CORNELL UNIVERSITY OFFICIAL PUBLICATION

Announcement of the

Graduate School

for 1939-40

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THE GRADUATE SCHOOL

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1938–39

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THE SECRETARY OF THE FACULTY.
THE DEAN, *Chairman ex officio.*

The Office of the Graduate School is in Morrill Hall (second floor). The office hours are 8:30 to 1 and 2 to 4.

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CALENDAR OF THE GRADUATE SCHOOL FOR 1939–40

SUMMER SESSION, 1939

1939		
June	15	Last day for new students to file applications for admission to the Graduate School for the Summer Session.
July	3	Summer Session registration.
July	8	Last day for payment of tuition.
July	10	Last day for filing statement-of-courses blanks, change-of-committee blanks, recommendation-of-previous-residence blanks, and for new students to file candidacy blanks to receive residence credit for the Summer Session.
July	17	Last day for taking qualifying examinations for Ph.D. in order to have them considered as of the beginning of the Session.
August	3	Last day for taking language examinations in order to have them considered as of the beginning of the Session.
August	12	Summer Session ends.
August	10	Last day for new students to file applications for admission to the Graduate School for first term of 1939–40.
Sept.	13	Last day for payment of graduation fee for candidates for September degrees.
Sept.	23	Last day for completing requirements for advanced degrees to be conferred in September.

FIRST TERM

Sept.	25	Registration of new students.
Sept.	26	Registration of old students.
Sept.	28	Instruction begins.
Oct.	12	Last day for filing statement-of-courses blanks, change-of-committee blanks, recommendation-of-previous-residence blanks, and for new students to file candidacy blanks to receive residence credit for the term.
Oct.	15	Last day for taking qualifying examinations for Ph.D. in order to have them considered as of the beginning of the term.
Oct.	19	Last day for payment of tuition for the first term.
Oct.	28	Last day for taking language examinations in order to have them considered as of the beginning of the term.
Nov.	29	Instruction ends at 4 P. M.
		Thanksgiving Recess
Dec.	4	Instruction resumed at 8 A. M.
Dec.	15	Last day for announcing titles of theses by candidates for advanced degrees to be conferred in June, 1940.
Dec.	20	Instruction ends at 4 P. M.
1940		*Christmas Recess*
Jan.	4	Instruction resumed at 8 A. M.
Jan.	25	Last day for new students to file applications for admission to the Graduate School for the second term.
Feb.	1	Last day for payment of graduation fee for candidates for February degrees.
Feb.	6	Last day for completing requirements for advanced degrees to be conferred in February.
Feb.	7	Term ends.
Feb.	8	A holiday.

SECOND TERM

Feb.	9	Registration
Feb.	10	
Feb.	12	Instruction begins.
Feb.	24	Last day for filing statement-of-courses blanks, change-of-committee blanks, recommendation-of-previous-residence blanks, and for new students to file candidacy blanks to receive residence credit for the term.
March	1	Last day for filing applications for fellowships and scholarships for 1940–41.
March	1	Last day for taking qualifying examinations for Ph.D. in order to have them considered as of the beginning of the term.
March	4	Last day for payment of tuition for the second term.
March	12	Last day for taking language examinations in order to have them considered as of the beginning of the term.
March	30	Instruction ends at 12:50 P. M.

Spring Recess

April	8	Instruction resumed at 8 A. M.
May	1	Last day for making application for June, 1940, degrees.
May	20	Examination period for June degrees.
June	11	
June	7	Last day for payment of graduation fee for candidates for June degrees.
June	11	Last day for completing requirements for advanced degrees to be conferred at Commencement.
June	17	Commencement.

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 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 or research 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 General Committee of the Graduate School is the chief administrative body of the Faculty. It is composed of thirteen members elected by the Faculty and two members *ex-officio* (see page 2). It is the duty of the General Committee "to pass upon questions which do not involve a change of policy; to consider such matters as may be referred to it by the Faculty; and upon its own initiative to make recommendations to the Faculty regarding questions involving the interests of the Graduate School."

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 of providing each such student with a comprehensive view of a field of knowledge and 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.

Graduate work, in the main, falls under three headings: (1) work

in formal courses, listed in this Announcement in bold-faced titles[1]. (2) informal work, such as reading, seminars, special problems and the like—as assigned by the candidate's Special Committee or by other professors under whom he may be working; and (3) research, ordinarily for the thesis. The division of time among these three categories depends upon the degree for which the student is a candidate, his fields of work, and the program of study mutually agreed upon by his Special Committee. Requirements for advanced degrees are, in general, based upon the satisfactory completion of graduate work term by term.

The following degrees are offered:

Master of Arts (A.M.)
Master of Science (M.S.)
Master of Science in Agriculture[2] (M.S. in Agr.)
Master of Fine Arts[3] (M.F.A.)
Master of Architecture[3] (M.Arch.)
Master of Landscape Architecture[3] (M.L.A.)
Master of Science in Engineering[4] (M.S. in Eng.)
Master of Chemical Engineering[4] (M.Chem.E.)
Master of Civil Engineering[4] (M.C.E.)
Master of Electrical Engineering[4] (M.E.E.)
Master of Mechanical Engineering[4] (M.M.E.)
Master of Laws[5] (LL.M.)
Master of Education[6] (M.Ed.)
Master of Science in Education[6] (M.S. in Ed.)
Doctor of the Science of Law[5] (J.S.D.)
Doctor of Philosophy (Ph.D.)

ADMISSION

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

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

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.

[1]Courses primarily for undergraduates are titled in italics and ordinarily are not open to graduate students.
[2]Open only to students who have had a four-year course in Agriculture or the equivalent.
[3]Under the special jurisdiction of the Division of Architecture and Fine Arts.
[4]Under the special jurisdiction of the Division of Engineering.
[5]Under the special jurisdiction of the Division of Law.
[6]Under the special jurisdiction of the Graduate School of Education.

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 to the first and second terms, respectively; and not later than June 15 for entrance to the Summer Session.

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

To be admitted to the Graduate School, either as a non-candidate or as a candidate for a degree, 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.

Requirements in foreign languages for admission. There are no requirements in foreign language for admission either to non-candidacy or to candidacy for or for graduation with any of the degrees of M.S. in Agr., M.Ed., or M.S. in Ed.

A candidate for any of the degrees A.M., M.S., M.Arch., M.L.A., M.F.A., M.Chem.E., M.C.E., M.E.E., M.M.E., or M.S. in Eng. must satisfy either (a), (b), or (c) of the following requirements.

(a) To be admitted to candidacy for A.M., M.S., M.Arch., M.L.A., or M.F.A., he must have had previous training in one foreign language equivalent to three entrance units, or two units in each of two languages; to candidacy for M.Chem.E., M.C.E., M.E.E., M.M.E., or M.S. in Eng., two entrance units in one foreign language.

(b) At the beginning[1] of candidacy he must demonstrate his ability to read either French or German (or another language other than English approved by his Special Committee) by passing an examination given by a member of the Language Examination Board (see p. 29).

(c) An applicant who, at entrance, can not meet either of the requirements (a) or (b), but who is otherwise qualified for admission, may be admitted to candidacy subject (1) to presenting three terms of residence (instead of two) for graduation

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

and (2) to demonstrating, before a member of the Language Examination Board not later than the beginning[1] of the third term of residence, a reading knowledge of a foreign language as provided in (b) above. 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 candidate for LL.M. or J.S.D. may be required to demonstrate a reading knowledge of such foreign languages as his Special Committee may deem necessary for the proper achievement of his program.

A candidate for the Ph.D. degree is expected to possess a reading knowledge of two foreign languages at the beginning of his candidacy at Cornell for that degree. See page 20, however, for further details regarding the language requirement for Ph.D.

Resident Doctors

Persons who hold the Doctor's degree or who have equivalent standing may, subject to permission from the Dean, be admitted to 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. Resident Doctors ordinarily are not permitted to attend classes.

Graduate Students not Candidates for Degrees

Students admitted to the Graduate School usually 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 be admitted to the Graduate School as a "non-candidate" and arrange a program of graduate study suitable to his purposes. A non-candidate is required to select from among the members of the Graduate Faculty an adviser to direct his work and to file with the Dean not later than two weeks after first registration a statement of the field in which he wishes to work signed by the adviser. A non-candidate is expected to pursue a coordinated program of graduate work and to file each term a statement of courses[2], approved by his adviser, as provided for candidates for degrees (see p. 25).

Candidates for Degrees

No student will be awarded any degree by Cornell University

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

[2]These courses must in general be selected from those titled in bold-faced type in this Announcement.

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.

The work of each candidate for a degree is directed by a Special Committee, selected by the student as explained below. The requirements for advanced degrees are: (1) the satisfactory completion, during a minimum period of residence specified for each degree, of graduate work acceptable to the Special Committee; (2) with the exception of candidates for the degrees LL.M.[1], M.Ed. and M.S. in Ed.[2], and of candidates working under Plan B[3] for A.M., M.S., or M.S. in Agr., the presentation of an acceptable thesis or essay; and (3) the passing of a "final" examination.

REQUIREMENTS FOR DEGREES

Residence

Minimum residence requirements are set for each of the advanced degrees offered by the Graduate School.

For J.S.D. and for each master's degree a minimum of two terms of residence is required, except that three terms are required of those candidates who are unable on beginning candidacy to meet the foreign language requirement for certain degrees (see p. 12).

For Ph.D. a minimum of six terms of residence is required, except that seven terms are required of those candidates who are unable to demonstrate a reading knowledge of at least one approved foreign language on beginning candidacy at Cornell University. For further information concerning residence for Ph.D. see p. 21.

Additional information concerning residence will be found on p. 26.

Masters' Degrees

Depending on the degree for which he is a candidate, the work of a graduate student will follow one or another of the following procedures.

Plan A. Open to candidates for A.M., M.S., M.S. in Agr., M.F.A., M.Arch., M.L.A., M.S. in Eng., M.Chem.E., M.C.E., M.E.E., or M.M.E.

Plan A is intended primarily for those candidates who, by suitably restricting their graduate work to a given field, wish to acquire some degree of competence in that field, frequently as a basis for further study and research, or for professional purposes.

The candidate selects a Major Subject and a related Minor Subject and a Special Committee, made up of one member of the Faculty to represent each subject. He must (1) work under the direction of this Special Committee for at least the minimum required period of residence and must complete his work to the satisfaction of the committee; (2) present a thesis (or essay) acceptable to his committee; and (3) pass a final examination.

[1]See p. 17. [2]See p. 18. [3]See p. 10.

Major and Minor Subjects. 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. Before selecting his Major and Minor Subjects the student should consult members of the Faculty in the field or fields concerned regarding suitable combinations of subjects. Ordinarily the candidate will devote the major portion of his time — say something over one-half — to his Major Subject, and the remainder to his Minor Subject, the exact division being determined by his committee. Work in Major and Minor Subjects may consist of work in formal courses, informal work in seminars, or assigned reading or study — all in the discretion of the Special Committee. There are no requirements in semester hours under Plan A.

Special Committees. After the candidate 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. Not later than two weeks after first registration in the Graduate School a candidate must file, on the proper blank, a statement of the Major and Minor Subjects which he has selected. This statement must be signed by each member of the Special Committee as an indication of his approval and consent to serve on the committee.

Thesis or Essay. A candidate for any of the masters' degrees mentioned above must complete an acceptable thesis, or, in the discretion of his Special Committee, an essay. The thesis, or essay, is ordinarily written in the candidate's major field and under the direction of the chairman of his Special Committee, but it must be approved by both members of the Special Committee, for which purpose it should be in the committee's hands at least fifteen days before the final examination; and during the five days immediately preceding this examination a typewritten copy, approved by both members of the Special Committee, shall be on file in the office of the Graduate School.

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.

For further information regarding the thesis see page 26.

Final Examination. After the thesis, or essay, has been completed and filed in the office of the Graduate School as provided above and after the required period of residence has been substantially completed, 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.

For further information concerning final examinations see page 27.

Plan B. Open to candidates for A.M., M.S., or M.S. in Agr.

Plan B is designed for those who wish a somewhat broader training than is permitted under Plan A. It is intended to meet the needs of prospective or in-service teachers in secondary schools and of others who wish to supplement a four-year college course by an additional year of study at the graduate level. The candidate, working under the direction of a Special Committee, is required (1) to complete satisfactorily a minimum of thirty semester hours of work, comprising (a) work in formal courses and in seminars and (b) either an acceptable expository or critical essay or problem in research, or, if he prefers, a formal thesis; and (2) to pass a final comprehensive examination.

Fields of Concentration. Of the thirty semester hours in formal courses, seminars, and the like required of a candidate working under Plan B, approximately one-half must be in a field of concentration chosen by the candidate; and the remainder may be distributed among that field and related fields, in the discretion of the candidate's Special Committee, as best meets his needs.

The following is a provisional list of fields of concentration from which selection may be made; but the student's choice is not limited to this list. If none of these is suitable, he should consult the Dean of the Graduate School or the professors in the field in which he is interested.

Biological Sciences
Education
English
Fine Arts
Foreign Languages
Home Economics
Mathematics
Physical Sciences
Social Studies
Technical Agriculture

Special Committees. After the candidate has chosen his field of concentration, he must select two members of the Faculty to serve as his Special Committee. One of these must represent the field of concentration, the other may be chosen from either that field or some related field, depending on the candidate's program. The representative of the field of concentration is the chairman of the committee. The committee members' consent to serve, together with a statement of the field of concentration approved by both members of the Committee, must be filed with the Dean of the Graduate School, on the proper blank, not later than two weeks after first registration.

Thesis Research or Essay. A substantial part of the candidate's work in the field of concentration shall be devoted to studies requir-

ing original investigation, organization of material and criticism. Whether the candidate is to meet this requirement by work in seminars, by writing an essay or a thesis, or in some other way is left to the Special Committee in consultation with the student. If a thesis is required the candidate should follow the procedure for presenting theses outlined under Plan A, page 15.

The Special Committee will report to the office of the Graduate School the semester-hour equivalent of the thesis or the essay, or of other work, not otherwise reported in formal courses, done by the candidate in meeting this requirement.

