings in the group comprising the plant are for the most part contiguous and so arranged as to facilitate easy access between the clinical departments of the Medical College situated in the New York Hospital and the laboratories of the preclinical departments of the Medical College.

The Medical College group consists of buildings in the western part of the plant, facing York Avenue, opposite Sixty-ninth Street. These buildings from north to south are occupied by the departments of Anatomy, Public Health, Bacteriology, Pathology, Physiology, Biochemistry, and Pharmacology. The library is located in the building of the Department of Pathology and is constructed to accommodate with its stacks 100,000 volumes.

ANATOMY

Professors C. R. STOCKARD, C. V. MORRILL, G. N. PAPANICOLAOU, J. F. NONIDEZ, and P. B. ARMSTRONG.

Abundant material and sufficient apparatus are available for advanced study and work in the various branches of anatomy, embryology, histology, comparative morphology, descriptive anatomy, and experimental anatomy. Students desiring to pursue graduate work in any of these branches must have had in their college courses preliminary training in general zoology and comparative anatomy. A reading knowledge of German and French is essential.

New York City offers exceptional advantages for obtaining fresh human materials. The large slaughter-houses are accessible for comparative mammalian tissues and organs. The extensive collections of specimens and models in the city museums are extremely helpful and instructive to the advanced student.

The members of the staff offer courses in the various phases of anatomy in which they are especially engaged. The courses offered for the medical students appear in the Announcement of the Medical College, and are particularly recommended to those students who have not pursued work of this kind. Technical and practical anatomical work are fully provided.

Preliminary Requirements: Physics, Chemistry, and Biology as required for admission to the Medical College.

Morphology, Embryology, Histological Technic, General Histology, Microscopic Anatomy and Organology, Descriptive Anatomy, including courses in dissection of the human body. Demonstrations on the Cadaver, Live Anatomy, Topographical Anatomy, Neuro-Anatomy and Neuro-Histology, Applied Anatomy, Organs of Special Sense, Anatomical Research.

Anatomy of the Living Body. Professor STOCKARD.

Topographical and Regional Anatomy. Professors STOCKARD and MORRILL.
Human Histology and Histogenesis. Professor NONIDEZ.
Experimental Morphology. Professor STOCKARD.
Anatomy of the Infant and Postnatal Development. Professor STOCKARD.

BACTERIOLOGY AND IMMUNOLOGY

Professors JAMES M. NEILL and JOHN Y. SUGG.

The course given to second year students consists of lectures, laboratory work, and group conferences. Emphasis is placed upon the aspects of bacteriology and of immunology that are pertinent to an understanding of the etiology and pathogenesis of infectious diseases. The study of infectious material from patients is included in the laboratory part of the course, not only to acquaint the student with the technical procedures but to illustrate the directness of application of the fundamental principles of the subject to the practical methods used in the examination of clinical material.

Graduates and special students. Opportunities for advanced study and for research will be offered to students particularly interested in bacteriology and immunology. Hours to be arranged.

BIOCHEMISTRY AND CHEMICAL PATHOLOGY

Professor R. W. JACKSON.

The laboratories available for advanced work and research in physiological chemistry and chemical pathology include those of the Department of Biochemistry, and a research laboratory in the General Memorial Hospital. These laboratories provide adequate equipment for investigation in a great variety of special problems in the chemistry of the plant, animal, or human organism in health or disease, by chemical, physical, or optical methods. In the college and departmental libraries the principal journals relating to these subjects are on file.

Students expecting to pursue investigation in physiological chemistry or chemical pathology should have adequate preliminary training in inorganic, analytical, and organic chemistry, as well as in physics, physiology, and physical chemistry, though a study of these latter subjects may be pursued at the College, together with more advanced work in special lines.

Organic and Physiological Chemistry: Research.
Physiological Chemistry.
Chemical Pathology.

PATHOLOGY

Professors EUGENE L. OPIE, ROBERT A. MOORE, JACOB FURTH, and JULES FREUND; *Doctor* D. MURRAY ANGEVINE.

The departmental laboratories are suitably equipped for carrying on graduate study and research problems in the general field of Pathology. Since members of the staff are engaged in varied investigations concerning etiology and pathogenesis, the department offers wide opportunity for the experimental study of disease. Adequate facilities for the care of animals are generally available. There is a small departmental library where some of the current journals and reference books are kept on file. The main library is situated on the floor immediately beneath the department, and is readily accessible. There is a carefully culled collection of mounted museum specimens, in addition to an active file of preserved gross material for study. The histological collection is likewise unusually rich in material. Autopsies for the entire hospital are performed by the members of the department, and offer an opportunity for the study of fresh pathological tissues.

No regular course of study is offered by the department for graduate students, but applicants in this field are given every opportunity for special work under the direct supervision of a member of the department. Such work may include the original investigation of some problem, and may be credited towards the applicant's graduate degree. Applicants who have been admitted to the Graduate

School are required to present the equivalent of the first two years of medicine for admission to graduate work in the department.

Preliminary requirements: Anatomy, including Histology and Embryology, General Pathology, including Pathological Anatomy. Autopsy Technique and Experimental Pathology.

PHARMACOLOGY

Professors McKEEN CATTELL and HARRY GOLD.

Facilities are available for advanced work and research in both the chemical and pharmacodynamic aspects of pharmacology. In addition, arrangement can be made in special cases for correlating laboratory results with clinical studies. Special opportunities are afforded for the investigation of the action of drugs on the circulation, the autonomic nerves, and muscle. The department is well equipped with special apparatus, including a string galvanometer with amplifying system, and with galvanometers and accessories for the measurement of small temperature changes such as are employed for the measurement of heat production in tissues.

An adequate preliminary training in chemistry and physiology is prerequisite for graduate work in pharmacology.

Materia Medica and Pharmacy: Pharmacology.
Research in Pharmacodynamics.
Toxicology.

PHYSIOLOGY

Professors JOSEPH C. HINSEY, DAYTON J. EDWARDS, WILLIAM H. CHAMBERS, and ROBERT A. PHILLIPS.

The laboratories of this department are equipped for teaching and for research on special problems. Advantages are afforded also by a departmental library that contains complete sets of the principal physiological journals with selected sets on certain allied subjects and a fairly large number of books on physiology and related topics.

There are no courses arranged especially for graduate students but it is expected that candidates electing a major in physiology will familiarize themselves with the regular required work for the students of medicine. In addition there will be opportunity to pursue intensively some topic which the candidate may elect with the advice of a member of the department. Special facilities are available for carrying on work in the subjects of nerve conduction, endocrinology, dynamics of the heart and circulation, calorimetry as applied to animal metabolism, and problems related to the visceral and central nervous systems.

Students electing physiology as a minor course may select either the regular work given to medical students, or may select only a portion of this course provided an additional amount of special work is undertaken.

As a prerequisite for graduate work in physiology the student will be expected to have a thorough training in the fundamental sciences of physics, chemistry, and biology.

PUBLIC HEALTH AND PREVENTIVE MEDICINE

Professors JOHN C. TORREY and MORTON C. KAHN.

Public Health and Preventive Medicine. This course is comprehensive in nature and deals with the fundamental factors concerned in the origin, increase and control of communicable and non-communicable diseases. It is intended to familiarize the student with the opportunities for disease prevention through public health organizations and in private practice, both in urban and rural communities. Among the subjects discussed in a series of lectures are environmental control, sources and modes of infection, specific and non-specific prophylaxis, vital statistics, and public health administration. Many of these subjects are illustrated by laboratory and field demonstrations. 96 hours.

Epidemiology. A study of the factors and principles concerned in the origin, spread and abatement of the more important communicable diseases as illustrated by past and, when possible, current outbreaks. Collection of epidemiological data and statistical analyses. Conferences. Hours to be arranged.

Medical Zoology and Parasitology. This course is intended to supplement and extend the required work in this field. Diagnosis, life histories of parasites and their vectors, and control measures are considered. Laboratory work and conferences. Hours to be arranged.

Practical Field Work in Public Health. Technic of sanitary surveys. Study of municipal and county health organizations and their activities. Hours to be arranged.

Tropical Hygiene. Special hygienic problems associated with a tropical environment. Lectures and conferences. Hours to be arranged.

Public Health Laboratory Methods and Procedures. Students may select specific problems for investigation or the course may be made of general character.

THE AGRICULTURAL SCIENCES

AS PRESENTED IN THE NEW YORK STATE EXPERIMENT STATION AT GENEVA

U. P. HEDRICK, *Director*

P. J. PARROTT, *Vice-Director*

Since July 1, 1923, the New York State Experiment Station at Geneva has been under the administration of Cornell University. Research workers on its staff are members of the Faculty of the Graduate School, and its facilities for research are available to graduate students.

The Station is equipped to care for graduate students in certain specific lines of research, viz., Bacteriology, Chemistry, Dairying, Economic Entomology, Plant Pathology, Pomology, Seed Investigations and Vegetable Crops. Ample accommodations are available from the standpoint of laboratory facilities, reference library, etc., for research in the laboratory sciences. Greenhouses and also a farm of approximately 200 acres are available for work with fruits and vegetables, and a dairy herd is maintained for work with animals and to supply dairy products for experimental studies.

Certain phases of the investigations now being conducted at the Station and other problems for which the facilities of the Station are suitable may be used as thesis problems by graduate students.

BACTERIOLOGY

Professors R. S. BREED, H. J. CONN, G. J. HUCKER, C. S. PEDERSON, M. W. YALE and C. D. KELLY.

Members of this Division are engaged in a study of problems in applied dairy, cheese, soil, fermentation and food bacteriology and in fundamental physiological and taxonomic studies of bacteria. Thesis problems may be selected in any of these fields as follows:

Dairy Bacteriology. Professors BREED, HUCKER, and YALE.
Soil Bacteriology. Professor CONN.
Biological Stains. Professor CONN.
Food Poisoning. Professor HUCKER.
Food and Fermentation Bacteriology. Professor PEDERSON.
Taxonomy of Bacteria. Professors BREED, CONN, HUCKER, and PEDERSON.

CHEMISTRY

Professors D. K. TRESSLER, A. W. CLARK, W. F. WALSH, Z. I. KERTESZ, and G. L. MACK, and *Doctors* C. O. WILLITS and A. W. AVENS.

Opportunities for graduate research in the following fields are offered: the chemistry, technology of preservation, and nutritive values of fruits, fruit juices, vegetables, and other foods; plant enzymes; the chemistry of pectin; insecticides and fungicides; vitamins of animal feeds, and the chemistry and technology of wine manufacture.

Nutritive Value of Foods. Professors TRESSLER and MACK.
The Chemistry of Fruits and Vegetables. Professor TRESSLER.
The Preservation of Fruits and Vegetables. Professor TRESSLER.
The Technology of the Preservation of Fruit Juices. Professors TRESSLER and WALSH.
Vitamins of Animal Feeds. Professor CLARK and Doctor WILLITS.
Plant Enzymes. Professor KERTESZ.

The Chemistry of Pectin. Professor KERTESZ.
Insecticides and Fungicides. Dr. AVENS.
Chemistry and Technology of Wine Manufacture. Professor TRESSLER.

DAIRYING

Professors A. C. DAHLBERG, D. C. CARPENTER, J. C. HENING, and J. G. MARQUARDT.

Advanced graduate work in the fields of chemistry and technology of ice cream manufacture, chemistry of proteins, and plastics, dairy chemistry, factors controlling the flavors in milk products, etc., is offered to graduate students as indicated below:

The Technology and Chemistry of Ice Cream Manufacture. Professors DAHLBERG and HENING.
Dairy Chemistry and Plastics. Professor CARPENTER.
Chemistry of Proteins. Professor CARPENTER.
Dairy and Milk Products. Professors DAHLBERG and HENING.
The Technology of Cheese Making. Professor MARQUARDT.

ENTOMOLOGY

Professors P. J. PARROTT, H. GLASGOW, F. Z. HARTZELL, S. W. HARMAN, P. J. CHAPMAN, D. M. DANIEL, G. E. R. HERVEY, F. G. MUNDINGER, and H. C. HUCKETT; and *Doctors* F. L. GAMBRELL, O. H. HAMMER, and L. A. CARRUTH.

The Staff of this Division is engaged in research work on a variety of agricultural insect pest problems of the State. Students may obtain, by arrangement, supervision of work on advanced research problems falling within the fields of insect pests affecting deciduous fruits, vegetable crops, nursery and ornamental plants, biological control of insects, and applications of biometry and ecology in applied entomology.

Fruit Insects. Professors PARROTT, CHAPMAN, HARTZELL, HARMAN, MUNDINGER, and Dr. HAMMER.
Vegetable Insects. Professors GLASGOW, HUCKETT, HERVEY, and Dr. CARRUTH.
Nursery Insects. Dr. GAMBRELL.
Applied Ecology. Professor HARTZELL.
Applications of Biometry. Professor HARTZELL.
Biological Control of Insects. Professor DANIEL.

PLANT PATHOLOGY

Professors O. A. REINKING, J. G. HORSFALL, W. O. GLOYER, J. M. HAMILTON, H. S. CUNNINGHAM, L. M. COOLEY, R. O. MAGIE, and D. H. PALMITER.

The Division offers opportunities for graduate research in diseases of fruits, vegetables, canning crops and hops; fungicides; diseases caused by *Fusaria*; taxonomy of *Fusaria*, and ecology of plant diseases. Students may select problems as indicated below:

Diseases of Fruits. Professors HAMILTON, REINKING, GLOYER, COOLEY and PALMITER.
Diseases of Vegetables. Professors HORSFALL, REINKING, GLOYER and CUNNINGHAM.
Diseases of Canning Crops. Professors HORSFALL and REINKING.
Diseases of Hops. Professor MAGIE.
Fungicides. Professors HAMILTON and HORSFALL.
Diseases caused by Fusaria. Professor REINKING.
Taxonomy of Fusaria. Professor REINKING.
Ecology of Plant Diseases. Professors HORSFALL AND REINKING.

POMOLOGY

Professors R. WELLINGTON, H. B. TUKEY, R. C. COLLISON, G. P. VAN ESELTINE, and B. R. NEBEL.

This Division is engaged in research in the following fields: genetics of fruit breeding; plant propagation and rootstocks including stock and cion relations; developmental morphology of deciduous fruits; orchard soil management; orchard management; cytology and taxonomy of horticultural plants. No formal courses are offered but students may register for work on problems as indicated below:

Fruit Breeding Problems. Professor WELLINGTON.
Developmental Morphology of Deciduous Fruits. Professor TUKEY.
Rootstock Problems, including Stock and Cion Relations. Professor TUKEY.
Fertilization and Nutritional Studies with Trees. Professor COLLISON.
Orchard Soil Technology. Professor COLLISON.
Cytology in Relation to Cultivated Fruits. Professor NEBEL.
Development of Horticultural Plants. Professor VAN ESELTINE.
The Taxonomy of Horticultural Plants. Professor VAN ESELTINE.

SEED INVESTIGATIONS

Professors M. T. MUNN and W. F. CROSIER.

Seed investigations covering the wide field of seed production, distribution and control are under way at the Station. By special arrangement qualified students can undertake graduate research in analytical methods, physiology of germination, taxonomy of incidental plant seeds, histology of seed structure, seed-borne microorganisms, seed control and improvement and a few closely allied fields.

Seed Investigations. Professors MUNN and CROSIER.

VEGETABLE CROPS

Professors C. B. SAYRE and W. T. TAPLEY.

Students may obtain, by arrangement, supervision of work on problems in the history and description of varieties, plant nutrition, fertilizers, and fertilizer placement for vegetable crops, factors affecting quality of cannery vegetables, cropping systems and improved methods of crop production and field plat technique. Studies in these fields of work can be best undertaken during the summer.

Variety Studies of Vegetables. Professors SAYRE and TAPLEY.
Vegetable Breeding Problems. Professors SAYRE and TAPLEY.

FELLOWS: SCHOLARS: ROSTER OF DEGREES

FELLOWS AND GRADUATE SCHOLARS IN 1936–37

RESIDENT DOCTORS

Allen, Elsa Guerdrum, A.B., Ph.D., Cornell, 1912, 1929.
Curtis, Quin F., A.B., Michigan, 1930, A.M., Ohio Wesleyan, 1936, Ph.D., Michigan, 1936.
Hirsh, Frederick Rudolph, jr., A.B., A.M., Ph.D., Cornell, 1926, 1928, 1931.
Rabotnikoff, Abraham Simon, M.E., M.M.E., Ph.D., Cornell, 1929, 1932, 1936.
Rappenecker, Caspar, A.B., Ph.D., Cornell, 1927, 1936.
Richards, Bert Lorin, Ph.D., Wisconsin, 1920.
Sabine, George Burr, A.B., Ph.D., Cornell, 1931, 1936.
Selman, Ireson Walton, Ph.D., Imperial College of Science and Technology of London.
Smith, Laura Lee W., B.S., Miami, 1925, M.S., Iowa State, 1927, Ph.D., California, 1930.
deTomasi, James Ambrogio, Dr.Sc., Milan, 1924.
Towl, Forrest Milton, C.E., M.C.E., Cornell, 1886, 1935.
Weindling, Richard, Ph.D., California, 1933.
Wheeler, Everett Pepperell, A.B., M.S., Ph.D., Cornell, 1923, 1926, 1930.
Woolley, Helen Thompson, Ph.B., Ph.D., Chicago, 1897, 1900.

ENDOWED AND UNIVERSITY FELLOWSHIPS

The Anna Cora Smith Fellowship in Home Economics: Reha Johnson Loosli, B.S., Utah State, 1930.
The Charles Bull Earle Memorial Fellowship in Mechanical and Electrical Engineering: Edward Porter Ellis, E. E., Cornell, 1936.
Clinton DeWitt Smith Fellowship in Agriculture: Ruth Elizabeth Remsberg, B.S., M.S., Idaho, 1928, 1929.
The Cornell Fellowship in English: Hugh Gilchrist Dick, A.B., Union College, 1930, A.M., Cornell, 1936.
The Cornell-Brookings Fellowship in Economics: Robert Lyman Smith, A.B., A.M., Oberlin, 1933, 1934.
Edgar J. Meyer Memorial Fellowship in Engineering Research: Clinton Ellicott Pearce, S.B., Massachusetts Institute of Technology, 1913.
The Erastus Brooks Fellowship in Mathematics: Jesse Emmert Ikenberry, A.B., Bridgewater College, 1928, A.M., Cornell, 1932.
The Fellowships in American History: Mary Effee Cameron, A.B., A.M., Mississippi State, 1929, 1931; Reid Bingham Duncan, B.A., M.A., Mississippi, 1932, 1933.
The Fellowships in Greek and Latin: Lillian Ruth Jaffin, A.B., Hunter, 1934, A.M., Cornell, 1935; Elizabeth Grace VanBuskirk, A.B., Vassar, 1927, A.M., Syracuse, 1929.
Fellowship in Political Economy: Paul B. Simpson, A.B., Reed College, 1936.
The George C. Boldt Fellowship in History: Goldwin Albert Smith, A.B., University of Western Ontario, 1933, A.M., Toronto, 1934.
The Goldwin Smith Fellowship in Botany, Geology, or Physical Geography: Oren L. Justice, B.S. in Ed., Ohio University, 1936.
The McGraw Fellowship in Civil Engineering: Dudley Joe Lewis, B.S. in C.E., A. and M. College of Texas, 1936.
The duPont Fellowship in Chemistry: Burt Carlton Pratt, B.S., Bucknell, 1933.
The President White Fellowship in Modern History: Edward Kidder Graham, A.B., A.M., North Carolina, 1933, 1934.
The President White Fellowship in Physics: Paul George Bohlke, B.S. in E.E., Nevada, 1936.

The President White Fellowship in Political and Social Science: George Frederick Reinhardt, A.B., California, 1933, A.M., Cornell, 1935.
The Sage Fellowship in Chemistry: William James Lord Wallace, B.S., Pittsburgh, 1927, M.A., Columbia, 1931.
The Schuyler Fellowship in Animal Biology: Leonard Grumbach, A.B., A.M., Cornell, 1934, 1935.
Sibley Fellowship in Mechanical and Electrical Engineering: Frederick Seward Erdman, B.S., Princeton, 1924, B.S. in M.E., Massachusetts Institute of Technology, 1927.
The Susan Linn Sage Fellowships in Philosophy: Cedric Evans, A.B., A.M., Nebraska, 1933, 1934; Alan Gewirtz, A.B., Columbia, 1934; Milton Howard Williams, A.B., Wesleyan, 1931, A.M., North Carolina, 1932.
The University Fellowship in Agriculture (First term): Frederick Harold Leinbach, B.S., Iowa State College, 1926, M.S., Colorado State, 1927; (*Second term*): George Rea Walker, B.S., Mississippi State College, 1934.
The University Fellowship in Architecture or Landscape Architecture: Richard N. Hoar, B.Arch., Alabama Polytechnic Institute, 1936.
The University Fellowship in German: Walter Julius Mueller, B.A., M.A., Wesleyan, 1934, 1935.
The University Fellowship in Romance Languages: Glen Shortliffe, B.A., M.A., Alberta, 1934, 1935.