Final Examination. After the candidate has satisfied the minimum period of residence and has satisfactorily completed[1] at least thirty semester hours of work approved by his Special Committee, he must present himself for the final comprehensive examination, which covers the thesis or essay, if presented, as well as work done in formal courses and seminars. The examination may be written or oral, or both, at the option of the Special Committee.

For further information concerning final examinations, see page 27.

Other Procedures. Procedures differing somewhat from Plan A or Plan B have been adopted for work leading to masters' degrees in certain professional fields.

Master of Laws, LL.M. The degree LL.M. is intended primarily for those who desire to increase their knowledge of the law by work in special fields. In addition to meeting the general requirements for admission given on page 12, the candidate must have received the degree Bachelor of Laws from an approved law school and must have demonstrated a high standard of professional ability. To complete the requirements for the degree the candidate (1) must work for a minimum period of two terms under the direction of a Special Committee of three chosen by the candidate, after consultation with the chairman of the Division of Law, from the Faculty in Law and related fields (such as Economics, Government, History, and Philosophy); (2) shall complete with high merit such a program of instruction and investigation as shall be approved by his Special Committee and acceptable to the Division; (3) must demonstrate his ability creditably to pursue research in Law by the submission of articles or reports; and (4) must pass with superior standing a final examination and such other examinations as shall be required by his Special Committee and acceptable to the Division.

For further information concerning LL.M. see page 191 of this Announcement and also the Announcement of the Cornell Law School.

[1]The final examination will usually be given near the end of the candidate's last term of residence during which he is taking such courses as are necessary to complete the required thirty semester hours of work. Eligibility for the final examination will depend on satisfactory progress in those courses, and their completion is essential to meeting all requirements for the degree.

Master of Education, M.Ed. This degree is awarded at the end of the fifth year of the five-year program recently established at Cornell University for the training of secondary school teachers. Details regarding prerequisites for admission, procedure in working for the degree, and requirements for graduation with the degree have not been determined as this Announcement goes to press (March 1, 1939). Prospective candidates should communicate with the Director of the Graduate School of Education, 211 Stone Hall, Ithaca, N. Y.

Master of Science in Education, M.S. in Ed. This degree is designed for school executives and teachers who wish to enter upon a course of professional study. The candidate, working under the direction of a Special Committee of three for a minimum period of two terms, is required to complete, to the satisfaction of his committee, an approved program of study adjusted to his needs. Within that program will be included work in formal courses and seminars, and either a thesis[1] or a critical essay or a problem in research. The Special Committee, chosen by the candidate with the approval of the Director of the Graduate School of Education, shall contain at least two members from the staff in Education, one of whom shall be chairman. The candidate is required to pass a comprehensive final examination. For further details see under "Graduate School of Education", this Announcement, page 142.

Doctors' Degrees

Two doctors' degrees are offered by the Graduate School of Cornell University: Doctor of the Science of Law, J.S.D., and Doctor of Philosophy, Ph.D.

Doctor of the Science of Law, J.S.D. Work leading to this degree is designed to train legal scholars and to stimulate original investigations in the science, history, administration, and progress of the law.

Admission. To be eligible for admission to candidacy for J.S.D. the candidate shall have received the degree Bachelor of Laws from an approved law school; shall have had some professional practice or teaching experience after obtaining that degree; and must have demonstrated a high standard of professional ability.

Residence and Special Committee. The candidate shall be in residence a minimum period of two terms working under the direction of a Special Committee of three chosen by the candidate after consultation with the Chairman of the Division of Law. The chairman of the committee and one other member shall be from the Faculty of the Law School, but the third member may be chosen from the Graduate School Faculty in a field appropriate to the

[1]The thesis, if written, should be presented in accordance with the procedures outlined on pages 15 and 26.

candidate's graduate objective, which normally will be in the related fields of Economics, Government, History, or Philosophy.

Program. The candidate shall pursue with distinction a program of study and investigation approved by his Special Committee and acceptable to the Division of Law and shall pass with superior standing such examinations as his Special Committee shall prescribe.

Thesis. The candidate must embody the results of his investigation in a thesis which shall be a creditable contribution to legal scholarship and which shall be presented in a form suitable for publication. He is required to file two bound copies, together with two copies of a typewritten abstract thereof, in the office of the Graduate School. For the procedures to be followed in presenting the thesis see pages 22 and 26.

Final Examination. After the thesis has been completed and filed in the office of the Graduate School, as provided on page 26, the candidate is required to present himself for a final examination.

For further information concerning J.S.D. see page 191 of this Announcement and also the Announcement of the Cornell Law School.

Doctor of Philosophy, Ph.D. Work leading to the Ph.D. degree is designed primarily to give the candidate a thoroughly comprehensive view of a field of knowledge; to train him in methods of research and scholarship in that field; and to develop qualities of leadership and a feeling of responsibility to add to the sum total of knowledge in his field. Each candidate is expected to maintain a high grade of achievement and increasingly to show evidence of ability in independent investigation and study. The requirements for the degree include, in addition to the requirements in foreign language, (1) six terms of residence as a graduate student, (2) the satisfactory completion, under the direction of a Special Committee, of work in one Major Subject and two Minor Subjects, (3) the presentation of an acceptable thesis, and (4) the passing of a qualifying examination and a final examination.

Admission. The general requirements for admission to the Graduate School are given on page 11 ff. In admitting to candidacy for Ph.D. special emphasis is placed on "promise of ability satisfactorily to pursue advanced study and research." In some fields of study the prospective candidate for Ph.D. frequently is first required to register and complete work for the appropriate master's degree as a basis for judging his ability.

Major and Minor Subjects. A candidate for Ph.D. must select a Major Subject and two Minor Subjects properly related to the Major Subject. He will devote more time to the Major Subject than to either Minor Subject, but the division of his time is left to

the Special Committee. 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. The candidate should consult members of the Faculty regarding his choice of subjects. Work in Major and Minor Subjects consists of work in formal courses, informal work in seminars, assigned reading and independent study—all in the discretion of the Special Committee. *There are no requirements in semester hours for the Ph.D. degree.*

Special Committees. After the candidate has chosen his Major and Minor Subjects, he must select a member[1] of the Faculty to represent each subject. The three persons so selected constitute the candidate's Special Committee, the representative of the Major Subject being chairman. Not later than two weeks after first registration in the Graduate School a candidate must file, on the proper blank, a statement of the Major and Minor Subjects which he has selected. This statement must be signed by each member of the Special Committee as an indication of his approval and consent to serve on the committee.

Requirements in Foreign Languages. Each candidate for Ph.D. 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[2] 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.

A candidate for Ph.D. is expected to meet the foreign language requirements at the beginning of his 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.

The Departments of Romance Languages and of German offer special courses for graduate students in beginning French and beginning German (see pages 60 and 55).

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.

[1]In special cases two members of the Faculty may be chosen to represent either the Major or a Minor Subject. If the candidate chooses two members to represent the Major Subject, he may designate one of them as chairman.

[2]To be designated by the office of the Graduate School.

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.

Residence; Work in Course. For Ph.D. a minimum of six terms of residence is required; or seven terms if the candidate does not pass one of the examinations in foreign language (see requirements in foreign language) on beginning candidacy at Cornell University. In addition to earning residence credit in regular (or summer) sessions of Cornell University a candidate for Ph.D. may, upon recommendation of his Special Committee, receive credit toward the minimum six (or seven) required terms for work done (1) in the Graduate School of Cornell University as a candidate for a master's degree[1]; (2) in another Graduate School as candidate for either a master's degree[1] or other graduate degree; (3) at Cornell University during the summer under "personal direction" of a member of the Faculty; (4) *in absentia* while registered in the Graduate School of Cornell University. But at least two consecutive terms, and ordinarily the last two, must be spent in regular sessions at Cornell University.

Work 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 not later than the end of the first term of residence at Cornell. But a candidate for Ph.D. must ordinarily spend the last year of required residence in Cornell University, in regular academic sessions, and in successive terms. In special circumstances, upon the recommendation of the student's Special Committee and with the approval of the General Committee of the Graduate School, continuous summer work for sixteen weeks under personal direction may be accepted as the equivalent of one of these two terms.

Personal Direction. A candidate for the Ph.D. degree who has demonstrated ability in graduate studies may, upon recommendation of his Special Committee and with the approval of the Dean, work during the summer under the personal direction of a member of the Faculty of the Graduate School. The privilege of working under Personal Direction will not ordinarily be granted to a student until he has completed at least a full year of graduate work in regular sessions. Application for the privilege must be accompanied by a statement of the member of the Faculty concerned showing the number of weeks during which he is prepared to supervise the work of

[1]Normally not more than two terms of residence toward the Ph.D. degree will be granted for residence gained while the student is a candidate for the master's degree.

the student and the nature of the work to be done. To secure credit for such work the student must register *in advance* at the office of the Graduate School, and the adviser must certify its satisfactory completion. A maximum of two terms may be earned in this way.

Credit toward the Ph.D. degree earned in Summer Sessions at Cornell or elsewhere is limited to two terms. A candidate who has already earned two terms of credit by work in summer sessions and who has demonstrated ability in graduate work may, however, upon the recommendation of his Special Committee and with the approval of the General Committee, earn two more terms of credit by working under Personal Direction. But the last year of residence must be in regular academic sessions and in successive terms.

Work in absentia. Under the following conditions a candidate for Ph.D. 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.

(f) A candidate for a degree at Cornell University is required to spend the last year of his candidacy in residence at the University, except that, with the consent of the Graduate Faculty, he may carry on the work of that year or a part of that year *in absentia.*

Thesis. A thesis is required of each candidate for Ph.D. Ordinarily the thesis is written in the candidate's major field and under the direction of the chairman of his Special Committee. But with the approval of the representatives of the Major and Minor Subjects the candidate may elect to do the thesis under the direction of another member of the Faculty, who then becomes a member of the Special Committee. The thesis must be approved by all members of the Special Committee, for which purpose it should be in the hands of the Committee at least fifteen days (*earlier* if possible) before the final examination B or C; and during the five days immediately preceding this examination a typewritten copy, bearing the written approval of all members of the Special Committee, shall be on file in the office of the Graduate School.

For further information concerning theses, see page 26.

Abstract of Thesis. Each candidate for Ph.D. must deposit in the office of the Graduate School, along with the 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 his abstract the candidate must deal directly with the contracting printer, whose name may be learned by inquiry at the Office of the Secretary of the University.

The abstract should be typed double-spaced on one side only of 8 x 10½ 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 each 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 candidate'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.

Diagrams or other illustrations should be used only when indispensable to the exposition and should be prepared, each diagram on a separate sheet, ready for publication. For further instructions consult the office of the Graduate School.

Qualifying Examination. Each candidate for Ph.D. must pass a qualifying examination given by his Special Committee. The primary purposes of the qualifying examination are (1) to ascertain whether the candidate is qualified to continue work for the doctorate; and, if so, (2) to plan his 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 candidate 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.

A report on each qualifying examination, whether passed, waived, or failed, should be filed by the Special Committee in the office of the Graduate School.

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 Examination. Each candidate for Ph.D. must pass a final examination, conducted by his Special Committee and covering (1) the Major and Minor Subjects and (2) the thesis and related topics. At the discretion of the Special Committee, the two parts of this examination may 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 26. 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 26. Examination C may be both oral and written.

No candidate may present himself for Final Examination B or C until he has satisfied the minimum period of residence and has filed the thesis as provided on page 26.

A candidate who has failed in any of these Final Examinations may not be re-examined within six months.

GENERAL REQUIREMENTS FOR AND INSTRUCTIONS TO CANDIDATES FOR ADVANCED DEGREES

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 five years preceding matriculation or certifies that at least three unsuccessful attempts at vaccination have been made within that period.

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 shall 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 graduate student who returns to the University to present his thesis and to take the final examination for an advanced degree, all other work for that degree having been previously completed, shall register as a "candidate for degree only" and shall pay only an administration fee of $12.50.

A graduate student who discontinues his work for any reason during a term in which he is registered should immediately report this fact to the office of the Graduate School.

Statement of Courses

At the beginning of each term and Summer Session a graduate student shall consult the members of his Special Committee or, if a "non-candidate", his adviser to plan and determine his program of work for the term. He shall then make out in duplicate a list of all the courses[1] which he plans to take during the term and shall have this list signed by the chairman of his committee (or adviser) as an indication of approval. The chairman of the committee (or adviser) shall retain one copy; the duplicate copy shall be filed in the office of the Graduate School within two weeks after registration. If an instructor should require evidence that the student's chairman approves registration in a given course, the student may borrow the copy on file with the chairman of his committee.

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 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.

[1]Courses primarily for undergraduates, titled in italics, are ordinarily not open to graduate students.

Residence

To receive credit for residence a candidate 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.

No candidate may earn more than two terms of residence credit in any given twelve months' period except with the permission of the Dean in special cases.

The amount of credit gained by a candidate who holds an appointment as instructor, as a teaching or research assistant, or who is acting in any capacity involving a significant loss of time from his graduate work, shall be determined by the General Committee of the Graduate School, upon recommendation of the Special Committee. In no case shall such credit exceed three-fourths, and in the case of full-time instructors one-half, of normal residence credit. Such candidates who, during an academic year have earned one and one-half terms' credit may earn an additional half term by work during the following Summer Session or by working during the following summer for eight weeks under Personal Direction. Full-time instructors who have earned one term of credit during an academic year may earn an additional term by working for sixteen weeks during the following summer under Personal Direction.

All work for an advanced degree, including the final examination, must be completed within four years after the minimum residence requirement for the degree has been satisfied.

The Thesis or Essay

The subject of the thesis, or essay, 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 should 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 for the Ph.D. 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.[1]]

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

Before the degree can be conferred two[2] 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.

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.

FINAL EXAMINATIONS

No candidate may proceed to the final examination for an advanced degree (for the Ph.D. degree Examination B or C) until he has completed the minimum residence requirement, has filed the thesis (if required) in the office of the Graduate School, and has completed such other work as may be required by his Special Committee.

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 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.

A report on each final examination shall be filed by the Special Committee in the office of the Graduate School. A candidate who has failed in a final examination for a master's degree may not be

[1]See "Application for Degrees", on this page.

[2]The candidate should consult the chairman of his committee to ascertain if additional copies are required by the department.

re-examined within three months; and for the Ph.D. or J.S.D. degrees within six months.

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

Work under Personal Direction

See page 21 and below on this page.