SPECIAL TEMPORARY FELLOWSHIPS

American Cyanamid Fellowship: Olen Branford Garrison, B.S., Clemson Agricultural College, 1933, M.S., Louisiana State, 1934.
American Zinc and Chemical Company Fellowship: Wreal Lester Lott, A.B., Brigham Young, 1933.
Anheuser-Busch Fellowship (in Animal Husbandry): Paul Eugene Newman, B.S. in Agr., Purdue, 1932, M.S., Wisconsin, 1934.
Anheuser-Busch Fellowship (in Poultry Nutrition): Arnold E. Schumacher, B.S., Pennsylvania State, 1936.
Charles Lathrop Pack Fellowships: John R. Arnold, A.B., Fresno State, 1932, M.A., University of California, 1934; Richard Weaver, B.S., Pennsylvania State, 1933; Marvin E. Wilson, B.A., Cornell College, 1931; Claiborne H. Young, B.S., New Hampshire, 1918.
Dairy and Ice Cream Machinery and Supplies Association Fellowship: Mark Bancroft Ford, B.S., Iowa State, 1936.
Freeport Sulphur Company Fellowship: John K. Loosli, B.S., Utah State Agricultural College, 1931, M.S., Colorado Agricultural College, 1932.
Frosted Foods Fellowship No. 2: Marylizabeth Wellington, A.B., Cornell, 1936.
Grange League Federation Poultry Fellowship: Willis D. Gallup, B.S. in Chem., M.S., Oklahoma A. and M., 1922, 1927.
Lederle Fellowship: Henry Richard Kreisel, D.V.M., Cornell, 1936.
Lily Disease Investigation Fellowship: Daniel Keith O'Leary, B.S., Washington, 1929.
Nassau County Farm Bureau Association Fellowship: Mathias Cowley Richards, B.S., Utah State, 1932.
National Association of Audubon Societies' Fellowship: James Taylor Tanner, B.S., M.S., Cornell, 1935, 1936.
New York Florists' Club Fellowship for Floriculture Research: Edward Putnam Hume, B.S., Cornell, 1936.
New York Florists' Club Fellowship for the Investigation of Diseases of Roses Grown Under Glass: Eldon Wood Lyle, B.S., Oregon State, 1930.
New York Florists' Club Fellowship for the Study of Diseases of Cyclamens and Other Potted Plants, Lilies and Miscellaneous Plants: Jack Mayson Bickerton, B.S.A., British Columbia, 1934.
Niagara Sprayer and Chemical Company Fellowship for the Testing and Development of Fungicides: Russell A. Hyre, B.S., Ohio State, 1930.
North Shore Disease and Insect Control Fellowship: Kenneth Eugene Maxwell, B.S., California, 1933.

Procter and Gamble Company Fellowship: Francis B. Rosevear, A.B., A.M., Cornell, 1933, 1935.
Staten Island Growers' Fellowship: Manson Bruce Linn, A.B., Wabash College, 1930.
Texas Gulf Sulphur Company Fellowship: Eugene Marshall Stafford, B.S., M.S., California, 1933, 1935.

SCHOLARSHIPS

The Graduate Scholarship in Animal Biology: Henry Keith Townes, Jr., B.S., A.B., Furman, 1933.
The Graduate Scholarship in Civil Engineering: Yung-Moon Lee, B.S.C.E., Pei-Yang University, 1932, M.C.E., Cornell, 1936.
The Graduate Scholarships in Greek and Latin: Franklin Harold Copp, A.B., Hobart, 1936; Miriam Ethel Friedman, A.B., Hunter, 1935, A.M., Cornell, 1936.
The Graduate Scholarship in Physics: Anne Rebecca Oliver, A.B., Goucher College, 1934, A.M., Smith, 1935.
The Susan Linn Sage Graduate Scholarships in Philosophy: Paul Eshelman Williams, A.B., College of Puget Sound, 1933, A.M., California, 1935; Robert Linn Ormsby, B.A., Toronto, 1933; (First term): Donald Cassin Whittemore, A.B., Brown, 1933.
The Susan Linn Sage Graduate Scholarships in Psychology: Cleo Chrisof, A.B., Goucher, 1930; Martha Louise Lemmon, A.B., Sweet Briar, 1934, A.M., Cornell, 1935; Sarah Geraldine Longwell, A.B., Denison, 1929, A.M., Radcliffe, 1930.

TUITION SCHOLARSHIPS

Russell Bennett Archer, B.O.E., Syracuse, 1925 (Second term).
Donald Cross Bryant, A.B., A.M., Cornell, 1923, 1930.
Mary Osborne Bryant, A.B., Indiana, 1924, A.M., Pennsylvania, 1930.
George F. Dow, B.S., M.S., Maine, 1927, 1929.
Frederick Donald Hart, M.E., Cornell, 1936.
Joseph Corwin Howell, A.B., Rollins College, 1935 (First term).
Thelma Kistler, A.B., Cornell, 1932.
Harry Leon Kutz, A.B., Syracuse, 1930, A.M., Syracuse, 1931.
Karl Frank Lagler, A.B., Rochester, 1934 (First term).
Robert John Landry, A.B., Amherst, 1935.
Maxwell Littman, B.S., Cornell, 1936.
Hui Sien Liu, B.S.C.E., Tangshan College, 1933, M.C.E., Cornell, 1935.
Robert A. McHugh, A.B., Lafayette College, 1935.
Emory Aubert Mooney, jr., A.B., Furman, 1930, A.M., Virginia, 1933.
Charles Driscoll Murphy, A.B., Wisconsin, 1929, A.M., Harvard, 1930.
Joseph Merritt Murray, B.S., A.M., Indiana University, 1930, 1934.
Helene A. Nusslé, A.B., Coe, 1917.
Grace E. Ostrander, A.B., New York State College for Teachers, 1925, A.M., Cornell, 1933 (Second Term).
William Tuthill Payne, A.B., Cornell, 1930.
Petrana Peneva, Diploma, University of Sofia, 1921.
Alice A. Pierce, B.S., Syracuse, 1930, A.M., Cornell, 1932 (Second term. Special scholarship in the Department of Rural Education).
Mary Shaw Ryan, A.B., Goucher, 1933.
John Albert Sanford, A.B., Union, 1931.
Seymour Sherman, A.B., Cornell, 1936.
Alfred Lewis Shoemaker, A.B., Muhlenberg, 1934.
Dwight E. Sollberger, B.S. in Ed., Slippery Rock State Teachers College, 1932.
Clinton R. Stimson, B.S., Cornell, 1935, M.S., Iowa State College, 1936.
Vladimir Gerassim Terentieff, Cand. of Laws, Moscow, 1916.
Evelyn M. Van Duzer, B.S., Albright College, 1929, M.S., Cornell, 1933.
Thomas Cobb Watkins, B.S., Davidson, 1928, M.S., North Carolina, 1930.
Bertram John Weston, B.A., Cambridge, 1928, M.Sc. in Agr., U. of Pretoria (South Africa), 1931.
Judson Dwight Wilcox, A.B., Cornell, 1935.
William Yu Yang, B.S., Nanking, 1930.

ADVANCED DEGREES CONFERRED IN 1935–36

MASTERS OF ARTS

Conferred September 25, 1935

Alice Elliott Belding, A.B.; Zoology, Nature Study. Thesis: Squirrel Records as Noted by Early American Historians.

Mary Alice Cotter, A.B.; The Romantic Poets, Victorian Literature. Thesis: The Writings of Charles Dickens to the Year 1837.

Abbie Marguerite Durkee, A.B.; Musicology, English History. Thesis: The English Madrigal with Especial Reference to Michael East.

Ruth Emery, A.B.; English History, European History. Thesis: Benjamin Robert Haydon, A Study of his Life and Times.

Samuel Arnold Guttman, A.B.; Physiology, Anatomy. Thesis: Studies on the Effect of Radiation on the Excitability and Rhythmicity of Muscle.

Sophie Dorothea Herty, A.B.; Plant Physiology, Morphology. Thesis: The Influence of Temperature on Translocation from Leaves of *Phaseolus vulgaris* L.

Richard Greenfield Horton, A.B.; Human Physiology, General Zoology. Thesis: The Relations of Cyanides and Vitamin C to Experimental Goiter.

Sarah Janet Humphrey, A.B.; Dramatic Production, Dramatic Literature. Thesis: Delsarte's Synthetic Philosophy of Expression.

Albert Henry Huntington, A.B.; Labor Economics, Sociology. Thesis: Some Aspects of Relief in the City of Ithaca, New York.

Frances Mary Jennings, A.B.; Latin, French. Thesis: An English Translation of "Ad C. Herennium—De Ratione Dicendi"—Book IV.

Karl vonVorse Krombein, B.S.; Taxonomic Entomology, Education. Thesis: A Revision of the North American Myzininae (Hymenoptera: Tiphiidae).

Adolphus Joseph Lockhart, A.B.; Inorganic Chemistry, Organic Chemistry. Thesis: Studies on the Oxidation of Hydrazine and of Hydroxylamine by the Complex Delectronator Potassium Permanganate.

Louise McGilvrey, A.B.; Victorian Era, The Romantic Poets. Thesis: The Novels of Anne Brontë as Related to her Life and Compared to the Novels of her Sisters.

Ralph Duane Myers, A.B.; Physics, Astronomy. Thesis: The Surface Photo-Electric Effect.

Homer Whitman Patnode, A.B.; Petrography, Economic Geology. Thesis: Petrographic Study of an Intra-Septum Intrusion in the Sierra Nevada.

Ethel Louella Paris, B.S.; Education, Zoology. Thesis: A Study of Problems Peculiar to the Teaching of Physics at Bennett High School, Buffalo, New York.

Lincoln Coles Pettit, A.B.; Insect Embryology, Medical Entomology. Thesis: The Embryonic Development of *Blatta germanica* Linn. A Review with Added Notes.

Myra Zoe Robinson, A.B.; General Zoology, Systematic Zoology. Thesis: A Comparison of Perching Mechanism in Birds.

George William Scott, jr., A.B.; Experimental Physics, Theoretical Physics. Thesis: The Continuous Beta Ray Spectrum.

Estella V. Lenore Sherrill, A.B.; Modern European History, English History. Thesis: The Political Position of Women in Six Countries of Modern Europe.

Clyde Sherman Stine, A.B.; Public Speaking, Economics. Thesis: A Rhetorical Study of Selected American Speeches Delivered in the League of Nations Controversy.

Frederick Harold Test, B.S.; Ornithology, Systematic Zoology. Thesis: Bird Weight and its Significance.

Louise Augusta Thompson; French, Latin. Thesis: A Parallel Between Paul Valery and T. S. Eliot.

Louise Tobey, A.B.; Zoology, Nature Study. Thesis: The Past and Present Status of the Game and Fur-Bearing Animals of the State of New Hampshire.

Kenneth Stead Weaver, A.B.; Latin Language, Latin Literature. Thesis: Continuing Negatives in Cicero.

Marie Elsie West, A.B.; Spanish, Geography. Thesis: Digressions in the Picaresque Novel.

CONFERRED FEBRUARY 5, 1936

Hugh Gilchrist Dick, A.B.; English Literature, Seventeenth Century Literature. Thesis: *Albumazar* by Thomas Tomkis, 1614. Edited with Introduction and Notes.