Work in Summer Session

A statement of graduate work offered during the Summer Session of Cornell University will be found in the Announcement of the Summer Session.

Credit toward advanced degrees may be earned in Summer Sessions in accordance with the following conditions and rules.

For A.M., M.S., M.S. in Agr., and Ph.D. residence during Summer Sessions may be counted at the rate of three Summer Sessions for one term of credit, and five sessions for two terms; for all other advanced degrees at the rate of two Summer Sessions for each term of credit.

Since Cornell University grants no advanced degree for less than two terms of residence and work in the Graduate School and since the minimum residence requirement for masters' degrees is two terms, work in Summer Sessions elsewhere can not be counted toward masters' degrees at Cornell.

The credit toward the Ph.D. that may be earned in Summer Sessions at Cornell University or elsewhere is limited to two terms. A candidate who has demonstrated unusual ability in his graduate studies, however, may, upon recommendation of his Special Committee and upon approval by the General Committee, earn a maximum of two more terms by work in the summer under Personal Direction (see p. 21). But the last year of candidacy for Ph.D. must be spent in residence at the University and in consecutive, regular sessions.

To obtain residence credit in the Graduate School for Summer Session work the candidate must register both in the Summer Session and in the Graduate School. He must file in the office of the Graduate School within one week after registration a statement-of-courses blank, as provided for students in the regular session (see p. 25).

A candidate registered under Personal Direction during the summer may be admitted to the current Summer Session classes without payment of further tuition only if the amount of the tuition which he has paid for Personal Direction work is at least equal to that paid by students regularly enrolled in the Summer Session. Such students who wish to attend Summer Session classes must register also in the Summer Session.

Language Examination Board

The Language Examination Board is composed of approximately forty members of the Faculty, there being one representative in French and one in German for each of the general fields in which graduate work is offered. A student who wishes to take a language examination should call at the office of the Graduate School in Morrill Hall for assignment to an examiner.

A student who is permitted by his Special Committee to substitute another language for French or German will be assigned to an examiner by the office of the Graduate School.

All examinations to test a candidate's knowledge of a foreign language must be passed at Cornell University before a member of the Language Examination Board. In case of failure in an examination, no re-examination can be given, ordinarily, within one month.

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.

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 resi-

dence at Cornell required to complete the residence requirement for the degree in question, any waivers previous to July 1, 1934, included.

A member of the teaching or scientific staff registered in the Graduate School whose salary equals or exceeds $1,500 shall pay tuition.

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 graduate student who returns to the University to present his thesis and to take the final examination for an advanced degree, all other work for that degree having been previously completed, shall register as a "candidate for degree only" and shall pay only an administration fee of $12.50.

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[1] 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.

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[1] 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

[1]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.

and in the Summer Session and must pay a tuition fee of $55 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. The Willard Straight fee of $3 is also charged to each student exempt from payment of Summer Session tuition. 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 Tompkins County, N. Y., must register in person with the Committee on Traffic Control and pay a registration fee of $1 each term during the academic year. A student must present evidence that the vehicle may be legally operated in New York State and that the Operator may legally drive in New York State. This registration must be completed within a week of beginning to have or operate a motor-driven vehicle here. A registration fee of $2 is charged if late.

Students may not park any motor-driven vehicle on the University Campus or grounds unless the vehicle has a student parking permit. These permits are issued only when the student actually needs to drive to the campus. They are required from the first day of each term and cost $2 a term during the regular academic year, and $1 for the Summer Session.

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 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 degrees at Cornell University, who have been in residence during the preceding academic year.

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 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 should estimate his living expenses at the rate of twenty dollars a week during the school year from September till June, exclusive of the tuition and other fees, clothing, and traveling expenses. There are no boarding houses near the University. 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.

Opportunities for self-support are limited. Graduate work is very exacting. It is urged that students, particularly during the first year, should provide themselves with sufficient funds for personal expenses, tuition, and fees. For further information consult the *General Information Number*, which will be mailed free to any applicant by the Secretary of the University, 209 Morrill Hall.

For Women. All women graduate students at Cornell University live in houses approved by the Dean of Women. Graduate women students who are under twenty-one years of age are required to live in the University Residential Halls. The first of September the Office of the Dean of Women issues a list of rooms off the campus available for the fall term. Anyone wishing this list and assistance in locating suitable rooms should write to the Dean of Women, Cornell University. For information regarding any possibilities for self help for women, inquiries should be addressed to the same office.

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 already enrolled at Cornell University.

Loan Funds for Women Graduate Students

There is available a loan fund 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 ordinarily 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 carrying cash stipends 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 1940–41

For 1940–41 there are offered the following fellowships and scholarships carrying stipends as indicated and exemption from tuition unless otherwise noted:

Agriculture

Three *Henry Strong Denison Fellowships in Agriculture.* Stipends, $1,000 each. Do not carry exemption from tuition. These fellowships, in memory of Henry Strong Denison, a graduate of Cornell University in the class of 1905, were established by a gift from the Henry Strong Denison Medical Foundation, Inc., founded by Mrs. Ella S. Denison. With the income from this gift, the Board of Trustees of Cornell University has established three fellowships to be distributed annually among the following fields: plant sciences, animal sciences, social sciences, and agricultural engineering. The fellowships are awarded for the academic year. Preference will be given to those applicants who expect to complete the requirements for the Ph.D. degree and who appear most promising from the standpoint of ability to conduct research.

The Clinton DeWitt Smith Fellowship in Agriculture. Stipend $400. Does not carry exemption from tuition. This fellowship is limited to students who come from farm homes and who have had farm training. Applicants should submit detailed statements covering such experience.

The University Fellowship in Agriculture. Stipend $400.

See also under Animal Biology, Botany, and Entomology.

Animal Biology

The Schuyler Fellowship in Animal Biology. Stipend $400.

The Graduate Scholarship in Animal Biology. Stipend $200.

See also under Agriculture and Entomology.

Architecture

The University Fellowship in Architecture, Landscape Architecture, and Fine Arts. Stipend $400.

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

Bacteriology

Applicants who wish to pursue work in Bacteriology should apply for either the fellowships in Agriculture or the scholarship in Veterinary Medicine.

Botany

The Goldwin Smith Fellowship in Botany, Geology, or Physical Geography. Stipend $400. Awarded for work in Botany in 1940–41.
See also under Agriculture.

Chemistry

The Sage Fellowship in Chemistry. Stipend $600.
The du Pont Fellowship in Chemistry. Stipend $750.
The Carl G. Schluederberg Fellowship. Stipend to be announced.
The John E. Teeple Fellowship. Stipend to be announced.

Classics

Two *Fellowships in Greek and Latin.* Stipend $600 each. (These two fellowships may, at the discretion of the Faculty, be increased to three or more fellowships or scholarships with correspondingly reduced stipends.)
One *Scholarship in Greek and Latin.* Stipend $300.

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 in 1940–41.
The Fellowship in Political Economy. Stipend $600. Awarded in 1940–41 and alternate years.

Education

See Honorary Scholarships in Education below.

Engineering

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.
The Graduate Scholarship in Civil Engineering. Stipend $200.
The Sibley Fellowship in Mechanical and Electrical Engineering. Stipend $400. (Ordinarily awarded for work in Mechanical Engineering.)
The Charles Bull Earle Memorial Fellowship in Mechanical and Electrical Engineering. Stipend $400. (Ordinarily awarded for work in Electrical Engineering.)
The Edgar J. Meyer Memorial Fellowship in Engineering Research. Stipend $400. (Ordinarily awarded for work in Mechanical Engineering.)
See also the John McMullen Graduate Scholarships and the Elon Huntington Hooker Fellowship in Hydraulics, listed below.

English

The Cornell Fellowship in English. Stipend $600.

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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.

ENTOMOLOGY

See Comstock Scholarships below and also under Agriculture and Animal Biology.

FINE ARTS

See Architecture.

GEOLOGY

The Graduate Scholarship in Botany, Geology, or Physical Geography. Stipend $200. Awarded for work in Geology or Physical Geography in 1940–41. 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 1940–41.

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 $400. Does not carry exemption from tuition.

LANDSCAPE ARCHITECTURE

See Architecture.

MATHEMATICS

The Erastus Brooks Fellowship in Mathematics. Stipend $600.

NATURE STUDY

See Comstock Scholarships and Special Temporary Fellowships below.

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.

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 38.

[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.

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

The Board of Trustees has established thirty tuition scholarships for graduate students. 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 not later than March 1 to the professor, or professors, in whose field the applicant is working or to the office of the Graduate School. Awards are made in April of each year.

The holder of a tuition scholarship may accept another appointment or additional work interfering with his studies only upon permission from the General Committee of the Graduate School.

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 1940–41 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 1939–40 the stipend has been 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 Graduate Scholarships

The John McMullen Graduate Scholarships: Open to candidates for advanced degrees in Chemical, Civil, Electrical, or Mechanical 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 fifteen scholarships of an annual value of $900. 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 must register in the Graduate School and pay the appropriate tuition and fees. Correspondence 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 and does not carry free tuition. 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 not later than March 1. 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 Nature Association Fellowships in Nature Education (Nature Education).
The American Potash Institute Fellowship (Vegetable Crops and Agronomy).
The Dairy and Ice Cream Machinery and Supplies Association Fellowship (Dairy).
The Freeport Sulfur Company Fellowship Number 2 (Plant Pathology).
The Frosted Foods Fellowship Number 7 (Foods Chemistry).
The Frosted Foods Fellowship Number 8 (Foods Chemistry).
The Frosted Foods Fellowship Number 9 (Foods Chemistry).
The G. L. F. Poultry Fellowship (Poultry Husbandry).
The Lederle Fellowship (Veterinary Medicine).
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 Silver Producers Fellowship for the Investigation of the Fungicidal Properties of Silver (Plant Pathology).
The Staten Island Growers' Fellowship (Plant Pathology).
The Texas Gulf Sulphur Company Fellowship Number 1 (Entomology and Plant Pathology).
The Texas Gulf Sulphur Company Fellowship for the Study of the Insecticidal and Fungicidal Properties of Sulphur (Entomology and Plant Pathology).
The Wilbur White Fellowship (Vegetable Crops).

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*; 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*; Mrs. DOROTHY RIDDLE, *Librarian of the College of Home Economics*; Miss E. C. WILLIAMS, *Librarian of the Veterinary College*; Miss R. S. HARRIS, *Librarian of the College of Architecture*; Dr. H. H. KING, *Faculty Research Assistant.*

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 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. 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 Regional and City Planning, 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. 42)

(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
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
Regional and City Planning 2,3,4
Sculpture 2,3,4
Theory of Music 2,3,4

AESTHETICS

Professors R. M. OGDEN, R. W. CHURCH, and G. H. SABINE.

The courses in Aesthetics offered by the Philosophy Department are:

Philosophy 8a. Psychology of Aesthetic Perception. First term. Three hours a week. Professor OGDEN. T Th S 11. Museum of Casts.

Philosophy 8b. Philosophy of Art. Second term. Three hours a week. Assistant Professor CHURCH. T Th S 11. Goldwin Smith 227.

Philosophy 19. Advanced readings in Aesthetics. Second term. Assistant Professor CHURCH. Hours by appointment. Goldwin Smith 224.

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

Philosophy 29. The Philosophy of Value. Second term. Professor SABINE. T Th S 11. Goldwin Smith 220.

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

ARCHITECTURE

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

Graduate work is offered in architectural design, in the history of architecture, in advanced construction, and in regional and city 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, seminar discussions, and especially by direct personal criticism and advice.

Architectural Design. Professors BOSWORTH, BURNHAM, SEYMOUR, and HARTELL.

History of Architecture. Professor DUNBAR.

Architectural Construction. Professors BAXTER, TILTON, and YOUNG.

REGIONAL AND CITY PLANNING

Professors CLARKE and HARTELL.

Graduate work is offered in regional and city planning to students in Architecture, Landscape Architecture, and others who are qualified.

Courses offered by the Department of Regional and City Planning are:

710. **Principles of Regional and City Planning.** History, theory, and application of the principles of planning.

711. **City Planning Practice.** Practical application of the theories of city planning.

712. **Regional Planning Practice.** Study of principles involved in county, regional, state, and national planning.

713. **Housing.** Theory and standards of housing practice.

714. **Seminar in Regional and City Planning.**

THE HISTORY AND PRACTICE OF THE FINE ARTS

Professors D. L. FINLAYSON, CHRISTIAN MIDJO, W. McL. DUNBAR, W. K. STONE, F. O. WAAGÉ, and K. L. WASHBURN, and Mr. P. A. UNDERWOOD.

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 MIDJO, STONE, and WASHBURN.

Composition. Professor MIDJO.

Sculpture. Professor WASHBURN.

History of Art. Professors FINLAYSON and WAAGÉ.

History of Architecture. Professor DUNBAR.

Other members of the staff will cooperate as necessary.

LANDSCAPE ARCHITECTURE

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

History of Landscape Architecture. Professors MONTILLON and LAWSON.

Planting Design. Professors CURTIS and LAWSON.

Park and Parkway Design. Professor CLARKE.

MUSIC

Professors PAUL J. WEAVER, OTTO KINKELDEY, ANDREW C. HAIGH, RONALD INGALLS, and RICHARD T. GORE.

1. *Theory Practice of Music.* Assistant Professor GORE. T Th 2.
5. *The Art of Music.* Professor WEAVER. M W F 10.
7. *Instrumental Ensemble.* Assistant Professor INGALLS. T F 3–5.
8. *The Orchestra.* First term. Assistant Professor INGALLS. M W F 9.
10. *History of Music.* Professor WEAVER. T Th 11.
20. *Harmony, First Year.* Assistant Professor GORE. M W F 12.
21. *Harmony, Second Year.* Assistant Professor GORE. 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. Not given in 1939–40.]

34. *Historical Survey of Chamber Music.* Second term. Assistant Professor INGALLS. M W F 2.
40. *Composition, First Year.* Assistant Professor HAIGH. T Th S 10.
41. *Composition, Second Year.* Assistant Professor HAIGH. T Th S 8.
50. **Bach.** First term. Professor WEAVER. M 4–6.

[51. **Haydn and Mozart.** First term. Assistant Professor INGALLS. M 4–6. Not given in 1939–40.]

[52. **Brahms.** Second term. Assistant Professor INGALLS. M 4–6. Not given in 1939–40.]

53. **Debussy.** Second term. Assistant Professor HAIGH. M 4–6.

[54. **Beethoven.** Second term. Assistant Professor HAIGH. M 4–6. Not given in 1939–40.]

60 and 61. *Applied Music (organ, piano, violin).* Assistant Professors GORE, 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, EDWIN NUNGEZER, JOHN C. ADAMS, and 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 Dra-

matic 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; *Costumes*, ELIZABETH D. WORMAN.

Tragedy and Comedy. (*English* 49.)

Shakespeare. (*English* 61.)

Topics in Dramatic History before 1700. (*English* 251.)

Dramatic Structure. Assistant Professor MYERS. (*English* 150 and 250.)

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

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

Stagecraft. (*Public Speaking* 45, second term, M W 12, T 1:40–4.)

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

Stage Design and Theatre Crafts. Mr. LEWIS. (*Public Speaking* 46, first term, T Th 12.)

History of Theatrical Costume. Miss WORMAN. (*Public Speaking* 47, T 2–4, and an hour to be arranged.)

History of the Theatre. Professor DRUMMOND. (*Public Speaking* 48. Not given in 1939–40.)

Playwriting. Professor DRUMMOND. (*Public Speaking* 49b, not given in 1939–40.)

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 1939–40.)

Modern Theories of Stage Presentation. Assistant Professor STAINTON. (*Public Speaking* 68, first term, M 2–4.)

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 H. J. DAVIS, F. C. PRESCOTT, C. S. NORTHUP, B. S. MONROE, L. N. BROUGHTON, R. C. BALD, LANE COOPER, W. H. FRENCH, EDWIN NUNGEZER, and W. M. SALE.

See also courses described under English Language and Literature, p. 51.

33. *Sixteenth Century Literature.* Throughout the year. Three hours a week.
36. *Victorian Literature.* Throughout the year. Three hours a week.
39. *American Literature.* Throughout the year. Three hours a week.
53. *Modern American Poetry.* First term. Three hours a week.
56. *Middle English Metrical Romances.* Second term. Two hours a week.
60. *Chaucer and his Age.* Throughout the year. Three hours a week.
61. *Shakespeare.* Throughout the year. Three hours a week.
63. *Milton.* First term. Three hours a week.
65. *Wordsworth.* Second term. Three hours a week.
71. *Spenser.* Second term. Three hours a week.
72. *Dryden and Pope.* First term. Two hours a week.
73. *Pope.* Second term. Three hours a week.

76. *Byron and Shelley.* Throughout the year. Three hours a week.
77. *Coleridge and Keats.* Second term. Three hours a week.

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.

108. **Elizabethan Literature.** Throughout the year. Assistant Professor NUNGEZER. M W F 12. Goldwin Smith 338.

[110. **Studies in Seventeenth Century Literature.** Throughout the year. Professor DAVIS. Not given in 1939–40.]

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.

114. **Studies in Eighteenth Century Literature.** Throughout the year. Professor DAVIS. Room and hour to be arranged.

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.

LANGUAGES AND LITERATURES

THE CLASSICS

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

Approved Major and Minor Subjects (key to symbols on p. 42)

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 in the value of $600 and tuition and one scholarship of $300 and tuition 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. Both terms. Three hours a week.

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

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

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

5. *Greek Composition.* Throughout the year. One hour a week.

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. Not given in 1939–40.]

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

20. **Lyric Poetry; Aeschylus, Prometheus Vinctus; Theocritus; Demosthenes, Philippics.** Throughout the year. Prerequisite, Greek 17. Professor JONES. T Th S 11. Goldwin Smith 124.

[22. **Plato, the Republic; Pindar, Selected Odes; Thucydides.** Throughout the year. Prerequisite, Greek 20. Not given in 1939–40.]

25. **Advanced Greek Composition.** Throughout the year. Prerequisite, Greek 5. Professor JONES. Th 2. Goldwin Smith 124.

[33. **Seminary. Studies in Greek and Roman Rhetoric and Oratory.** Professor CAPLAN. T 2. Not given in 1939–40.]

39. **Seminary. Aeschylus.** Professor HUTTON. M 2. Library, Classical Seminary Room.

[40. **Seminary. The Greek Anthology.** Development of the Epigram and of related literary forms; history of the collections. Professor HUTTON. Not given in 1939–40.]

[41. **Seminary. Strabo; or Homeric Geography.** Professor JONES. Not given in 1939–40.]

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

Assistant Professor WAAGÉ.

1. *History of Painting and Sculpture: Ancient and Mediaeval.* First term. Three hours a week.

2. *History of Greek Sculpture.* First term. Three hours a week.

3. *Art of the Roman Empire.* Second term. Three hours a week.

4. *Ancient Art.* Second term. Three hours a week.

[5. *Ancient Painting and Mosaic.* Second term. Three hours a week. Not given in 1939–40.]

6. *History of Coins.* First term. Two or three hours a week.

101. **Pausanias and the Topography of Greece with Special Reference to Athens.** Goldwin Smith 35.

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

LATIN

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

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

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

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

11. *Republican Poetry to Lucretius; and a Survey of Post-Augustan Literature.* Second term. Two hours a week.

[12. *Epic Poetry, Ennius; Virgil, Georgics, The Last Six Books of the Aeneid.* First term. Two hours a week. Not given in 1939–40.]

[16. **The Greater Republican Writers.** Plautus; Cicero; Lucretius. Throughout the year. Not given in 1939–40.]

17. **Literature and History of the Early Empire.** Tacitus: Annals; Juvenal; Pliny's Letters; Suetonius. Throughout the year. Professor CAPLAN. M W F 9. Goldwin Smith 124.

21. *Latin Writing.* Throughout the year. One hour a week.

26. *Teachers' Training Course.* First term. Professor DURHAM. T Th 12. Goldwin Smith 128.

[27. *Topography and Architectural Remains of Rome.* Not given in 1939–40.]

[41. **Seminary. Horace.** Professor CAPLAN. Not given in 1939–40.]

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

45. **Latin Writing, Advanced Course.** Throughout the year. First term: Professor HUTTON; second term: Dr. GREENE. M 2. Goldwin Smith 124.

[47. **Historical Latin Syntax.** Second term. Professor DURHAM. Not given in 1939–40.]

[48. **Vulgar Latin: Petronius, Cena Trimalchionis; Vulgar Latin Inscriptions, including Christian Inscriptions.** Second term. Professor DURHAM. Not given in 1939–40.]

49. **Indo-European Philology; Sounds and Flexions of Latin; Italic Dialects.** First term. Two hours. Professor DURHAM. M W 12. Goldwin Smith 128.

[50. **Latin Epigraphy.** First term. Two hours. Professor DURHAM. Not given in 1939–40.]

COMPARATIVE STUDY OF LITERATURE

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

Approved Major and Minor Subjects (key to symbols on p. 42)

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 advanced degrees 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 1939–40.]

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 1939–40.]

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 H. J. DAVIS, F. C. PRESCOTT, C. S. NORTHUP, B. S. MONROE, L. N. BROUGHTON, R. C. BALD, LANE COOPER, W. H. FRENCH, EDWIN NUNGEZER, E. A. TENNEY, W. M. SALE, J. C. ADAMS, H. A. MYERS, and C. W. JONES.

Approved Major and Minor Subjects (key to symbols on p. 42)

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 Criticism 1, 2, 3, 4
Literary Theory 1, 2, 3, 4
Medieval Literature 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 type of work within each field will vary, according as it is chosen for a major or a minor, and for the master's or the doctor's degree.

In their first term of residence, candidates for the degree of Doctor of Philosophy need designate their major fields of study only as "The English Language", "English Literature", or "American Literature". At the beginning of their second term, they are expected to designate the fields as they appear in the list of approved major and minor subjects. Candidates for the degree of Master of Arts must choose their major and minor subjects within two weeks after registration.

The Cornell University Library has collections suitable for advanced work in every division of English Literature; those in Old and Middle English and in Elizabethan and Nineteenth Century Literature are especially rich. A seminary room for study and small classes is also available. In addition, the Department has a separate collection, the Hart Memorial Library, with many reference books and ample desk and table space. Adjacent to this is the Goldwin Smith Library, in which are other valuable sets and volumes.

The *Cornell Studies in English*, a series of monographs, affords opportunity for the publication of work of graduates and members of the staff. Twenty-seven numbers have appeared.

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 the languages, ancient and modern, may, if it is of good quality, be counted against a shortage in undergraduate English. Training in the Greek and Latin literatures is especially acceptable as preparation for graduate work in English. All candidates for the degree of Doctor of Philosophy must have at least a full year course in Old English; must exhibit a general knowledge of English and American literature in an examination taken not less than two terms before the degree is to be awarded; and must accomplish satisfactory work in research. The 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 (see p. 20). The candidate's Special Committee may also, at its discretion, require a reading knowledge of Latin. The candidate for the degree of Master of Arts must have sufficient knowledge of French or German to make use of scholarly works in one of these languages.

One fellowship of the value of $600, with exemption from tuition, is awarded annually to a graduate student in English. To secure consideration applicants must ordinarily have completed a year of graduate study. The Department also nominates deserving applicants for tuition scholarships (see p. 37).

Courses in English open to candidates for advanced degrees are listed below in three groups: I. Undergraduate courses (to be taken by those graduate students who need preliminary work); II. Graduate courses primarily intended for students in their first year of graduate work, or for students beginning work in a field new to them; and III. Seminaries designed for advanced graduate students. The candidate for the Master's degree is ordinarily expected to have completed successfully at least three courses from Groups II, or III,

or to have completed three courses which his Special Committee deems equivalent in scope and quality. The candidate for the Doctor's degree is ordinarily expected to have completed successfully at least four courses of Group II, and two of Group III, or to have completed six courses which his Special Committee deems equivalent in scope and quality.

Group I. Undergraduate courses: graduate students taking these courses are expected to do extra work in order to achieve graduate credit. For a full description of these courses see the *Announcement of the College of Arts and Sciences.* This *Announcement* also describes the undergraduate courses to be offered in 1940–41 and may show minor changes in or additions to the courses for 1939–40.

32. *Medieval Literature.* Throughout the year. Three hours a week.
33. *Sixteenth Century Literature.* Throughout the year. Three hours a week.
36. *Victorian Literature.* Throughout the year. Three hours a week.
39. *American Literature.* Throughout the year. Three hours a week.
40. *The English Novel.* First term. Three hours a week.
42. *Early Nineteenth Century Novel.* First term. Three hours a week.
49. *Tragedy and Comedy.* Second term. Three hours a week.
53. *Modern American Poetry.* First term. Three hours a week.
55. *Biography.* Throughout the year. Three hours a week.
56. *Middle English Metrical Romances.* Second term. Two hours a week.
57. *The Myths in English Literature.* First term. Three hours a week.
60. *Chaucer and his Age.* Throughout the year. Three hours a week.
61. *Shakespeare.* Throughout the year. Three hours a week.
63. *Milton.* First term. Three hours a week.
65. *Wordsworth.* Second term. Three hours a week.
71. *Spenser.* Second term. Three hours a week.
72. *Dryden and Pope.* First term. Two hours a week.
73. *Pope.* Second term. Three hours a week.
74. *Johnson.* Second term. Three hours a week.
76. *Byron and Shelley.* Throughout the year. Three hours a week.
77. *Coleridge and Keats.* Second term. Three hours a week.
78. *Newman and Arnold.* First term. Three hours a week.
81. *Old and Middle English.* Throughout the year. Three hours a week.
82. *The English Language.* Second term. Two hours a week.
89. *Literary Criticism.* Second term. Three hours a week.

Group II. Graduate courses designed primarily for first-year students, or students beginning work in a field new to them. Open with permission to qualified undergraduates.

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.

102. **Middle English Literature.** Throughout the year. Assistant Professor FRENCH. Hours to be arranged.
A survey of English literature from 1150 to 1500, with special attention to literary and textual problems; the Arthurian tradition in England; the metrical romances; the dialects.

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

106. **Dante in English.** Throughout the year. Professor COOPER.

108. **Elizabethan Literature.** Throughout the year. Assistant Professor NUNGEZER. M W F 12. Goldwin Smith 338.

[109. **Shakespeare.** Throughout the year. Professor BALD. Not given in 1939–40.]

[110. **Seventeenth Century Literature.** Throughout the year. Professor DAVIS. Room and hour to be arranged. Not given in 1939–40.]

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.

114. **Studies in Eighteenth Century Literature.** Throughout the year. Professor DAVIS. Room and hour to be arranged.

[115. **Studies in the English Novel.** Throughout the year. Assistant Professor SALE. Not given in 1939–40.]

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.

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

140. **American Literature.** Throughout the year. 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.

142. **Theories of Interpretation.** Throughout the year. Assistant Professor SALE. Room and hour to be arranged.

A study of the nature of language as an aid in the interpretation of literature. Relevant portions of the work of Hobbes, Berkeley, Coleridge, Dewey, Richards, and others will be considered.

150. **Dramatic Structure.** Throughout the year. Assistant Professor MYERS. M 3. Goldwin Smith 183.

A study of dramatic history and theory, with reading of representative plays. This course is supplementary to English 23 and 49, which should precede or accompany it.

Group III. Graduate seminaries designed for advanced students, or other students who have had exceptional preparation. The purpose of these seminaries is to bring to the student's attention possible fields for research, and to give advanced instruction in the methods of research. These courses are subject to change from year to year. Places of meeting and hours are to be arranged with the professors in charge.

201. **Old English.** Professor MONROE.
202. **Middle English.** Assistant Professor FRENCH.
208. **Elizabethan Literature.** Assistant Professor NUNGEZER.
211. **Poetic Theory and Criticism.** Professor PRESCOTT.
214. **Swift.** Professor DAVIS.
216. **Wordsworth.** Professor BROUGHTON.
217. **Shelley.** Professor PRESCOTT.
241. **The English Language.** Professor MONROE.

250. **Dramatic Structure.** Assistant Professor MYERS.
251. **Topics in Dramatic History before 1700.** Professor BALD.
260. **Methods and Materials of Literary Research.** Professor BALD.