Margaret Anita Hannes, A.B.; French, English. Thesis: A Critical Edition of *la Symphonie Pastorale* by Andre Gide.

Madeleine Margaret Hickey, A.B.; French, English. Thesis: A Study of the Drama of Jules Romains.

Muriel Dorothy Kaiser, A.B.; Latin, German. Thesis: The *De Paradiso* of St. Ambrose: an Introduction and an English Translation.

Virgil Ray Ruegsegger, A.B.; Rural School Administration, Rural School Supervision. Thesis: Are Conditions in Michigan such as to Make it Advisable to Attempt a Reorganization of Rural Schools Using only One Type of Administrative Unit as a Basis?

Louise Carol Titcomb, B.M.; Musicology, French. Thesis: English Cathedral Music from the Reformation to Purcell.

CONFERRED JUNE 15, 1936

Henry Arlo Anderson, A.B.; American Literature, Seventeenth Century Literature. Thesis: The Contribution of Transcendentalism to Education.

Marian Bender, A.B.; Seventeenth Century English, English Prose Fiction. Thesis: The Mysticism of Henry Vaughan.

Ethel Bernstein, A.B.; Nineteenth Century Literature, Elizabethan Literature. Thesis: Donne's Influence on Browning.

Frances Bickelhaupt, A.B.; American History, Modern European History. Thesis: Methodism in the Old Northwest, 1787–1820.

Julius Marcus Bloch, A.B.; American History, Government. Thesis: The Foundations of Woodrow Wilson's Political Philosophy.

Henry George Bovenkerk, A.B., M.Theol.; Rural Social Organization, Rural Economy. Thesis: The Structure of the Japanese Village.

Sylvia Roslyn Britwoods, A.B.; Seventeenth Century English Literature, Elizabethan Literature. Thesis: Oberon in England, 1500–1650.

Benjamin Bartram Cadbury, A.B.; Vertebrate Zoology, Entomology. Thesis: Notes on the Salamanders of West Virginia.

Lawrence David Clark, A.B.; Physics, Education. Thesis: The Stroboscopic Measurement of Sound Frequency.

Florence Roberta Cope, A.B.; Modern English Literature, Dramatic Literature. Thesis: James Elroy Flecker—*Hassan*.

Robert Mitchell Crabbs, A.B.; Nineteenth Century Poetry, Old English. Thesis: Browning and the Modern Poets.

Harold King Darling, A.B.; American History, European History. Thesis: Early American-Hawaiian Relations, 1789–1851.

Ethel DuBois, A.B.; Embryology, Genetics. Thesis: The Development of the Pronephros and Early Mesonephros in the White Rat.

Seymour Ballard Dunn, A.B.; Modern European History, Education. Thesis: THE NATIONAL FESTIVAL: A French Revolutionary Institution, 1789–1804.

David Hamilton Edwards, A.B.; Sixteenth Century Literature, Tudor-Stuart History. Thesis: *A Woman is a Weathercock* by Nathan Field, 1612. Edited with Introduction and Notes.

Scott Bowen Elledge, A.B.; Comparative Study of Literature, English Literature. Thesis: Milton's Later Friendships (1652–1674).

Nathalie Mary Esselborn, A.B.; French, Spanish. Thesis: The Religious Aspects of the Life and Works of Charles Baudelaire.

Wilfred Raphael Farrell, A.B.; German Literature, German Philology. Thesis: Wilhelm von Polenz: A Study of his Life and Work.

Miriam Friedman, A.B.; Greek, Latin. Thesis: Greek Epistolography with Special Reference to the Extant Manuals.

Maurice Gale, A.B.; German Elizabethan Literature. Thesis: Studies on the Text of Richard Wagner's Tone Drama *Der Ring des Nibelungen*.

William Jay Galligan, A.B.; Dramatic Production, Dramatic Literature. Thesis: Dramatic Structure and Problems of Presentation.
Edith Louise Gardner, A.B.; English, German. Thesis: Matthew Arnold and Johann Wolfgang Goethe.
Harriet Mitchell Gay, A.B.; Histology and Embryology, Cytology. Thesis: A Study of the Development of the Coronary Vessels of the Rat, with Supplementary Observations of the Foetal Calf and Cat.
Rose A. Gaynor, A.B.; Victorian Literature, Public Speaking. Thesis: A Study of Browning's *A Blot in the 'Scutcheon.*
Chevan Schanwei Hsu, A.B.; Economics, Business Management. Thesis: An Historical Study of Real Estate Mortgage Loans by American Banks.
Mildred Lawton Willingham French Lam, A.B.; Philosophy, English. Thesis: The Development of Locke's Theory of Relations.
Edwin Henderson Lombard, A.B.; Dramatic Production, Dramatic Literature. Essay: The Japanese Theatre.
Willis Harrison McCann, A.B.; Psychology, Physiology. Thesis: A Comparative Study of the Punctiform and Continuous Methods of Stimulating the Warm Spots.
Sydney Joseph Mehlman, A.B.; Latin, Greek. Thesis: Non-Classical Words in Some of the Works of Hugo of Saint Victor.
Isabel Merrick Morgan, A.B.; Bacteriology, Histology. Thesis: The Accessory Factor Present in Chest Fluid which Participates in Transformation *in Vitro* of Pneumococcus Type·II R to III S.
Carl George Parrish, Mus.Bac.; Musicology, German Literature. Thesis: French Clavecin Composers Before Francois Couperin Le Grand.
June Estelle Perkins, A.B.; German, French. Thesis: The Background of Nature in the Poetry of Annette von Droste-Hulshoff.
Carl Lewis Saddlemire, A.B.; French, Education. Thesis: Some Aspects of Baudelaire's Literary Criticism.
Sadie Samuel, A.B.; English Language and Literature, Greek. Thesis: The Influence of Plato on Sir Philip Sidney's Defense of Poesy.
Lois Margaret Schoonover, A.B.; Paleontology, Petrography. Thesis: The Eocene Crassatellas of the Atlantic and Gulf Coast Provinces.
Edward I. Shapiro, B.S.; Geometry, Analysis. Thesis: A Study of the Cardioid in Circular Coordinates.
Loretta Josephine Sullivan, A.B.; Latin, Greek. Thesis: Cicero on Poetry and Poets.
Charlotte Gridley Throop, A.B.; Theoretical Physics, Physics. Thesis: The Raman, Ultra-violet, and Infra-red Spectra of Diborane.
Marshall John Walker, B.Chem.; Theoretical Physics, Experimental Physics. Thesis: The Interrelation of the Band Spectra Constants of Diatomic Molecules.
George Arthur White, B.S.; Rural Education, Economics. Thesis: Economic Influences on Education, Especially During the Eighteenth and Nineteenth Centuries in England and the United States.

MASTERS OF ARTS IN EDUCATION

CONFERRED SEPTEMBER 25, 1935

David Walter Densmore, B.S. in Ed.
Joseph Francis Herney, A.B.
Weimer Kerr Hicks, A.B. Thesis: Guidance in a Preparatory School.
John Maxwell Lahr, A.B.
Elsie Ottosen McAllister, A.B.
Reginald Enice Maloney, A.B.
Harold Frederic Miller, A.B. Thesis: A Study of Needed Changes in the 7th, 8th, and 9th Grades of the Seneca-Ontario-Yates District.
Harry Brown Ward, B.S.
Graydon Wallis Yaple, A.B.

CONFERRED IN JUNE 15, 1936

Helen Miriam Appleby, A.B.

MASTERS OF SCIENCE

CONFERRED SEPTEMBER 25, 1935

Sylvia Mae Allen, A.B.; Plant Breeding, Cytology. Thesis: A Study of Crossing Over in *Zea euclaena* Hybrids with Reference to Chromosome Nine.

Robert Louis Armacost, A.B.; Plant Physiology, Cytology. Thesis: Investigations of the Physiology of Orchid Seed Germination.

Harry Devoe Bauder, B.S.; Agricultural Education, Dairy Industry. Thesis: To Discover the Factors to be Considered in Making a Program of Vocational Education in Agriculture for the Van Hornesville Community.

Helen Brandriff, A.B.; Mycology, Cytology. Thesis: The Development of the Ascocarp of *Acrospermum compressum* Tode.

Millard Tennyson Carter, B.S.; Agricultural Education, Secondary Education. Thesis: A Procedure for Making the Courses of Study for the Agricultural Curriculum of the Negro High Schools in Virginia.

James Samuel Champion, B.S.; Agricultural Education, Rural Education. Thesis: An Analysis of Direct and Indirect Supervision of Instruction in Vocational Agriculture.

Cyril Frederick Crowe, B.S.; Animal Husbandry, Prices and Statistics. Thesis: Forecasting Daughter Production from Parental Pedigrees.

Edna Drill, B.S. in Ed.; Botany, Nature Study. Thesis: A Study of Some of the Factors Affecting the Germination of the Seeds of *Abutilon theophrasti*.

Pearl Whitfield Durkee, A.B., B.S. in E.E.; General Physics, Radiation. Thesis: The Reflectivity of Bismuth at a Low Temperature in a Magnetic Field.

Georges T. L. Gauthier, B.S.A.; Entomology, General Pomology. Thesis: The Insect Fauna of the Raspberry.

George Bippus Happ, B.S.; Ornithology, Systematic Zoology. Thesis: A Study of the Flicker (*Colaptes auratus* (*Linnaeus*)).

Paul Byron Jones, B.S.; Farm Management, Marketing. Thesis: An Economic Study of Land Utilization in Tioga County, New York.

Winifred Grace Kingsley, A.B.; Taxonomic Botany, Ornithology. Thesis: Biological and Physiological Conditions in Peat Bogs.

Sylvia Victorine Kotrba, B.S.; Entomology, Invertebrate Zoology. Thesis: An Essay on the Structure of the Larva of *Anopheles quadrimaculatus* Say.

Andrew LaMar Lane, B.S.; Rural Education, Educational Administration. Thesis: The Discovery and Tentative Solution of Certain Problems Involved in the Administration of a Small Central Rural School.

Harry Keller Lane, B.S.; Zoology, Nature Study and Education. Thesis: A Contribution to the Knowledge of the Vertebrate Fauna of Lancaster County, Pennsylvania.

Fay Bowman LeBeau, B.S.; Economics of the Household, Foods. Thesis: A Study of the Incomes of Two Hundred Women Graduated from the College at Hampton Institute, Virginia, 1926–1933.

Clement Moran, A.B.; General Physics, Experimental Physics. Thesis: Effect of the Size of Ions on the Structural Temperature of Water in Solutions.

Ruth Palmer, B.S.; Economics of the Household, Rural Social Organization. Thesis: Farm Houses Studied as Centers for Family Living, 143 Farm Houses in New York State, 1931.

Clarence Ashley Spencer, B.S.Agr.; Farm Management, Rural Economics. Thesis: A Study of 36 New York State Institutional Farms and Wallkill Prison Farm.

Evelyn Turner, B.S.; Household Management, Family Life. Thesis: Homemaking Practices, Problems, and Attitudes of Fifteen Families with Children Under Twelve Years of Age, Tompkins County, New York, 1935.

Mary Althea Tyrrell, B.S.; Nature Study, Biology. Thesis: A Study of the Solution of Some of the Problems Connected with Procuring Equipment and

Materials for the Teaching of Biology in Moderately-sized High Schools in Eastern Nebraska.

William Augustus Willie, B.S.; Bacteriology, Histology and Embryology. Thesis: The Isolation of Acid-fast Bacteria from Soil.

William Thomas Winne, A.B.; Economic Botany, Paleobotany. Thesis: A Study of the Water Chestnut, *Trapa natans*, with a View to its Control in the Mohawk River.

CONFERRED FEBRUARY 5, 1936

Yien Shan Chen, B.S.; Plant Breeding, Marketing. Thesis: A Review of Cotton Genetics and Breeding Methods.

Ernest Alexander Frier, B.S.; Educational Administration, Secondary Education. Thesis: A Study of the Health Program and its Supervision as Practiced in the King Ferry Central School Located at King Ferry, New York.

James Alfred McAleer, A.B.; Rural Social Organization, Business Management. Thesis: The Single and Unmarried Population of Counties and Communities in New York State: 1930.

William Pennock, B.S.; Plant Physiology, Organic Chemistry. Thesis: The Rooting Response of Hard-wood Cuttings to Treatment with Neutral Red, with Special Reference to Privet.

Marion Ann Snyder, A.B.; Bacteriology, Biochemistry. Thesis: The Maximum Incubation Temperature Permitting Growth of the Beta Hemolytic Streptococci.

Charlotte Mary Spencer, B.S.; Animal Nutrition, Human Nutrition. Thesis: Studies on the Ash and Lipid Content of Bones of Rats.

Iris Josephine Trump, B.S.; Cytology, Plant Physiology. Thesis: A Review of the Literature Concerning the Cytology of the Genus Solanum.

CONFERRED JUNE 15, 1936

Hilda Aboy-Ferrer, B.S.; Plant Morphology, Bacteriology. Thesis: A Study of the Anatomy and Morphology of *Ceratophyllum demersum*.

Frances Rosamond Alrich, B.S.; Physical Chemistry, Organic Chemistry. Thesis: The System Ammonium Iodide, Iodine, and Water at 0° C.

Earl Lee Arnold, B.S.; Agricultural Engineering, Rural Education. Thesis: The Causes and Prevention of Drill Clogging when Sowing Pea Seed Treated with Cuprous Oxide.

Alexander P. H. Barclay, A.B.; Electrical Communications, Physics. Thesis: A Study of Some Glass and Metal Electron Tubes.

Cecilia Benitez-Gautier, B.S.; Bacteriology, Chemistry. Thesis: The Quantitative Determination of Saprophytic Acid Fast Bacteria in Soil.

Otto Ernest Burger, A.B., B.Comm.; Farm Management, Prices and Statistics. Thesis: An Analytical Review of United States Research Studies in Farm Management and Farm Economics until 1934–35.

Vera Aileen Caulum, B.S.; Textiles and Clothing and Household Arts, Economics of the Household. Thesis: Clothing Practices of 242 Families in Cortland County, New York, 1935.

Wei Liang Chia, B.S.; Plant Breeding, Plant Physiology. Thesis: Genetics and Breeding of the Soybean

Hiralal Maganlal Desai, B.Agr.; Agronomy, Marketing. Thesis: Mixed Farming in the Bombay Presidency and its Agronomic Problems.

Harold Ernest Fischer, B.S.; Plant Breeding, Vegetable Crops. Thesis: The Genetics and Breeding of the Tomato, *Lycopersicum esculentum*.

George Richard Goetchius, B.S.; Pathogenic Bacteriology, Histology. Thesis: The Colon-Typhoid Intermediates as Encountered in the Intestinal Tract of Gallus Domesticus.

Stella Louise Gould, B.S.; Foods and Nutrition, Agricultural Chemistry. Thesis: Ascorbic Acid Content of Cabbage.

Allan Marshall Grant, A.B.; Structural Geology, Sedimentary Petrography. Thesis: An Attempt to Correlate the Cambro-Ordovician Limestones near Birmingham, Pennsylvania, by Means of Heavy Minerals.

George Raymond Hanselman, M.E.; Business Law, Industrial Engineering. Thesis: Business Law for Engineers.

Francisco de Paula Hernandez-Gimenez, Bacheller, Ing.Agr.; Prices and Statistics, Farm Management. Thesis: Index Numbers of Commodity Prices in Spain, 1913–1935.

Olive Maren Hoefle, B.S.; Economic Botany, Ornamental Horticulture. Thesis: Identification of the Seeds of Fleshy Fruit-Bearing Plants of the Northeastern United States.

Helen E. Kallenberg Hoffman, B.S.; Child Development and Parent Education, Educational Psychology. Thesis: A Study of Narrative Mealtime Records of Ten Nursery School Children: Descriptive Summaries of Personality Based on One Person's Analysis; A comparison of Analyses of the Records by Three Persons.

Syed Abduel Jabbar, G.B.V.C., I.D.D.; Animal Husbandry, Animal Breeding. Thesis: Cattle Farming in India.

Julius Kronrad, B.S. in Ch.E.; Inorganic Chemistry, Optical Chemistry. Thesis: The Halogen Azides.

Karl Frank Lagler, A.B.; Vertebrate Zoology, Aquiculture. Thesis: Contributions to the Lepidology of Fishes of the Ithaca Region.

Welford Forrest Lamoreux, B.S.; Animal Breeding, Physiology. Thesis: Analysis of Variation in the Body Temperature of the Chick.

Max Mergentime, B.S.; Vegetable Crops, Plant Physiology. Thesis: A Study of the Literature of Frozen Fruits and Vegetables.

Woodrow Wilson Middlekauff, B.S.; Economic Entomology, Ornithology. Thesis: A Host Index of the Superfamily Tenthredinoidea.

Ivan Gregg Morrison, B.S.; Agricultural Engineering, Agricultural Education. Thesis: An Analysis of the Repair Jobs on a Two-Horse Mower.

Patricia Helen O'Hara, Ph.B.; Foods and Nutrition, Biochemistry. Thesis: A Study of Vitamin C Metabolism: Urinary Excretion of Vitamin C and Capillary Resistance during Restricted and Liberal Vitamin C Intake.

Si Chiu Peh, B.S.; Plant Breeding, Agronomy. Thesis: A Comparison of Results Obtained from Direct Planting and Transplanting of Rice.

Caroline Gertrude Pringle, B.S.; Economics of the Household and Household Management, Prices and Statistics. Thesis: Small Kitchen Equipment Used by 160 Young Families, Ithaca, New York, 1936.

Lois Marion Purdey, B.S.; Child Nutrition, Animal Nutrition. Thesis: A Dietary Study of 484 Adolescent Girls in a Summer Camp.

Winfield Scott Stone, D.V.M.; Diseases of Breeding Animals, Physiology of Reproduction. Thesis: The Effect of a Virulent Strain of Brucella Abortus on Guinea Pigs Previously Injected with Strain No. 19 of Brucella Abortus.

Hsuan Hsien Sun, B.S.; Industrial Chemistry, Inorganic Chemistry. Thesis: The Lubricating Property of Aluminum-Base Greases.

Tien-Hsi Sun, A.B.; Rural Social Organization, Rural Economy. Thesis: A Study of the Rural Reconstruction Movement in China.

Siang Yu Tang, B.S.; Genetics, Plant Physiology. Thesis: Some of the More Important Results on the Breeding and Genetics of the Tobacco Plant, *Nicotiana tabacum.*

James Taylor Tanner, B.S.; Ornithology, Physics. Thesis: Sound Recording for A Natural History Museum.

Frank Robert Ashbridge Thomlinson, B.Com.; Marketing, Agricultural Prices and Statistics. Thesis: A Brief Review of the Maize Trade in South Africa with Special Reference to the Maize Control Acts.

Philip Freeland Tryon, B.S.; Organic Chemistry, Physical Chemistry. Thesis: Part I: The Reaction of Coumarin in the Michael Condensation. Part II: The Action of Hypobromite on Furoic Acid.

William Bertrand Turner, B.S.; Organic Chemistry, Mineralogy. Thesis: The Action of Magnesium on Certain Beta-Bromo Phenetoles.

Yen-chieh Wang, B.S.; Silviculture, Genetics. Thesis: Some Results of Germination Tests on Seed of the 1935 Crop.

Joseph Allen Wheat, B.S.; Inorganic Chemistry, Analytical Chemistry. Thesis:

Equilibria in the Binary Systems Chlorine Chloroform, Bromine Chloroform, The Chloroform Chlorinates.

Clara Beauman Williams, B.S.; Home Management, Family Life. Thesis: Description of 427 Farm Families Interviewed Regarding Their Financial History, Tompkins and Livingston Counties, New York, 1935.

MASTERS OF SCIENCE IN EDUCATION

Conferred September 25, 1935

Jean Danes Blue, B.S. Thesis: The Construction of a Set of Objective Tests Concerning Some of the Clothing Problems Encountered by High School Girls.
Madeleine Frink Coutant, B.S.
Anna Elizabeth Lewis, B.S.
Edward Cowden Raney, B.S. in Ed.
Raymond DeWitt Richardson, A.B.
Ernest Hiram Truby, A.B.

Conferred February 5, 1936

Raymond Frank Currier, B.S. in Ed.
Frances Glee Benson Sanderson, B.S.

Conferred June 15, 1936

John Delaney, B.S.
Robert John Palmer, B.S. in Ed.
Dorothy Jane Parker, B.S.
Herrick Alfred Smith, B.A.
Lacey Howard Woodward, B.S.

MASTERS OF SCIENCE IN AGRICULTURE

Conferred September 25, 1935

William Harley Chilson, B.S.; Dairy Industry, Nutrition. Thesis: A Study of Some of the Factors Involved in the Development of the Oxidized Flavor in Market Milk.

Robert William Lawrence, B.S.; Agricultural Education, Agricultural Engineering. Thesis: Major Educational Services Available to the Rural Population of One Area in New York.

Percy Sylvester Lilly, B.S.; Agricultural Economics, Agricultural Education. Thesis: The Economic Evolution of Tobacco Production in Three Counties of Virginia—Pittsylvania, Halifax and Mecklenburg Counties 1850 to 1930.

Elton Ray Wagner, B.S.; Pomology, Plant Physiology. Thesis: Factors Influencing the Amount of Winter Injury to Fruit Trees in Western New York and in the Hudson Valley Following the Winter of 1933–34.