GERMANIC LANGUAGES AND LITERATURES

GERMAN

Professors A. W. BOESCHE, P. R. POPE, A. L. ANDREWS, H. SCHNEIDER, and V. LANGE.

Approved Major and Minor Subjects (key to symbols on p. 42)

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 classroom 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.* Second term. Six hours a week.
1a. *Course for Beginners.* Throughout the year. Three hours a week.
1c. *Course for Chemists.* Throughout the year. Three hours a week.
1g. *Course for Graduates.* M W F 8. Goldwin Smith 177.

Intended for those graduate students who have no knowledge of German and must prepare themselves for the reading examination in it. The first term is devoted to the fundamentals of grammar, the second term to conferences with individual students or groups of students upon readings assigned them on subjects connected with their special fields of study.

3. *Intermediate Course.* Repeated in second term. Five hours a week.
3a. *Intermediate Course.* Throughout the year. Three hours a week.
4. *Elementary German Composition and Conversation.* Throughout the year. Three hours a week.
5. *Reading of Modern German Texts.* Throughout the year. Three hours a week.
[6. *German Civilization.* Second term. Two hours a week. Not given in 1939–40.]
8. *Scientific German.* Second term. Three hours a week.
10. *Advanced German Composition and Conversation.* Throughout the year. Three hours a week.
11. *Schiller's Dramas.* First term. Three hours a week.
12. *Schiller's Poems.* Second term. Three hours a week.
13. *Goethe's Life and Works.* First term. Three hours a week.

14. *Goethe's Faust.* Second term. Three hours a week.
15. *Survey of German Literature.* Both terms. Three hours a week.
16. *Contemporary German Literature.* Throughout the year. Three hours a week.
17. *Nineteenth Century Drama.* First term. Three hours a week.
18. *Lessing's Life and Works.* First term. Three hours a week.
[19. *German Lyric Poetry from Goethe to George.* First term. Three hours a week. Not given in 1939–40.]
20. *The German Novel from Moerike to the Present.* Second term. Three hours a week.
21. *Bibliographical Introduction to the History of German Literature.* First term. Two hours a week.
22. *German Romanticism.* Second term. Three hours a week.
23. *Gerhard Hauptmann.* First term. Two hours a week.
[25. *Wagner's Life and Works.* First term. Three hours a week. Not given in 1939–40.]

36. **Friedrich Nietzsche.** Second term. Two hours a week. Primarily for graduates. Assistant Professor LANGE. By appointment.

37. **Middle High German.** Both terms. Three hours a week. In some years Middle Low German will be substituted in the second term. Professor ANDREWS. M W F 3. Goldwin Smith 178.
[40. *Teacher's Course in Methods.* Second term. Two hours a week. Not given in 1939–40.]

42. **Gothic.** First term. Three hours a week. Professor BOESCHE. M W F 11. Goldwin Smith 188.
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. Three hours a week. Prerequisite, German 37. Professor BOESCHE. T Th S 11. Goldwin Smith 188.
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. One hour a week. Professor ANDREWS. Not given in 1939–40.]
A consideration of the sources of knowledge of the Germanic people up to and including the migrations.

48. **Principles of Germanic Philology.** Second term. Two hours a week. Professor ANDREWS. T 3–5. Goldwin Smith 177.
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. **Seminary in German Literature.** First term. Two hours a week. Assistant Professor LANGE. Th 3–5. Goldwin Smith 181.
Select problems in German literary criticism.

52. **Seminary in German Philology.** Second term. Two hours a week. Professor ANDREWS. F 3–5. Goldwin Smith 178.
Exercises in the application of the sound-laws to etymologies.

SCANDINAVIAN

Professor HALLDOR HERMANNSSON.

Approved Major and Minor Subjects (key to symbols on p. 42)

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. M W F 12. Given in alternate years.

[4. **Swedish.** First term. Three hours a week. Given in alternate years, not in 1939–40.]

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

[6. **Modern Scandinavian Literature.** Second term. Given in alternate years, not in 1939–40.]

7. **Early Scandinavian Civilization and History.** Second term. Two hours a week. W F 12.

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.

Approved Major and Minor Subjects (key to symbols on p. 42)

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 dramatic literature, and such candidates must expect to be in residence two years and one summer beyond the requirements for the Master's degree. If preparing for general teaching candidates might well make Public Speaking and Speech Training one of their minor subjects.

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; *Costumes,* ELIZABETH D. WORMAN.

13. **Advanced Argumentation.** Second term. Assistant Professor WAGNER. M W F 12. Goldwin Smith 234.

[15. **Advanced Public Speaking.** Assistant Professor MUCHMORE. Not given in 1939–40.]

16. **Forms of Public Address.** First term. Professor WICHELNS. T 11, Th 11–1. Room 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. M 2–4. Goldwin Smith 245.
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. Room 234.

[25. **British Rhetoric and Oratory.** Assistant Professor WAGNER. Not given in 1939–40.]

[27. **American Rhetoric and Oratory.** Professor WICHELNS. Not given in 1939–40.]

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

33. **Advanced Phonetics and Speech Training.** Second term. Assistant Professor THOMAS. M W F 9.

36. **Principles of Speech Correction.** Throughout the year. 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.** Second term. 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.* First term. Mr. LEWIS. T Th 12.

47. *History of Theatrical Costume.* Throughout the year. Miss WORMAN. T 2–4, and an hour to be arranged. Goldwin Smith 242.

[48. **History of the Theatre.** Professor DRUMMOND. Not given in 1939–40.]

[49b. **Playwriting.** Professor DRUMMOND. Not given in 1939–40.]

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.

[Studies in Greek and Roman Rhetoric and Oratory. Professor CAPLAN. See Greek 33. Not given in 1939–40.]

Dramatic Literature. See English 49, 61, and 251.

Fine Arts. See especially Architecture 425 (History of Painting and Sculpture), 072 (Appreciation of Architecture); Philosophy 8a, 8b; Music 5, 10.

Seminary Courses

[60. **Rhetorical Criticism.** Assistant Professor WAGNER. Not given in 1939–40.]

62. **Philosophy of Rhetoric.** Throughout the year. Professor WICHELNS. W 2–4.

63. **Speech Training.** Throughout the year. 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 1939–40.]

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

Dramatic Structure. See especially English 150, 250. Assistant Professor MYERS.

ROMANCE LANGUAGES AND LITERATURES

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

Approved Major and Minor Subjects (key to symbols on p. 42)

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 Eighteenth Century 3, 4
French Literature of the Romantic Period 3, 4
Medieval French Literature 3, 4
Modern French Literature 3, 4
Contemporary French Literature 3, 4
General History of 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 catagories: those intended primarily for undergraduates, those intended alike for undergraduates and graduates, and those intended primarily for graduates. A working knowledge of Latin is especially desirable for all candidates for advanced degrees in this department. All candidates for the degree of Doctor of Philosophy must satisfy the language requirement in French and German before beginning to earn the fourth term of residence credit (see p. 20). 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 his 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; *Assistant Professor* Rideout.

1. *First Course for Beginners.* Throughout the year. Three hours a week. A special section for graduate students who need instruction in preparation for

the language examination for the Doctor's degree will be constituted at T Th S 8.

16. *History of French Literature.* Throughout the year. Professor MASON M W F 11.

17. *Literature of the Seventeenth Century.* Throughout the year. Professor BISHOP. M W F 11.

[18. *Literature of the Eighteenth Century.* Throughout the year. Professor BISHOP. Not given in 1939–40.]

19. *The Romantic Movement in French Literature.* Throughout the year. Professor MASON. M W F 9.

[20. *Modern French Literature.* Throughout the year. Professor MASON. Not given in 1939–40.]

[21. *Contemporary French Literature.* Throughout the year. Professor MASON. Not given in 1939–40.]

23. *French Historical Grammar.* First term. Professor PUMPELLY. T Th 10.

[24. **French Philology.** Throughout the year. Prerequisite, college entrance Latin or the equivalent. Professor PUMPELLY. T 10, Th 2. Not given in 1939–40.]

Lectures on the historical development of the French language, with a detailed phonological and morphological study of the *Chanson de Roland.*

[31. **Literature of the Sixteenth Century.** Throughout the year. Professor BISHOP. T Th 12. Not given in 1939–40.]

A study of the important figures of the French Renaissance, especially Rabelais, Montaigne, and the poets of the Pléiade.

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

[42. **Old Provençal Philology and Literature.** Second term. Professor HAMILTON. Hours to be arranged. Not given in 1939–40.]

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

A topic in French literary history is studied by means of lectures, readings, reports, individual and collective research. The course serves as an introduction to methods of literary history.

ITALIAN

Professor HAMILTON

4. *Italian Poetry.* Throughout the year. T Th S 9.

14. *Nineteenth Century Literature.* Throughout the year. T Th S 11.

15. *The Literature of the Italian Renaissance.* First term. Hours to be arranged.

SPANISH

Professor DALE.

10. *History of Spanish Literature.* Throughout the year. M W F 12.

[15. *Drama of the Golden Age.* First term. Not given in 1939–40.]

17. *Cervantes.* Second term. T Th S 11.

19. *The Nineteenth Century Novel.* Second term. T Th S 10.

[20. *Spanish Poetry.* Second term. Not given in 1939–40.]

[21. *Spanish Literature since 1898.* Throughout the year. Not given in 1939–40.]

[41. **Old Spanish.** Throughout the year. Not given in 1939–40.]

42. **Calderón and Alarcón.** Second term. W 2:15. Library, Spanish Seminary.

Selected plays by each author will be analyzed in an effort to determine their contributions which are not in the Lope tradition.

[43. **The Picaresque Novel.** Throughout the year. Not given in 1939–40.]

SUSAN LINN SAGE SCHOOL OF PHILOSOPHY

Professors G. WATTS CUNNINGHAM, GEORGE H. SABINE, E. A. BURTT, HAROLD R. SMART, RICHARD ROBINSON, and 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 39 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. 42)

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.* Both terms. Three hours a week.
2. *Logic.* Both terms. Three hours a week.
3. *Problems of Philosophy.* First term. Three hours a week.
4. *Ethics.* Second term. Three hours a week.
5. *History of Philosophy.* Throughout the year. Three hours a week.
8a. *Aesthetics: Psychology of Aesthetic Perception.* First term. Three hours a week.
8b. *Aesthetics: Philosophy of Art.* Second term. Three hours a week.
[9. *Religious Problems in Contemporary Thought.* First term. Two hours a week. Not given in 1939–40.]
10a. *History of Political Theory: Ancient.* First term. Three hours a week.
10b. *History of Political Theory: Modern.* Second term. Three hours a week.
13. *The Philosophy of Religion.* Second term. Three hours a week.
[14. *History of Religions.* First term. Three hours a week. Not given in 1939–40.]
15. *Philosophy of Science.* First term. Three hours a week.

Introduction to Legal Philosophy. (See Government 18.)

[**Symbolic Logic.** (See Mathematics 19.) Not given in 1939–40.]

19. **Advanced Readings in Aesthetics.** Second term. Assistant Professor CHURCH. Hours by appointment. Goldwin Smith 224.
Readings to be selected in accordance with the interests and preparation of the student.

20. **Contemporary Philosophy.** Second term. Assistant Professor SMART. M W F 12. Goldwin Smith 220.
Main tendencies of contemporary philosophy, especially British and American.

25. **Plato and Aristotle.** Throughout the year. Assistant Professor ROBINSON. T Th S 10. Goldwin Smith 220.
A philosophical study of the two greatest ancient thinkers, with substantial readings from their works in translation.

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. Professor SABINE. T Th S 11. 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 2, or hours to be arranged. 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. Assistant Professor SMART. F 3, 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, or hours to be arranged. 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 1939–40.

39. **Seminar in Contemporary Philosophy.** Throughout the year. Professor CUNNINGHAM. M 3, or hours to be arranged. Goldwin Smith 220.
Topic for 1939–40: To be selected.

[40. **Seminar in Logic.** Throughout the year. Assistant Professor SMART. T 2, or hours to be arranged. Goldwin Smith 220. Given in alternate years, not in 1939–40.]

[41. **Seminar in Philosophy of Religion.** Throughout the year. Professor BURTT. W 2:30, or hours to be arranged. Goldwin Smith 218. Not given in 1939–40.]

42. **Seminar in Ancient and Medieval Philosophy.** Throughout the year. Assistant Professor ROBINSON. To be given at the discretion of the instructor in conference with prospective students. Goldwin Smith 220.

[43. **Seminar in Political Theory.** Throughout the year. Professor SABINE. F 2:30, or hours to be arranged. Goldwin Smith 220. Not given in 1939–40.]

44. **Seminar in Epistemology.** Throughout the year. Assistant Professor ROBINSON. F 3:30, or hours to be arranged. Goldwin Smith 220.
Topic for 1939–40: Universals.

[45. **Seminar in Aesthetics.** Second term. Assistant Professor CHURCH. Hours to be arranged. Goldwin Smith 220. Not given in 1939–40.]

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, M. S. KENDRICK, R. E. MONTGOMERY, P. M. O'LEARY, H. L. REED, and F. A. SOUTHARD.

Approved Major and Minor Subjects (key to symbols on p. 42)

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

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 knowledge 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.* Either term. Five hours a week.

2a. *Modern Economic Society.* First term. Three hours a week.

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

3. *Introduction to Economics.* Either term. Three hours a week.

11. *Money and Banking.* Either term. Three hours a week.

[12. *Central Banking and Monetary Policy.* Second term. Three hours a week. Not given in 1939–40.]

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

15. *Trade Fluctuations.* First term. Three hours a week.

16. **Money and Credit.** First term. Prerequisite, Economics 11, 12, and 15. Professor REED. T 2–4.

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

21a. *Accounting.* Either term. Three hours a week.

21b. *Accounting.* Either term. Three hours a week.

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.* First term. Three hours a week.

32a. *Public Control of Business.* First term. Three hours a week.

32b. *Public Control of Business.* Second term. Three hours a week.

34. *Transportation.* First term. Three hours a week.

36. *Taxation.* Second term. Three hours a week.

38. **Seminar in Control of Industry.** Professor O'LEARY.

A critical examination of certain problems arising from various efforts to control the operation of the economic system. Individual topics for investigation will be assigned during the second term.

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

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

[43. *Quantitative Measurements of Economic Phenomena.* First term. Two hours a week. Not given in 1939–40.]