Conferred February 5, 1936

Willard Revo Fazar, B.S.S.; Marketing, Farm Management. Thesis: The Regulation and Taxation of the Motor Truck.

Tull Neal Gearreald, B.S.; Marketing, Prices and Statistics. Thesis: A Study of the Marketing of Fruits and Vegetables in Delaware.

Wendell Edgar Keepper, B.S.; Marketing, Farm Management. Thesis: An Economic Study of the Operation of Roadside Stands in New York State—1931, 1932, 1933.

Eric Bradford Wilson, B.S. in E.E.; Farm Management, Prices and Statistics. Thesis: A Preliminary Study of Land Utilization in Schuyler County, New York, 1934.

Henry Solomon Woolf, B.Sc.Agr.; Rural Economics, Farm Crops. Thesis: The Problem of Rural Credit on the Dry-Lands.

CONFERRED JUNE 15, 1936

Denzel Stewart Curtis, B.S.; Vegetable Crops, Plant Physiology. Thesis: Physical and Structural Properties of the Tissues Related to Stringiness and Toughness in Celery.

John Norman Efferson, B.S.; Farm Management, Marketing. Thesis: An Economic Study of Land Utilization in Genesee County, New York.

Jose Miguel Garcia, B.S. in Ag.; Farm Management, Statistics. Thesis: A Farm Management Study of 224 Coffee Farms in Puerto Rico, 1934.

Chung Man Wong, B.S.; Animal Husbandry, Animal Breeding. Thesis: The Application of American Methods to Swine Production in China.

MASTERS OF SCIENCE IN ENGINEERING

CONFERRED FEBRUARY 5, 1936

Ray W. Lynch, B.S.; Administrative Engineering, Highway Engineering. Thesis: Methods and Management of Oil Well Drilling.

CONFERRED JUNE 15, 1936

Julian David Abell, A.B., B.S.; Hydraulics, Structures. Thesis: The Hydraulic Gradient in Earth Dams.

John Joseph Danis, B.S.; Hydraulics, Structures. Thesis: A Theoretical Study of the Bearing Power of Soils as Influenced by Moisture Content.

William Jonas Ely, B.S.; Hydraulics, Structural Engineering. Thesis: A Study of the Shear Resistance of Soils and Methods for its Measurement.

Duncan Hallock, B.S.; Hydraulics, Structures. Thesis: Stresses in a Tainter Gate.

Albert John Lindemann, B.S. in A.E.; Industrial Engineering, Electrical Engineering. Thesis: Economic Lot Size.

Harry John Loberg, M.E.; Industrial Marketing, Industrial Statistics. Thesis: Industrial Marketing—Case Studies.

MASTER OF FORESTRY

CONFERRED SEPTEMBER 25, 1935

George Shaw Meagher, B.S.F.; Forest Management, Silviculture. Thesis: Forest Management in a Hardwood Slope Forest of Western New York.

MASTER OF LAWS

CONFERRED JUNE 15, 1936

Hubert Alfred Simmons, Jr., A.B., LL.B.; Law of Private Corporations, Constitutional Law, Jurisprudence.

MASTERS OF CHEMISTRY

CONFERRED SEPTEMBER 25, 1935

Nikolai Nikolaewitch Kojevnikoff, B.Chem.; Organic Chemistry, Electro-Chemistry. Thesis: Electrolysis of Organic Acids.

CONFERRED FEBRUARY 5, 1936

William Berton DeLong, B.Chem.; Industrial Chemistry, Microscopy. Thesis: Studies on the Crystal Form of Paraffin Wax.

CONFERRED JUNE 15, 1936

Charles Henry Bridges, B.Chem.; Industrial Chemistry, Organic Chemistry. Thesis: Heat Transfer Between Condensing Mixtures of Steam and Organic Vapor and a Metal Tube.

MASTERS OF ARCHITECTURE

CONFERRED JUNE 15, 1936

Michal Kunic, Arch. Eng.; Large Scale Planning, Architecture. Thesis: "Coronaworks, Ithaca, N. Y." Housing Development.

Richard J. Marlitt, A.B., B.Arch.; History of Architecture, Architectural Design. Thesis: The Eighteenth Century Architecture of France and England.

Benjamin John Rabe, B.Arch.; Architectural Design, History of Architecture. Thesis: Architectural Drawings and Thesis.

MASTER OF FINE ARTS

CONFERRED JUNE 15, 1936

John Colby Lewis, A.B.; Dramatic Production, History of Fine Arts. Thesis: Modern Theories of Dramatic Production Held by Jacques Copeau, Leopold Jessner, Alexander Tairov, Nicolas Evreinov, Vsevelod Meyerhold, Theodore Komisarjevsky.

MASTERS OF CIVIL ENGINEERING

CONFERRED SEPTEMBER 25, 1935

An-Ling Chang, B.S. in C.E.; Structural Engineering, Railroad Engineering. Thesis: Investigation and Design of Cantilever Bridges.

Chao Woo Chen, B.S.C.E.; Structures, Railroad Engineering. Thesis: Structures of Arch and Rigid Frame.

Shao-yuan Hu, B.S.C.E.; Hydraulic Engineering, Meteorology. Thesis: Reservoir as a Means of Flood Control.

Yen Kang Hwang, B.S.C.E.; Structural Engineering, Railroad Engineering. Thesis: Design of a Reinforced Concrete Theatre and Office Building.

Hui Sien Liu, B.S.C.E.; Structural Engineering, Railroad Engineering. Thesis: Design of Concrete Highway Bridges.

Shih-Ping Tseu, B.S.C.E.; Railway Engineering, Structural Engineering. Thesis: Water Front Terminals.

Pao-Wo Tsu, B.S. in C.E.; Structural Engineering, Hydraulic Engineering. Thesis: Analysis of Multiple Arches on Elastic Piers.

Eugene Tu, B.S.C.E.; Structural Engineering, Sanitary Engineering. Thesis: Design of Concrete Rigid Frame Office Building.

Chao Woo, B.S. in C.E.; Structural Engineering, Hydraulics. Thesis: Design of a Concrete Rigid Frame Building.

Jiland Yin, B.S.C.E.; Railway Engineering, Reinforced Concrete. Thesis: A Study of Railroad Maintenance of Way.

CONFERRED FEBRUARY 5, 1936

Arthur Vincent Peterson, B.S. in C.E.; Structural Engineering, Highway Engineering. Thesis: Preliminary Photoelastic Investigation of Shearing Stress Distribution in Transversely Welded Connections.

CONFERRED JUNE 15, 1936

Andres Hizon y Ochoa, B.S.C.E.; Geodetic Surveying, Mathematics, Geodetic Astronomy. Thesis: Plane-Coordinates Based on the Lambert Conformal Projection and on the Transverse Mercator Projection with Applications in the Philippine Islands.

Tsing Hwa Lee, B.S.C.E.; Structures, Railroad Engineering. Thesis: The Comparative Design of Three-hinged, Two-hinged, and Hingeless Reinforced Concrete Arch Bridges in Spandrel-braced Type.

Egbert Purdy Morgan, C.E.; Structural Engineering, Industrial Engineering. Thesis: A Study of the Practical Use of Steel and Reinforced Concrete in Factory Design and Layout.

Harry Willard Tobey, jr., C.E.; Structural Engineering, Mechanics. Thesis: Soil Tests for Earth Dams.

S. Shee Wang, B.A.; Structural Engineering, Regional Planning. Thesis: The Study of the Elastic Arch and the Cantilever Bridge.

MASTERS OF MECHANICAL ENGINEERING

CONFERRED SEPTEMBER 25, 1935

Yueh-Chang Lu, B.S.M.E.; Industrial Engineering, Power Plant Engineering. Thesis: Design and Management of a City Power Plant in China.

CONFERRED JUNE 15, 1936

Byron Elliott Short, B.S. in M.E., M.S. in M.E.; Heat Transmission, Fluid Mechanics. Thesis: Heat Transfer and Pressure Drop in Heat Exchangers.

Ludolph Frisch Welanetz, M.E.; Experimental Engineering, Industrial Engineering. Thesis: Friction Characteristics of Bearings on Reciprocating Shafts.

DOCTORS OF PHILOSOPHY

CONFERRED SEPTEMBER 25, 1935

William Angus, B.S., A.M.; Dramatic Production, Dramatic Literature, Phonetics and Speech Training. Thesis: "The Actor: A Treatise on the Art of Playing" Edited with Introduction and Notes.

Alfred William Avens, B.S., M.S.; Physical Chemistry, Inorganic Chemistry, Analytical Chemistry. Thesis: Qualitative Analysis without Hydrogen Sulphide.

Clifford Warren Barber, D.V.M.; Veterinary Pathology, Biochemistry, Poultry Diseases. Thesis: A Study of Fowl Paralysis.

Joseph Alonzo Baty, A.B.; Physical Chemistry, Analytical Chemistry, Organic Chemistry. Thesis: Chemical Reaction in the Silent Discharge.

Emma M. S. Besig, A.B., A.M.; Education, English, Educational Theory. Thesis: The History of Composition Teaching in Secondary Schools.

Gertrude K. Blanch, B.S., M.S.; Geometry, Algebra, Analysis. Thesis: Properties of the Veneroni Transformation in S_4.

Ward Culver Bowen, A.B., A.M.; Economic Geology, Mineralogy, Structural Geology. Thesis: A Review of Theories of Origin of the Zinc Ores of Sussex County, New Jersey.

Charles Auguste Choquette, A.B., A.M.; French Literature, Spanish Literature, French Philology. Thesis: A Study and Dictionary of the Figurative Imagery of Baudelaire's *Les Fleurs du Mal.*

Charles Logan Cooper, B.S., M.S.; Educational Supervision, Educational Psychology, Rural Social Organization. Thesis: Major Factors Involved in the Vocational Choices of Negro College Students.

Alexander Latham Dounce, A.B.; Organic Chemistry, Biochemistry, Chemical Microscopy. Thesis: A Study of Dihydrofurans and the Dehydration Rearrangement of 2, 3-Ethylenic 1, 4-Diols.

Philip Lyle Gamble, B.S., A.M.; Taxation, Finance, Constitutional Law. Thesis: The Taxation of Insurance Companies.

Denzell Leigh Gill, B.S.; Plant Pathology, Plant Physiology, Floriculture. Thesis: A Comparative Study of Geranium Cutting Rots and Their Control.

Arthur Benjamin Gould, B.S., M.S.; Inorganic Chemistry, Optical Chemistry, Analytical Chemistry. Thesis: A Study of the Preparation of Alkali and Alkaline Earth Trinitrides from the Metal Ammoniums and from the Metallic Amides.

David Elson Harrower, B.S., M.S.; Ornithology, Vertebrate Zoology, Rural Education. Thesis: The Habits of the Passerine Birds of Central America with Particular Reference to their Breeding.

Amelia Marguerite Heydweiller, A.B.; Ornithology, Nature Study, Vertebrate Zoology. Thesis: Life History of the Tree Sparrow (*Spizella arborea*).

Charles Harold King, A.B., A.M.; European History, English History, English. Thesis: George Whitefield, Revivalist.

Vladimir Nicitich Krukovsky, Agr.Eng., M.S.; Dairy Industry, Dairy Bacteriology, Biochemistry. Thesis: The Effect of Temperature of Separation on the Properties of Cream, with Special Reference to Adsorption.

George Edward Loder, B.S., A.M. in Ed.; Agricultural Economics, Educational Methods, Administration and Supervision. Thesis: Bread in Ithaca.

Robert Phillips Ludlum, A.B., A.M.; American History, Constitutional Law, English History. Thesis: Joshua R. Giddings, Anti-slavery Radical (Part I, 1795–1844).

Donald Hutchins MacMahon, A.B., A.M.; Dramatic Literature, Victorian Poetry, Eighteenth Century Literature. Thesis: Charles Reade as a Dramatist.

Eleanor Clara McMullen, A.B., A.M.; Vertebrate Zoology, Botany, Entomology. Thesis: The Larval, Metamorphosic and Adult Estate of the Aortic Arches in Four Genera of Plethodontid Salamanders.

Paul Franklin Macy, B.S. in Agr.; Agronomy, Physical Chemistry, Plant Physiology. Thesis: The Critical Nutrient Composition of Plants.

Frank Leroy Manning, B.S., M.S.; Agricultural Prices and Statistics, Economics, Marketing. Thesis: A Statistical Study, Involving Multiple Curvilinear Correlation, of Factors Affecting the Farm Price of Apples.

Nelson Francis Murphy, Chem.Eng.; Physical Chemistry, Industrial Chemistry, Inorganic Chemistry. Thesis: Oxidation and Reduction with Hydrogen Peroxide.

George Benjamin Robinson, B.S.; Business Management, Marketing, Economics. Thesis: School Taxation in Tompkins County, New York.

Kennedy Furlong Rubert, M.E., Aero. E., M.M.E.; Heat Transfer, Experimental Engineering, Mathematics. Thesis: Testing Radiators in a Vacuum for Direct Radiation and Convection.

Dorman Gladstone Stout, B.S.A., M.S.; Rural Education, Rural Social Organization, Agricultural Economics. Thesis: Attitudes and Beliefs of Youth Toward Certain Social Institutions.

Noah Franklin Stump, B.S., A.M.; Mental and Educational Measurements, Educational Psychology, Curriculum. Thesis: The Experimental Development of an Auditory Group Test of Intelligence.

Lillian Clara Thomsen, B.S. in Ed., M.S.; Limnology, Botany, Entomology. Thesis: Aquatic Diptera Ceratopogonidae.

Edward Hamilton Wallace, B.S.; Physical Chemistry, Industrial Organization, Analytical Chemistry. Thesis: The Polyhalides of Cesium—Cesium Bromide and Iodine Monobromide; Cesium Bromide and Iodine.

John George Waugh, A.B., B.S. in Ed., A.M.; Pomology, Plant Physiology, Organic Chemistry. Thesis: Some Investigations on the Photosynthetic-Respiratory Activity of Apple Leaves.

Robley Cook Williams, A.B.; Experimental Physics, Theoretical Physics, Astronomy. Thesis: The Fine-Structure of the Alpha Lines of Hydrogen and Deuterium and the Spectroscopic Determination of e/m.

CONFERRED FEBRUARY 5, 1936

Harry Darkes Albright, A.B., A.M.; Dramatic Production, Dramatic Literature, Speech Training. Thesis: The Theory and Staging of Musical Drama.

Harold Orlando Boraas, A.B., A.M.; Educational Psychology, Educational and Mental Measurements, Educational Supervision. Thesis: An Experimental Study of the Relative Merits of Certain Written Letter Forms with Respect to Legibility, with Speed and Stability as Related Factors.

Frank Warner Brumley, B.S.A., M.S.A.; Farm Management, Marketing, Business Management. Thesis: An Economic Study of Commercial Poultry Farming in Florida 1926, 1927–28, 1928–29, 1930–31 and 1931–32.

Marion Lucile Dawson, A.B., M.S.; Anatomy, Cytology, Paleobotany. Thesis: The Floral Anatomy of the Polemoniaceae.

Harold Frederick Hartman, A.B., A.M.; Constitutional Law, Modern European History, English History. Thesis: The Constitutional Doctrines of Edward Douglass White.

Thomas Norman Hurd, B.S.; Business Management, Statistics, Finance. Thesis: An Analysis of Local Government in Tompkins County, New York.

Frank Stover Jamison, B.S., M.S.; Vegetable Gardening, Plant Physiology, Farm Management. Thesis: Studies of the Effects of Handling Methods on the Quality of Market Peas.

Major B. Jenks, B.S., A.M.; American History, European History, International Relations. Thesis: George Clinton and New York State Politics 1775 to 1801.

Flemmie Pansy Kittrell, B.S., M.S.; Nutrition, Child Development, Rural Education. Thesis: A Study of Negro Infant Feeding Practices in a Selected Community of North Carolina.

William Jacob Koster, B.S.; Vertebrate Zoology, Aquiculture, Botany. Thesis: The Life-History and Ecology of the Sculpins (Cottidae) of Central New York.

Erich Otto Mader; Plant Pathology, Plant Physiology, Bacteriology. Thesis: The Effect of Different Amounts of Bordeaux Mixture and of its Seasonal Distribution on Foliage and Tuber Development of Potato Plants.

Noble Samuel Royston Maloeuf, B.S., M.S.; Physiological Morphology, Bio-Chemistry, Insect Physiology. Thesis: I. The Postembryonic History of the Somatic Musculature of the Dragonfly Thorax. II. The Myogenic Automatism of the Contraction of the Heart of Insects. III. Quantitative Studies on the Respiration of Aquatic Arthropods and on the Permeability of their Outer Integument to Gases, Water, and Electrolytes.

Phillip Allen Miller, A.B.; Physical Chemistry, General Physics, Organic Chemistry. Thesis: The Action of Sulfur Monochloride on Rubber.

George Keith Parris, B.S.A.; Plant Pathology, Plant Physiology, Plant Breeding. Thesis: Comparisons of Photosynthesis and Respiration Rates of Diseased and and Healthy Bean Leaflets.

Albert Rose, A.B.; Theoretical Physics, Experimental Physics, Philosophy. Thesis: A Determination and Analysis of the Therminoic Constants of Thoriated Tungsten.

Annemarie Margaret Sauerlander, A.B., A.M.; German Literature, German Philology, European History. Thesis: Lily Braun: A Study of her Personality, her Socialistic and Literary Activity, and an Estimate of her Place in German Literature.

Herbert Franz Ferdinand Schaumann, A.B.; German Literature, German Philology, Philosophy. Thesis: Fundamental Characteristics of German-American Lyrics.

Raymond Wright Short, A.B.; American Literature, English Literature, French Literature. Thesis: The Patronage of Poetry under James First.

Ross Edmond Shrader, A.B.; Experimental Physics, Theoretical Physics, Mathematics. Thesis: The Widths of the L Lines and Limits of Pb (82).

Henry Ernst Martin Specht, B.Chem.; Inorganic Chemistry, Physical Chemistry, Optical Chemistry. Thesis: Investigation of the Imino or Monazene Radical Obtained by the Interaction of Hydrogen Trinitride and Fuming Sulphuric Acid.

Diran H. Tomboulian, A.B., A.M.; Experimental Physics, Theoretical Physics, Optical Chemistry. Thesis: The Spectrum of NaIII and an Extension of the BrI-Like Isoelectronic Sequence to the Spectra of RbIII and SrIV.

Orion Ulrey, B.S.; Marketing, Farm Management, Prices and Statistics. Thesis: The Public Produce Markets of Michigan.

Dorothy May Wertz, A.B., A.M.; Literary Criticism, History of Ancient and Mediaeval Education, Classical and Mediaeval Rhetoric. Thesis: The Influence of the *Regula Pastoralis* to the year 900.

Conferred June 15, 1936

Edward Delbert Amstutz, B.S., M.S.; Organic Chemistry, Biological Chemistry, Inorganic Chemistry. Thesis: The Mechanism of Certain Reactions in the Furan Series.

Charles Arthur Annis, B.Com., A.M.; Money and Banking and International Finance, Economic Theory and Its History, Public Finance. Thesis: A Study of Canadian Tariffs and Trade Agreements.

Virgil Norman Argo, B.S., M.S.; Apiculture, Morphology of Insects, Ecology. Thesis: The Effect of Temperature upon the Oxygen Requirements of the Adult Cluster Fly (*Pollenia rudis* Fabricius).

Frederick Gottlieb Baender, B.E., M.M.E.; Experimental Engineering, Mathematics, Heat-Power Engineering. Thesis: Determination of Film Coeffi-

cients in the Condensation of Steam on the Outside of a Horizontal Copper Tube with Varying Per Cents on Non-Condensable Gases in the Steam.

William Carroll Bark, A.B., A.M.; Ancient History, Renaissance and Reformation History, Mediaeval Latin Literature. Thesis: Marius Mercator and the *Collectio Palatina*.

Samuel Booth Barker, B.S.; Physiology, Biochemistry, Anatomy. Thesis: The Effects of Increased Metabolism on the Ketone Body Excretion of Depancreatized Dogs.

Cornelius Betten, jr., A.B.; Industrial Chemistry, Analytical Chemistry, Organic Chemistry. Thesis: The Rate of Heat Transfer in the Condensation of Mixed Vapors.

Lindsay MacLeod Black, B.S.A.; Plant Pathology, Plant Physiology, Physical Chemistry. Thesis: The Potato Yellow Dwarf Disease.

Laurence Henry Bowen, A.B., A.M.; Geometry, Mathematical Analysis, Astronomy. Thesis: Composite Double Curves on Rational Ruled Surfaces.

Harvey Bird Bowman, B.S.Agr., M.S.; Zoology, Entomology, Rural Education. Thesis: Further Notes on the Margined Mad Tom, *Rabida insignis* (Richardson), and Notes on a Kindred Species, *Noturus flavus* (Rafinesque).

Daniel Grover Clark, B.S.; Plant Physiology, Soil Bacteriology, Physical Chemistry. Thesis: Physiological Studies on Rhizobium Species: I. Nitrogen Fixing Power of the Organism. II. Some Chemical and Physical Characteristics of a Growth Substance Affecting Rhizobia.

Theodora Morris Cope, A.B., M.S.; Vertebrate Ecology, Ornithology, Economic Botany. Thesis: Observations on the Vertebrate Ecology of Some Pennsylvania Virgin Forests.

William Marshall Curtiss, B.S.; Business Management, Statistics, Farm Management. Thesis: Highways in Rural New York.