44. *Labor Management Policies and Methods.* Second term. Two hours a week.

45. *The Economics of Dissent.* First term. Three hours a week.

46. *Legal and Constitutional Aspects of Labor Problems.* Second term. Two hours a week.

49. **Special Studies in Industrial Relations.** 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.

71. *International Trade and Commercial Policy.* First term. Three hours a week.

72. *International Finance.* Second term. Three hours a week.

[74. *International Economic Organization.* Second term. Three hours a week. Not given in 1939–40.]

81. *Economics of Enterprise.* First term. Three hours a week.

82. *The Distribution of Income.* Second term. Three hours a week.

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

A seminar course, consisting of selected phases of economic theory. The subject matter varies from year to year to meet the needs and interests of members of the seminar.

AGRICULTURAL ECONOMICS AND FARM MANAGEMENT

See under AGRICULTURE, p. 125.

ECONOMICS OF THE HOUSEHOLD

See under HOME ECONOMICS, p. 183.

GOVERNMENT

Professors R. E. CUSHMAN, H. W. BRIGGS, and M. A. SHEPARD; *Doctor* ELIAS HUZAR.

Approved Major and Minor Subjects (key to symbols on p. 42)

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 1939–40 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* Throughout the year. Three hours a week.
2. *Comparative Government.* Second term. Three hours a week.
3. *State and Local Government.* Second term. Three hours a week.

6. **Municipal Government and Administration.** First term. Credit three hours. Dr. HUZAR. M W F 11. Boardman B.

Causes and effects of urbanization; law of municipal corporations; relations with state and national government; metropolitan areas; forms and functions of city government; selected problems in administration.

7. **Public Administration.** Second term. Credit three hours. Dr. HUZAR. M W F 11. Boardman B.

Development and control of bureaucracy in a democratic society; principles and problems of the civil service; administrative organization; fiscal processes; regulatory administration.

9. *Introduction to International Relations.* First term. Three hours a week.

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.** First 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 a term. 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. Professor BRIGGS. M W F 9. Boardman A. Not given in 1939–40.]

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

16. **Contemporary American Foreign Policy.** Second term. Credit three hours. Professor BRIGGS. M W F 9. Boardman A.

The foreign relations of the United States during the 20th century; our Caribbean policy; post-war relations with Europe, the League of Nations, and the Far East; neutrality, isolation, and international cooperation.

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. Not given in 1939–40.]

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** (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 1939–40.]

The philosophical background and evolution of American constitutional doctrines.

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

[235. **Problems in Financial Administration** (See Agricultural Economics 235). Not given in 1939–40.]

236. **Problems in Public Administration** (See Agricultural Economics 236.)

Seminary in Constitutional Problems. Throughout the year. Professor CUSHMAN. 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. 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, P. E. MOSELY, and KNIGHT BIGGERSTAFF, and *Miss* G. GASKILL.

Approved Major and Minor Subjects (key to symbols on p. 42)

American History 1, 2, 3, 4
Ancient History 1, 2, 3, 4
English History 1, 2, 3, 4

Far Eastern 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 little short of two hundred thousand volumes dealing with history. 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 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. Bretz 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. Boardmen 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 1939–40.]

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. 2, 4 p. m.

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

Ancient History

Professor M. L. W. Laistner.

[3. *Greek History, 500–323 B. C.* First term. M W F 11. Boardman E. Not given in 1939–40.]
[4. *The Hellenistic Age.* Second term. M W F 11. Boardman E. Not given in 1939–40.]
[5. *The Roman Republic, 133–30 B. C.* Second term. Not given in 1939–40.]
6. *The Roman Empire, 30 B. C.-180 A. D.* First term.
[7. *The History of Education (Greek, Roman, and Early Medieval.* First term. Not given in 1939–40.]

8. **Seminary in Greek and Roman Historiography.** First term. M 2–4. Boardman 4.

[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 1939–40.]

English History

Professor F. G. Marcham.

61. *English History.* Throughout the year. Three hours a week.

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

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

67 and 68. *History of England from the Eighteenth Century to Present.* Throughout the year. Three hours a week. Given in alternate years.

69. **Seminary in Tudor and Stuart History.** Throughout the year. Professor Marcham.
Study of materials for research in Tudor and Stuart history and some of the leading historical problems of the period.

Far Eastern History

Assistant Professor Knight Biggerstaff and *Miss* Gussie Gaskill.

15. *Chinese History.* Throughout the year. Assistant Professor Biggerstaff.

16. **Modern Chinese Foreign Relations.** Throughout the year. Assistant Professor Biggerstaff.

20. **Seminary in Modern Chinese History.** Throughout the year. Assistant Professor Biggerstaff and Miss Gaskill.

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 1939–40.]

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,* 1914–1938.

43. **The French Revolution.** First term. Professor Becker.
A study of French society before 1789, and of the Revolution from 1789 to 1795.

44. **The Napoleonic Era.** Second term. 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. **The History of Russia.** Throughout the year. Assistant Professor Mosely. M W F 11. Boardman D.

[52. **Modern History of the Balkans and Near East.** First term. Assistant Professor Mosely. M W F 11. Boardman D. Not given in 1939–40.]

[53. **Modern History of the German People.** Second term. Assistant Professor Mosely. M W F 11. Boardman D. Not given in 1939–40.]

Seminary in Modern European History. Professor Becker. Th 4:15.
Lectures on certain aspects of historiography, and reports on special topics by members of the class.

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 1939–40.]

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 1939–40.]
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.

SOCIOLOGY

SOCIOLOGY, RURAL SOCIOLOGY, AND ANTHROPOLOGY

Professors DWIGHT SANDERSON, W. A. ANDERSON, L. S. COTTRELL, JR., and J. L. WOODWARD, and *Doctors* R. L. SHARP and PHILIPP WEINTRAUB.

Approved Major and Minor Subjects (key to symbols on p. 42)

Sociology 1, 2, 3, 4
Rural Sociology 1, 2, 3, 4
Anthropology 2, 3, 4

Requirements for the Degree of Ph.D.

Note. If the major for the Ph.D. degree lies in either of the first two fields, not more than one of the other two may be selected as a minor.

General Sociology. When offered as a major for the Ph.D.: (1) a thorough knowledge of the field of sociological theory and its history, (2) a thorough knowledge of the methodology of sociological research, and (3) a detailed knowledge of at least three of the following sub-fields in sociology: criminology, social psychology, population, social pathology, urban sociology, rural sociology, the family, educational sociology, sociology of law, social anthropology.

When offered as a minor for the Ph.D.: a general knowledge of part I of the above requirement and a satisfactory knowledge of one or two sub-fields.

Rural Sociology. When offered as a major for the Ph.D.: (1) a thorough knowledge of the field of sociological theory and its history; (2) a thorough knowledge of the methodology of sociological research; (3) a thorough knowledge of rural sociology and of the research in this field; and (4) a detailed knowledge of at least two of the following sub-fields in sociology: social psychology, population, the family, educational sociology, social anthropology, urban sociology, social pathology, criminology.

When offered as a minor: a general knowledge of parts 1 and 3 of the above requirement, and a satisfactory knowledge of one or two of the sub-fields under part 4.

Graduate students who desire to major in rural sociology should have had a considerable personal experience with rural life and rural institutions, and a knowledge of sociology, psychology, and economics. Introductory courses in general sociology, rural sociology, and economics are prerequisite to graduate courses.

Anthropology. When offered as a minor for the Ph.D. degree, the requirements are substantially the equivalent of the major requirements for the A.M. degree.

Requirements for the Degree of A.M. or M.S.

General Sociology and Rural Sociology. Graduate students offering General Sociology or Rural Sociology as a major or minor for the master's degree should consult the professors concerned to ascertain the exact requirements. In general, the major requirements for the master's degree are substantially the equivalent of the minor requirements for the Ph.D. degree.

Anthropology. When offered as a major: (1) a general knowledge of the factual, theoretical and methodological contributions of anthropology to the historical and comparative study of man and his behavior; (2) a more detailed knowledge of the field of cultural anthropology with special emphasis upon ethnology, including the archaeology and ethnography of some one continental area, and social anthropology, including the analysis and comparison of particular cultures.

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

The following courses are offered in the departments of Economics (E.) and Rural Social Organization (R.) as indicated:

General Sociology

E50a. *Introduction to Sociology.* Either term. Three hours a week.
E50b. *Introduction to Sociology.* Either term. Follows E50a. Three hours a week.
R1. *General Sociology.* Either term. Three hours a week.
E54. *The Family.* Second term. Three hours a week.
R123. *Social-work Practice.* Throughout the year.

[E51. **Population Problems.** First term. Assistant Professor Woodward. Given in alternate years. Not given in 1939–40.]

E52. **Criminology.** First term. Credit three hours. Assistant Professor Woodward. T Th S 11. Goldwin Smith 264. Given in alternate years.
A study of the various factors making for law violation and of society's methods for dealing with the criminal and the juvenile delinquent.

R121. **The Family.** Either term. Credit three hours. Professor Cottrell. T Th S 8. Warren Hall 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.

R122. **Social Problems and Public Welfare Organization.** Second term. Credit three hours. Professor Cottrell. M W F 11. Warren Hall 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, and the like. Consideration is given to the methods by which society attempts to deal with the problems involved.

R131. **Social Psychology.** First term. Credit three hours for undergraduates, four hours for graduates. Prerequisite, an introductory course in sociology and one course in psychology. Professor Cottrell. T Th S 10. Warren Hall 340. Fee for materials, $1.
A study of (1) the organization and functioning of personality regarded as a product of social interaction; and (2) the dynamics of interaction of persons in intra-group and inter-group relations. An attempt is made to develop an integrated social-psychological theory which is relevant to both personal and group behavior.

[R207. **Sociological Theory.** Throughout the year. Credit three hours a term. Professor Anderson. Given in alternate years, not in 1939–40.]
A course devoted to the critical analysis of sociological theories from the time of August Comte to those of present day sociologists.

R208. **Systematic Sociology.** Second term. Usually given throughout the year. Credit three hours a term. Professor Anderson. Warren Hall 302.
This course is designed to present the whole field of study, with special emphasis on the concepts in a system of sociology.

E58. **Seminar in Sociology.** Throughout the year. Credit two hours a term. Dr. Weintraub. T 2–4.
The topic for discussion in 1939–40 will be "Social Stratification".

E60. **Seminar in Population Theory.** First term. Credit two hours. Assistant Professor Woodward and Dr. Weintraub. Hours to be arranged.

[R209. **Seminar.** Second term. Credit two hours. Professor Sanderson. F 2–4. Warren Hall 302. Given in alternate years, not in 1939–40.]
The structural characteristics and classification of different types of social groups as related to their functions will be studied.

R218. **Seminar.** First term. Credit two hours. Professors SANDERSON and COTTRELL. F 2–4. Warren Hall 302.

A study of research methods in sociology.

R219. **Seminar: Quantitative Methods in Sociology.** Second term. Credit three hours. Prerequisite, two courses in statistics and permission of the instructor. Professor COTTRELL. W 2–4. Warren Hall 302.

A consideration of the special problems involved in the application of quantitative methods to sociological and social-psychological research.

[R231. **Seminar in Social Psychology.** Second term. Credit two hours. Prerequisite, course R131. Professor COTTRELL. Given in alternate years, not in 1939–40.]

A critical examination of the methods and results of research in social psychology. Special attention is given to the development of research methods applicable to the study of personality, social attitudes, public opinion, propaganda, and collective behavior.

RURAL SOCIOLOGY

R12. *Rural Sociology.* First term. Credit three or four hours.

R111. **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. Warren Hall 340. Fee for materials, $1.

The application of sociology to the practical problems of community organization. The course covers three main divisions: the use of community organization 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.

R112. *Rural Recreation.* Second term. Credit two hours.

R132. **Rural Leadership.** Second term. Credit two hours. Prerequisite, course 1 and permission of instructor. Professor SANDERSON. Th 2–4. Warren Hall 302.

A seminar course in which rural leadership is studied from both sociological and psychological points of view.

R133. **Rural Group Leadership.** First term. Credit two hours. Extension Assistant Professor DUTHIE. T 8, and hour to be arranged. Warren Hall 302.

A consideration of the factors involved in group formation, the relationships of the leader to the group, and the group members to each other. The place of the program in group work and the process of program formation are described, with special reference to work with 4-H Clubs, Scouts and juvenile groups. Practice in leadership or an acceptable equivalent will be required. (This may be satisfied by taking course 123 at the same time.)

[R211. **The Rural Community.** First term. Credit two hours. Primarily for graduate students. Prerequisite, courses 1 and 12 or their equivalent. Professor SANDERSON. Given in alternate years, not in 1939–40.]

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.

R213. **Research in Rural Social Organization.** Throughout the year. Hours and credits to be arranged. For graduate students only. Professors SANDERSON, ANDERSON, and COTTRELL.

[R217. **Seminar in the History of Research in Rural Sociology.** Second term. Credit two hours. Primarily for graduate students. Professor ANDERSON. Given in alternate years, not in 1939–40.]

A review of research in rural sociology, emphasizing content and methods.

ANTHROPOLOGY

E55. **Social Anthropology.** First term. Credit three hours. Dr. SHARP. M W F 11. Goldwin Smith 264.

Analysis and comparison of the cultures of selected folk communities as a basis for the study of more complex societies; elementary forms and interrelations of social groupings, economic and governmental institutions, aesthetic and religious activities; the role of the individual in relation to culture patterns.

E56. **Social Anthropology of Religion and Ethics.** Second term. Credit three hours. Dr. SHARP. M W F 12. Goldwin Smith 264.

Religious practices and beliefs of selected communities and their relation to other aspects of social life; comparative moral behavior and values.

[E57. **American Ethnology.** Second term. Credit three hours. Dr. SHARP. Given in alternate years, not in 1939–40.]

E59. **Seminar in Anthropology.** First term. Credit two hours. Dr. SHARP. Hours to be arranged. For graduate students interested in special aspects of cultural anthropology.

Attention of students in Anthropology is called to the following course.

Anatomy 223. *Physical Anthropology and Human Evolution.* First term. Credit three hours.

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. One of the Henry Strong Denison Fellowships in Agriculture is awarded in the field of animal sciences. This fellowship has a stipend of $1,000, but does not carry 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 will be found on page 42.

ANATOMY

Stimson Hall; *Professor* J. W. PAPEZ.

Approved Major and Minor Subjects (key to symbols on p. 42)

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. 193)

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.

NOTE: Courses marked with an * have been discontinued.

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

223. *Physical Anthropology and Human Evolution.* First term. Three lectures or demonstrations a week.

224. *Artistic Anatomy.* Throughout the year. 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, Histology

and Embryology. Professor PAPEZ and assistants. 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, Histology and Embryology. Professor PAPEZ and assistants. 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, Histology and Embryology. Professor PAPEZ and assistants. 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. Professor PAPEZ and assistants. 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, Histology and Embryology. Professor PAPEZ and assistants.

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, Histology and Embryology. Professor PAPEZ and assistants. 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, Histology and Embryology. Professor PAPEZ and assistants.

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. Professor PAPEZ and assistants. 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. 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. Professor PAPEZ. Hours to be arranged. Stimson Hall 52.

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 levels and 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. Professor PAPEZ and assistants. Hours to be arranged. Anatomy laboratory, Stimson Hall. Two or more laboratory periods a week.

The study of a special topic with training in methods of research in anatomy and neuroanatomy.

ANIMAL BREEDING

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

Approved Major and Minor Subjects (key to symbols on p. 42)

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. Laboratory fee, $3. Deposit, $2.

Group discussions of advanced principles of genetics, with special attention to methods of analysis as illustrated in problems on both hypothetical and experimental data. Laboratory studies on the artificial production of mutations in Drosophila by means of X-rays, with as complete a genetic analysis of these as time permits.

P.B. 211. **Statistical Methods of Analysis.** First or second term. Assistant Professor LIVERMORE. Th 1:40–4. Plant Science Building 233. Laboratory fee, $2.

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

[A.H. 120. **Problems in Animal Genetics.** First term. Prerequisite, Animal Husbandry 20 or Plant Breeding 101. T Th 11. Recitation by appointment. Not given in 1939–40.]

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. **Endocrinology, Reproduction, and Lactation.** Second term. Credit two hours. Professor ASDELL. M W 10. Wing Hall 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 two hours. Prerequisites, Zoology 1, Plant Breeding 101 and permission of the instructor. Professor HUTT. W F 8. Poultry Building 305. Given in alternate years.

Inheritance in domestic birds, the application of genetic principles to poultry breeding, disease resistance, hybrid vigor, cytology, sex and secondary sex characters.

P.H. 121. **Physiology of Avian Reproduction.** Second term. Credit two hours. Prerequisites, Zoology 1, a course in animal physiology and permission of the instructor. Lecture, M 8; Laboratory, M 1:40–4. Dr. LAMOREUX. Given in alternate years.

Gross and microscopic anatomy of the reproductive organs of birds and their functions, with special reference to the fowl. Gametogenesis, fertilization, infertility and embryonic mortality, sex differentiation and the functions of the endocrine glands.

[P.H. 220. **Animal Genetics.** First term. Prerequisites, Plant Breeding 101 and permission of the instructor. Professor HUTT. Not given in 1939–40.]

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. T 4:15. Poultry Building 201.

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

ANIMAL DISEASES

Veterinary College; *Professors* W. A. HAGAN, PETER OLAFSON, E. L. BRUNETT, ALEX ZEISSIG, C. W. BARBER, R. R. BIRCH, H. L. GILMAN, D. W. BAKER, J. N. FROST, H. J. MILKS, H. C. STEPHENSON, D. H. UDALL, and M. G. FINCHER.

(See under VETERINARY MEDICINE, p. 195)

ANIMAL HUSBANDRY

Wing Hall; *Professors* F. B. MORRISON, E. S. SAVAGE, L. A. MAYNARD, C. M. MCCAY, E. S. HARRISON, S. A. ASDELL, R. B. HINMAN, G. W. SALISBURY, J. P. WILLMAN, and J. I. MILLER.

Animal Husbandry 1, 2, 3, 4 (See under AGRICULTURE, p. 132)

ANIMAL NUTRITION

Dairy Building; *Professors* L. A. MAYNARD, C. M. MCCAY, L. C. NORRIS, S. A. ASDELL, F. B. MORRISON, E. S. SAVAGE, G. F. HEUSER, and L. L. BARNES, and *Doctor* G. H. ELLIS.

Approved Major and Minor Subjects (key to symbols on p. 42)

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, CATHERINE PERSONIUS, L. A. MAYNARD, and C. M. MCCAY, under HOME ECONOMICS, p. 185.)

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.* First or 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, a course in physiology and in organic chemistry. Professor MAYNARD. Lectures, M W F 10. Wing 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. Dairy Industry Building 160. Laboratory fee, $10; breakage deposit, $5.

This course is designed to familiarize the student with the application of chemical methods to the solution of fundamental problems of nutrition.

[A.H. 213. **Biochemistry of Lactation.** Second term. Prerequisite, A.H. 110. Professor MAYNARD and Dr. ELLIS. One meeting a week at an hour to be arranged. Given in alternate years, not given in 1939–40.]

A discussion of the biochemistry of the processes involved in milk secretion and of the composition of milk as related to diet and to the blood precursors.

P.H. 210. **Experimental Methods in Poultry Nutrition.** First term. Registration by permission. Professor NORRIS. Discussion and laboratory period, W 1:40–5. Poultry Building. Given if desired by a sufficient number of students. Not given every year. Laboratory fee, $5.

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

A.H. 215. **Animal Nutrition.** Advanced course. First term. Prerequisite, A.H. 110 and permission to register. Professor MCCAY. One meeting a week at an hour to be arranged. Dairy Industry Building 160.

Lectures and conferences on the nutrition of animal species from the invertebrates to man, with special emphasis upon the fundamental discoveries in such fields as growth, comparative biochemistry, and physiology that have been synthesized into the modern science of nutrition.

219. **Animal Nutrition Seminar.** First and second terms. Registration by permission. Professors MAYNARD, MCCAY, NORRIS, and HAUCK. Weekly conferences, M 4:15. Dairy Industry Building 160.

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

ANIMAL PATHOLOGY

Moore Laboratory; *Professors* W. A. HAGAN, PETER OLAFSON, E. L. BRUNETT, and A. ZEISSIG.

Animal Pathology 1, 2, 3, 4 (See under VETERINARY MEDICINE, p. 194)

ANTHROPOLOGY

Goldwin Smith Hall; *Doctor* R. L. SHARP.

Anthropology 2, 3, 4 (See under SOCIOLOGY, p. 73)

Stimson Hall; *Professor* J. W. PAPEZ.

Human Anatomy 1, 2, 3, 4 (See under ANATOMY, p. 77)

APICULTURE

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

Apiculture 1, 2, 3 (See under ENTOMOLOGY, p. 83)

BIOLOGICAL CHEMISTRY

Stimson Hall; *Professor* SUMNER; *Doctors* HOWELL and DOUNCE.

Approved Major and Minor Subjects (key to symbols on p. 42)

Biochemistry 1, 2, 4

314. *Biochemistry for Undergraduates.* First term. Three lectures a week.

314a. *Biochemistry Laboratory for Undergraduates.* First term. Two afternoons a week.

320. **Biochemistry, Advanced Lecture Course.** First term. Credit three hours. Prerequisite, one term of Chemistry 305 and one term of Chemistry 310, or the equivalent, including introductory courses in qualitative and quantitative analysis. Professor SUMNER, Dr. HOWELL, and Dr. DOUNCE. Lectures, M W F 9–10. Stimson Hall 8.

The biological and physical chemistry of lipids and carbohydrates.

321. **Biochemistry, Advanced Laboratory Course.** First term. Credit two hours. Prerequisite, or parallel, course 320 or 322. Professor SUMNER, Dr. HOWELL, and Dr. DOUNCE. Laboratory, M W 1:40–4. Stimson 34. Laboratory fee, $10; breakage deposit, $3.

Laboratory experiments with lipids and carbohydrates.

322. **Biochemistry, Advanced Lecture Course.** Second term. Credit three hours. Prerequisite, one term of Chemistry 305 and one term of Chemistry 310, or the equivalent, including introductory courses in qualitative and quantitative analysis. Professor SUMNER, Dr. HOWELL, and Dr. DOUNCE. Lectures, M W F 9–10. Stimson Hall 8.

The biological and physical chemistry of proteins, enzymes, and related substances.

323. **Biochemistry, Advanced Laboratory Course.** Second term. Credit two hours. Prerequisite, or parallel, course 320 or 322. Professor SUMNER, Dr. HOWELL, and Dr. DOUNCE. Laboratory, M W 1:40–4. Stimson 34. Laboratory fee, $10; breakage deposit, $3.

Laboratory experiments with proteins and enzymes.

325. **Biochemistry, Research Work.** Throughout the year. Prerequisite, courses 321 to 323 inclusive. Professor SUMNER, Dr. HOWELL, and Dr. DOUNCE. Laboratory hours to be arranged. Stimson 34. Laboratory fee, $3 a credit hour; breakage deposit, $3.

CYTOLOGY

Plant Science Building; *Professor* L. W. SHARP.

Cytology 1, 2, 3, 4 (See under PLANT SCIENCES, p. 98)

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; at Geneva, A. C. DAHLBERG, D. C. CARPENTER, J. C. HENING, and J. C. MARQUARDT.

Dairy Science 1, 2, 3, 4 (See under AGRICULTURE, p. 134)

ECOLOGY

Comstock Hall; *Professor* PALM and *Assistant Professor* MOTTLEY.

Insect Ecology 1, 2, 3 (See under ENTOMOLOGY, p. 83)

Limnology 1, 2, 3, 4 (See under Limnology and Fisheries, p. 87)

McGraw Hall; *Professors* A. H. WRIGHT and W. J. HAMILTON, JR.

Vertebrate Ecology 1, 2, 3, 4 (See under VERTEBRATE TAXONOMY AND ECOLOGY, p. 92)

EMBRYOLOGY

Stimson Hall; *Professors* B. F. KINGSBURY and H. B. ADELMANN.

Embryology 3, 4 (See under HISTOLOGY AND EMBRYOLOGY, p. 86)

Comstock Hall; *Doctor* BUTT.

Insect Embryology 1, 2, 3 (See under ENTOMOLOGY, p. 83)

ENTOMOLOGY

Comstock Hall; *Professors* W. E. BLAUVELT, J. C. BRADLEY, D. L. COLLINS, R. W. LEIBY, G. F. MACLEOD, ROBERT MATHESON, C. M. MOTTLEY, C. E. PALM, E. F. PHILLIPS, P. A. READIO, T. R. HANSBERRY, and L. B. NORTON, and *Doctors* F. H. BUTT and W. T. M. FORBES; at Geneva, *Professors* P. J. CHAPMAN, D. M. DANIEL, H. GLASGOW, F. Z. HARTZELL, and P. J. PARROTT.

Approved Major and Minor Subjects (key to symbols on p. 42)

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.* First term. Credit three hours.

15. *Wing Venation and Evolution.* Second term. Credit one hour.

21. *Elementary Morphology of Insects.* First or second term. Credit three hours.

30a. *Elementary Taxonomy of Insects.* Second term. Credit one hour.

The following courses, 30b, 41, 43, 61 and 75, are also recommended for certain phases of the work:

30b. *Entomotaxy.* Second term, completed first term of following year. Credit two hours.

41. *General Economic Entomology.* Second term. Credit three hours.

43. *Insects Injurious to Trees and Shrubs.* Second term. Credit two hours.

61. *General Beekeeping.* Second term. Credit three hours.

75. *Laboratory Methods in General Biology.* Second term. Credit two hours.

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, 21, 30a. Professor BRADLEY and Mr. PATE. Lecture, W 10. Comstock Hall 300. Laboratory, T Th 1:40–4. Comstock Hall 300. Laboratory fee, $4.50.

A survey of the classification of the orders of insects. For the year 1939–40 the orders to be treated are: first term, Lepidoptera and Coleoptera; second

term, Apterygota, Orthoptera, Diptera, and small orders. For the year 1940–41 the orders to be treated are: first term, Hymenoptera and Hemiptera; second term, Apterygota, Orthoptera, Diptera, and small orders.

122. **Insect Morphology.** Both terms. Credit two hours each term. Prerequisite, courses 21, and 12 or 30a. Dr. BUTT. T Th 10. Comstock Hall 145. Lectures, assigned reading, and reports.

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. Dr. BUTT. Laboratory, two periods a week, by appointment. Comstock Hall 170. Laboratory fee, $3.

Technique in histological methods as applied to insects.

132. **Classification of Aquatic Insects.** First term. Credit two hours. Prerequisite, course 12. Professor BRADLEY and Mr. PATE. Laboratory, F 1:40–4 and one period Saturday morning. Comstock 300. Laboratory fee, $4.

[241. **Advanced Economic Entomology.** Throughout the year. Credit two hours a term. Professor READIO. Lecture, M 11. Conference, W 2–4. Not given in 1939–40.]

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, Dr. TOWNES, and Mr. BELKIN. Lecture, Th 9. Comstock Hall 245. Practical exercises, Th or F 1:40–4. Comstock 200. Laboratory fee, $2 or $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.

52. **Medical Entomology.** Second term. Credit two or three hours. Prerequisite, Zoology 1 or Biology 1. Professor MATHESON, Dr. TOWNES, and Mr. BELKIN. Lecture, T 9. Comstock Hall 245. Practical exercises, T or W 1:40–4. Comstock 200. Laboratory fee, $2 or $4.

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.

261. **Advanced Beekeeping.** First and second terms. Credit four hours a term. Professor PHILLIPS. M F 11–12:50. Comstock Hall 17.

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.

281. **Insect Physiology.** First term. Credit three hours. Prerequisite, courses 122a and 122b, and permission to register. Professor PHILLIPS and cooperating members of the staff. Lectures, discussions, and demonstrations, M Th 1:40–4. Comstock 17. Fee, $5.

For seniors and graduate students intending to work in entomology as a profession. The functions of the more important organs of various insects are discussed, together with the mechanisms by means of which these functions are coordinated. Experimental methods are discussed and demonstrated.

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.** Professor PALM.

300b. **Insect Morphology and Embryology.** Dr. BUTT.