Horace Jewel Davis, B.S.; Animal Nutrition, Biochemistry, Physiology. Thesis: The Vitamin G Requirements of Laying Hens.

Paul Marshall Elliott, B.S. in Ch.E.; Organic Chemistry, Optical Chemistry, Analytical Chemistry. Thesis: A Mechanism for the Fittig Synthesis of Acid Methronic Ester.

Carlton Case Ellis, B.S., M.S., D.V.M.; Poultry Pathology, Biochemistry, Poultry Industry. Thesis: Avian Coccidiosis, Studies of the Viability of Coccidial Oöcysts (*E. Tenella*).

Margaret Ballou Erb, A.B., A.M.; Psychology, Physiology and Neurology, Physiological Psychology. Thesis: The Memorial Forms of Apprehension.

Burnard James Errington, D.V.M.; Surgery, Sterility, Animal Physiology. Thesis: Variations in Inorganic Phosphorus and Calcium Content of the Blood of Horses.

Jeremiah Stanton Finch, A.B., A.M.; Eighteenth and Early 19th Century Literature, 17th Century English, English History. Thesis: Sir Thomas Browne: A Study of his Mind, Works, and Influence.

Caroll Willis Ford, A.B.; Finance, Economic Theory, Statistics. Thesis: The Problem of Commercial Bank Liquidity.

Milton John Foter, B.S., M.S.; Bacteriology, Biochemistry, Organic Chemistry. Thesis: A Study of the Minimum Temperatures of Growth and of Fermentation of Certain Lactic Acid Bacteria.

Albert Daniel Freiberg, A.B., A.M.; Psychology, Physiology, Systematic Psychology. Thesis: 'Fluctuations of Attention' with Tactual and Auditory Stimuli: A Study of Perceiving.

Clara Starrett Gage, A.B., A.M.; Comparative Study of Literature, English History, Old English. Thesis: Sources of Milton's Concepts of Angels and the Angelic World.

William Frederick Geigle, B.Chem.; Physical Chemistry, Optical Chemistry, Inorganic Chemistry. Thesis: The Polyiodides of Sodium-Sodium Iodide, Iodine, and Water.

Melvin Crawford Godwin, A.B.; Histology and Embryology, Anatomy, Physiology. Thesis: The Development of the Thyroid Gland and Complex IV in the Dog with Special Emphasis on the Fate of the Ultimobranchial Body.

Gertrude Younker Gottschall, A.B.; Biochemistry, Bacteriology, Physiology.

Thesis: The Estimation of Glutathione and the Glutathione Content of Blood and of Tissues.

Hellen Conny Menko Goudsmit, B.S., Doktorand; Biochemistry, Physiology, Bacteriology. Thesis: An Alcohol Soluble Protein Derived from Casein.

Peter Frederick Gross, A.B., M.S.; Organic Chemistry, Physical Chemistry, Biochemistry. Thesis: The Structure of Ketene Dimer.

Arthur Monroe Hanhardt, A.B., A.M.; German Literature, German Philology, Old Norse. Thesis: GERMAN REALISTIC REGIONAL LITERATURE (HEIMATKUNST) Origins, Characteristics, Theories, and Representative Authors.

Ross Arthur Harrison, A.B., A.M.; Geometry, Analysis, Education. Thesis: Cremona Webs in S_3 Without Base Curves.

Frederick Warren Hayward, B.S., M.S.; Organic Chemistry, Physical Chemistry, Biochemistry. Thesis: A Study of N-Methyl-oc-Pyrryl-Carbinol.

Donald David Hill, B.S., M.S.; Agronomy, Plant Breeding, Marketing. Thesis: Factors Affecting the Malting Quality of Oregon Barley, and a Comparison of Methods of Evaluation.

James Willis Howard, B.S.A.; Education, French, Agricultural Education. Thesis: A Study of Cadet Training in the Dominion of Canada.

Bertram Lucius Hughes, A.B., A.M.; English Literature of Early 19th Century, Speech and Phonetics, Victorian Literature. Thesis: The Social Protests in Early Victorian Poetry.

Kenneth Whitten Hunt, B.S., A.M.; Plant Morphology, Paleobotany, Geology. Thesis: A Study of the Style and Stigma, with Reference to the Nature of the Carpel.

Robert Anthony Johnson, B.S.A., M.S.; Ornithology, Rural Education, Entomology. Thesis: A Study of the Life History of the Atlantic Murre (*Uria aalge aalge*).

Harry Gorgas Michener Jopson, B.S., A.M.; Vertebrate Zoology, Entomology, Mammalogy. Thesis: A Comparative Study of the Salamanders of the Genus *Triturus* Found in Eastern North America.

Frances Lucile Kraft, A.B., M.S.; Bacteriology, General Physiology, Experimental Physiology and Biochemistry. Thesis: A Study of the Mechanism of the Production of Toxic Substances by the Salmonella Group of Bacteria.

Julia Ruth Lawrence, B.S., M.S.; Botany–Morphology, Plant Physiology, Paleobotany. Thesis: An Anatomical Consideration of the Family Boraginaceae.

John Randolph Lindsay, A.B.; Nineteenth Century English Literature, Elizabethan Literature, History of English Literature. Thesis: Shelley's Life as Reflected in *Alastor, The Revolt of Islam*, and *Rosalind and Helen*.

Chin-jen Luh, B.S., M.S.; Systematic Entomology, Limnology, Insect Morphology. Thesis: The Skeletal Structures of the Tympanum of Arctiidae (Lepidoptera).

James Edward Magoffin, B. Chem.; Physical Chemistry, Organic Chemistry, Inorganic Chemistry. Thesis: Energy Levels in Electrochemistry.

Louis Malter, B.S., A.M.; Experimental Physics, Theoretical Physics, Mathematics. Thesis: Anomalous Secondary Electron Emission.

Frank Bradshaw Maughan, B.S.; Economic Entomology, Plant Pathology, Genetics. Thesis: A Study of the Biology and Control of the Onion Thrips, (*Thrips tabaci* Lindeman), in Orange County, New York.

Henry Menusan, jr., B.S. in Chem.; Entomology, Morphology, Plant Physiology. Thesis: Effects of the Environment on the Rate of Growth and Development of Insects with Special Reference to the Bean Weevil, *Bruchus obtectus* Say.

John Ivan Miller, B.S., M.S. in Agr.; Animal Husbandry, Animal Nutrition, Veterinary Physiology. Thesis: Relative Efficiency for Growing Lambs of Protein in Low-Protein Rations Supplemented by Soybean-Oil Meal, Linseed Meal, or Corn-Gluten Meal.

Arthur Ulric Moore, A.B., A.M.; Dramatic Production, Speech Training and Phonetics, Dramatic Literature. Thesis: Art, Community, and Theatre, A Study of the Theories of Five Nineteenth Century Artists, Tolstoy, Wagner, Nietzsche, Appia, Rolland.

George Joachim Mundt, A.B.; German Literature, German Philology, Modern European History. Thesis: The Ideology of Modern German War-Literature.

Walter Scott Neff, A.B., A.M.; Psychology, Physiological Psychology, Physiology. Thesis: Perceiving and Symbolizing: An Experimental Study.

Ida Adams Paterson, A.B., A.M.; Latin, Classical Archaeology, Comparative Study of Literature. Thesis: The Humanism of Coluccio Salutati.

Ella Janet Pierce, A.B., A.M.; Sixteenth Century Literature, Old English, Eighteenth Century Literature. Thesis: Appreciation of the Elizabethans during the New England Renaissance (1830–1880).

John Ross Raeburn, B.Sc., M.S.; Prices and Statistics, Marketing, Farm Management. Thesis: A Statistical Study of Apple Prices Involving the Use of Curvilinear Joint Correlation.

Caspar Rappenecker, A.B.; Physical Geography, Meteorology and Climatology, Economics and Finance. Thesis: The Regional and Economic Geography of Jamaica, B.W.I.

William Arthur Rawlins, B.S.; Economic Entomology, Plant Physiology, Apiculture. Thesis: Biology and Control of the Wheat Wireworm, *Agriotes mancus* Say, in Western New York.

Thomas Walter Reed, B.S., M.S.; Economic Entomology, Insect Morphology, Insect Ecology. Thesis: A Study of Control Measures for the Apple Aphids, with Special Reference to the Use of Fall Treatments.

Richard Caig Ringrose, B.S.; Animal Nutrition, Physiology, Biochemistry. Thesis: The Nutritive Properties of Corn Gluten Meal for Poultry.

Donald Ramsay Roberts, A.B., A.M.; Literary Criticism, English History, Old English. Thesis: Shakespeare and the Rhetoric of Stylistic Ornamentation.

Frederick Washington Ross, B.S., M.S.; Cecidology, Morphology of Insects, Entomology. Thesis: Solidago Cecidology.

William Dunlap Sargent, B.S., M.S.; Entomology, Ornithology, Painting. Thesis: The Internal Thoracic Skeleton of the Anisoptera (Order Odonata).

Earl Leslie Sasser, B.S., A.M.; Victorian Literature, English Language, Speech. Thesis: The Fiction of Robert Buchanan.

Frank Robert Shaw, B.S.; Systematic Entomology, Insect Morphology, Medical Entomology. Thesis: A Study of the Biology of the Gladiolus Thrips, *Taeniothrips simplex* Morison, and its Relation to certain environmental Factors affecting its Control

Preston Slachman, B.Chem.; Industrial Chemistry, Mechanics of Engineering, Thermodynamics. Thesis: Plate Efficiency and Entrainment in Distillation.

Irene Hawkins Stuckey, A.B.; Cytology, Plant Physiology, Bacteriology. Thesis: Some Effects of Freezing on Plant Tissues.

Carlton Fulton Taylor, B.S.A.; Plant Pathology, Plant Physiology, Entomology. Thesis: A Comparative Study of Some Actinomyces from Soil.

George Malcolm Trout, B.S., M.S.; Dairy Industry, Physical Chemistry, Bacteriology. Thesis: The Reliability of Flavor Judgments, with Special Reference to the Oxidized Flavor of Milk.

Alden Orison Weber, A.B., A.M.; Metaphysics, History of Philosophy, Aesthetics. Thesis: An Analysis of Perception.

Kyle Chester Westover, B.S., M.S. in Agr.; Plant Physiology, Vegetable Gardening, Plant Breeding. Thesis: The Effect of Sungreening on the Potato Seed Tuber.

David Lonzo Wray, jr., B.S., M.S.; Insect Embryology and Morphology, Ecology, Economic Entomology. Thesis: The Embryology of *Calandra callosa* Olivier; The Southern corn billbug (Coleoptera, Rhynchophoridae).

Felix Lessing Yerzley, M.E.; Experimental Physics, Theoretical Physics, Mathematics. Thesis: An Investigation of Irregularities in Thermionic Emission from Tungsten.

MEMBERS OF THE STAFF OFFERING COURSES FOR GRADUATE STUDENTS, 1937–1938

INDEX