300c. **Taxonomy.** Professors BRADLEY (all orders), MATHESON (Diptera), and Dr. FORBES (Lepidoptera).

300d. **Economic Entomology.** Professors MATHESON, READIO, and MACLEOD, Assistant Professors LEIBY, COLLINS, and HANSBERRY; at Geneva, Professors PARROTT, GLASGOW, CHAPMAN, and HARTZELL.

300e. **Medical Entomology and Parasitology.** Professor MATHESON.

300f. **Apiculture.** Professor PHILLIPS.

300g. **Fisheries.** Professor ————.

300h. **Limnology.** Assistant Professor MOTTLEY.

300i. **Insect Physiology.** Professors PHILLIPS, MACLEOD, and MATHESON, and Assistant Professors HANSBERRY 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 200.

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. Second term. Open to qualified graduate students. Professor MACLEOD. W 4:15. Comstock Hall 50.

EXPERIMENTAL ZOOLOGY

McGraw Hall; *Professors* ————, ————, and B. P. YOUNG.

Experimental Zoology 1, 2, 3, 4 (See under ZOOLOGY, p. 93)

FISH CULTURE

Comstock Hall; *Professor* ————.

Fish Culture 1, 2, 3, 4 (See under LIMNOLOGY AND FISHERIES, p. 87)

GENERAL BIOLOGY

Roberts Hall; *Assistant Professor* MOTTLEY.

Approved Major and Minor Subjects (key to symbols on p. 42)

General Biology 4

1. *General Biology.* Throughout the year. Credit three hours a term.

7. **General Biology.** Throughout the year. Prerequisite, at least twelve hours in animal or plant sciences. Assistant Professor MOTTLEY. One conference period a week and a minimum of twelve hours in animal or plant sciences to be arranged.

For graduate students whose major field is outside of animal or plant sciences and who wish to obtain a more general knowledge of biological science than that offered in the various restricted fields. The conferences will deal with the unification of biological knowledge, discussion of theories and recent advances. Students who expect to teach in other fields may find the course useful in rounding out a cultural background.

GENETICS

(See under ANIMAL SCIENCES, p. 79, and under PLANT SCIENCES, p. 100)

HERPETOLOGY

McGraw Hall; *Professors* A. H. WRIGHT and W. J. HAMILTON, JR., and *Doctor* E. C. RANEY.

Herpetology 1, 2, 3, 4 (See under VERTEBRATE TAXONOMY AND ECOLOGY, p. 92)

HISTOLOGY AND EMBRYOLOGY

Stimson Hall; *Professors* B. F. KINGSBURY and H. B. ADELMANN.

Approved Major and Minor Subjects (key to symbols on p. 42)

Embryology 3, 4
Histology 3, 4
Histology and Embryology 1, 2, 3, 4
(See also INSECT EMBRYOLOGY 1, 2, 3; Comstock Hall, *Doctor* BUTT, under ENTOMOLOGY, p. 83)

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).* Throughout the year. Four hours a week.
9. *Embryology (Veterinary).* Second term. Two hours.
101. *The Tissues: Histology and histogenesis.* First term. Four hours.
102. *The Organs: Histology and development.* Second term. Four hours.
104. *Vertebrate Embryology.* Second term. Five hours.

107. **Advanced Histology and Embryology.** Throughout the year. Credit three hours or more a term. Prerequisite, courses 101 and 102 or 104, or equivalent courses. Professors KINGSBURY and ADELMANN, and instructor. Day and hours to be arranged. Stimson 43.

[115. **Experimental Embryology.** First term. Credit two hours. 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. Not given in 1939–40.]

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., and *Doctor* E. C. RANEY.

Ichthyology 1, 2, 3, 4 (See under VERTEBRATE TAXONOMY AND ECOLOGY, p. 92)

IMMUNOLOGY

Moore Laboratory; *Professors* W. A. HAGAN and A. ZEISSIG.

Immunology 1, 2, 3, 4 (See under VETERINARY MEDICINE, p. 194)

INVERTEBRATE ZOOLOGY

McGraw Hall; *Assistant Professor* B. P. YOUNG.

Invertebrate Zoology 1, 2, 3, 4 (See under ZOOLOGY, p. 93)

LIMNOLOGY AND FISHERIES

Comstock Hall; *Professors* ———— and MOTTLEY.

Approved Major and Minor Subjects (key to symbols on p. 42)

Fisheries 1, 2, 3, 4
Limnology 1, 2, 3, 4

The courses offered in this field require a certain background in other subjects. A student preparing to major in fresh-water biology or fisheries after graduation will find the following sequence of courses helpful: First year, Zoology 1; second year, Botany 1, Zoology 8 and 16, and Entomology 12; third year, Entomology 132, 171, 73 and 74; fourth year, Entomology 172 and 75. Students are urged to obtain a grounding in Statistics, and Zoology 22 is recommended before graduation.

73. *Aquiculture.* First term. Credit three hours.
74. *Fish Culture.* Second term. Credit two hours.
75. *Fisheries Management.* Second term. Credit one hour.
171. *Limnology.* Second term. Credit three hours.
172. *Advanced Limnology.* First term. Credit three hours.

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

300h. **Research in Limnology.** First and second terms. Should be preceded by course 171. Assistant Professor MOTTLEY.

Facilities are provided for laboratory and field work and conferences on problems related to fresh-water biology and fisheries.

MAMMALOGY

McGraw Hall; *Professors* A. H. WRIGHT and W. J. HAMILTON, JR.

Mammalogy 1, 2, 3, 4 (See under VERTEBRATE TAXONOMY AND ECOLOGY, p. 92)

MEDICAL SCIENCE

(See under MEDICAL SCIENCES, p. 196)

MORPHOLOGY

Comstock Hall; Dr. F. H. BUTT.
Insect Morphology 1, 2, 3 (See under ENTOMOLOGY, p. 83)
McGraw Hall; *Professor* ————.
Vertebrate Morphology 1, 2, 3, 4 (See under ZOOLOGY, p. 93)
McGraw Hall; *Professor* B. P. YOUNG.
Invertebrate Morphology 1, 2, 3, 4 (See under ZOOLOGY, p. 93)

NATURE STUDY

Fernow Hall; *Professor* E. L. PALMER.
Nature Study 1, 2, 3, 4 (See under GRADUATE SCHOOL OF EDUCATION, p. 150)

ORNITHOLOGY

Fernow Hall; *Professors* A. A. ALLEN and G. M. SUTTON, and *Doctor* P. P. KELLOGG.

Approved Major and Minor Subjects (key to symbols on p. 42)

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. One lecture and two laboratory periods a week.

126. **Advanced Ornithology.** First term. Credit three hours. Prerequisite, course 9 or Vertebrate Taxonomy 8. Professor ALLEN and Mr. ————. Lecture, W 11. Fernow 122. Laboratory and field work, T Th 1:40–4. Fernow 210. Laboratory fee, $3.

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.

131. **Applied Ornithology.** First term. Credit three hours. Should be preceded by course 9, or Vertebrate Taxonomy 8, and presupposes an elementary knowledge of botany and entomology. Dr. KELLOGG and Mr. ————. Lecture, W 9. Fernow 122. Laboratory and field work, M W 1:40–4. Laboratory fee, $3.

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, classroom, museum, and biological survey methods. Students are expected to supply their own cameras.

133. **Advanced Field and Museum Methods in Ornithology.** First term. Credit three hours. Prerequisites, Ornithology 9, 126, and 131 and permission to register. Assistant Professor SUTTON. S 8–1, with lecture during laboratory and several all-day field trips. Fernow 308. Laboratory fee, $3.

For students planning to participate in scientific expeditions and to carry on taxonomic work in Ornithology. This course includes such subjects as: field and museum equipment; collecting and preparing bird skins and the preparation of taxonomic papers and avifaunal lists, drawings in line, halftone, or full color, and other illustrative material.

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.** Professor ALLEN, Assistant Professor SUTTON, and Dr. P. P. KELLOGG.

2. **Game Management.** First term. Credit three hours. Prerequisite, Botany 13 and Ornithology 126 or 131. Professor ALLEN, Mr. KUTZ, and cooperating specialists from the New York State Conservation Department, the United States Biological Survey, and others. Lecture, F 11. Fernow 212. Laboratory and field work, S 8–1, and at least four all-day Saturday trips. Laboratory fee, $3.

The principles and practices of game management as applied to field, woodland, and aquatic game. Laboratory studies of game species, predators, cover maps, management plans, and feeding methods. Field work includes demonstrations and practice in game surveys, sanctuary and refuge methods, and other game-management practices.

PALEONTOLOGY

McGraw Hall; *Doctor* C. W. MERRIAM.
Paleontology 1, 2, 3, 4 (See under GEOLOGY, p. 115)

PARASITOLOGY

Comstock Hall; *Professor* ROBERT MATHESON.
Parasitology 1, 2, 3 (See under ENTOMOLOGY, p. 83)
James Law Hall; *Professor* D. W. BAKER.
Veterinary Parasitology 1, 2, 3, 4 (See under VETERINARY MEDICINE, p. 195)

PATHOLOGY

Moore Laboratory; *Professor* PETER OLAFSON.
Animal Pathology 1, 2, 3, 4 (See under VETERINARY MEDICINE, p. 194)

PHYSIOLOGY

Stimson Hall; *Professor* J. A. DYE.

Approved Major and Minor Subjects (key to symbols on p. 42)

Physiology 1, 2, 4
(See also ANIMAL PHYSIOLOGY 1, 2, 3, 4; James Law Hall, *Professors* H. H. DUKES, C. E. HAYDEN, under VETERINARY MEDICINE, p. 193)
(See also INSECT PHYSIOLOGY 1, 2, 3; Comstock Hall, *Professors* E. F. PHILLIPS, ROBERT MATHESON, and G. F. MACLEOD, under ENTOMOLOGY, p. 83)
(See also PSYCHOLOGY 1, 2, 4; Morrill Hall, *Professors* H. P. WELD, K. M. DALLENBACH, and LIDDELL, under PSYCHOLOGY, p. 90)

The laboratories of the department in Stimson Hall provide for elementary and advanced instruction in experimental physiology. Space and equipment are available for graduate study and research.

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.

303. *Human Physiology.* Either term. Credit three hours. Assistant Professor DYE.

305. **Physiology of the Endocrine Glands, Metabolism, and Reproduction.** Second term. Credit three hours. Assistant Professor DYE.

306. **Experimental Physiology.** Throughout the year. Hours to be arranged. Assistant Professor DYE.

308. **Research in Physiology.** Throughout the year. Hours to be arranged. Assistant Professor DYE.

310. **Seminar in Physiology.** Second term. Credit one hour. Assistant Professor DYE.

POULTRY HUSBANDRY

Poultry Building; *Professors* F. B. HUTT, G. F. HEUSER, G. O. HALL, L. C. NORRIS, A. L. ROMANOFF, and J. H. BRUCKNER, and *Doctor* LAMOREUX.
Poultry Husbandry 2, 4 (See under AGRICULTURE, p. 139)

PROTOZOOLOGY

McGraw Hall; *Professor* ————.
Protozoology 2, 3, 4 (See under ZOOLOGY, p. 93)

PSYCHOLOGY

Morrill Hall; *Professors* H. P. WELD, K. M. DALLENBACH, H. S. LIDDELL, GEORGE KREEZER, O. D. ANDERSON, and *Doctor* T. A. RYAN.

Approved Major and Minor Subjects (key to symbols on p. 42)

Applied Psychology 2, 3, 4
Experimental Psychology 1, 2, 3, 4
History of Psychology 3
Physiological Psychology 1, 2, 3, 4
Psychobiology 3, 4
Psychology 1, 2, 4
Systematic Psychology 3

The research department possesses a laboratory in Morrill Hall with rooms for general and individual research, for apparatus, for the library of periodical literature and for meetings of the seminaries. This laboratory also includes a workshop for the construction and assemblage of apparatus, and it contains the editorial offices of *The American Journal of Psychology*.

At the Cornell Behavior Farm, a farm of 100 acres near Ithaca, laboratories are equipped for investigations in neuro-endocrinology, the conditioned reflex, and the experimental neurosis.

1. *Elementary Psychology.* Either term. Three hours a week.
2. *The Special Psychologies.* Second term. Three hours a week.

3a and 3b. *Introductory Laboratory.* Either term, or both terms. Six hours a week.

[4. **Intermediate Course in Psychology.** First term. Credit three hours. Prerequisite, Psychology 1 and consent of the instructor. Dr. RYAN. M W F 9. Morrill 41. Not given in 1939–40.]

Intended for students who wish to continue the study of psychology at a more advanced level of presentation. Lectures, textbook assignments, and demonstrations.

5. **Perception.** First term. Credit three hours. Prerequisite, Psychology 1 and consent of the instructor. Dr. RYAN. M W F 9. Morrill 41.

The place of perception in psychology and its relation to every-day living. A review of the important experiments with special emphasis upon recent developments and upon modern theories of perception.

6. **Memory, Skill and Work.** Second term. Credit three hours. Prerequisite, Psychology 1 and consent of the instructor. Dr. RYAN. M W F 9. Morrill 42.

A study of fundamental experiments and principles. Lectures and readings.

7. **Introduction to Psychotechnology.** First term. Prerequisite, consent of the instructor. Dr. RYAN. T Th S 10. Goldwin Smith A.

A study of the results of experimental and statistical analyses of psychological problems in vocational guidance, medicine, law, athletics, and problems of everyday existence.

8. **Psychotechnology in Business and Industry.** Second term. Prerequisite, consent of the instructor. Dr. RYAN. 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.

10. **Social Psychology.** First 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.** Second term. Professor 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. Credit three hours. Prerequisite, senior standing and consent of the instructor. Professor WELD. T Th S 11. Morrill 41.

[14. **Contemporary Psychology.** First term. Professor DALLENBACH. T Th S 11. Seminary Room, Morrill. Not given in 1939–40.]
A comparative study of current psychological schools and points of view.

15. **Psychology of the Abnormal.** First term. Prerequisite, Psychology 1 and consent of the instructor. Assistant Professor KREEZER. M W F 10. Morrill 42.
A survey of the psychological disorders and deficiencies: maladjustments of normal children and adults; mental deficiency; hysteria, neurasthenia, and psychasthenia; schizophrenia, manic-depressive psychosis, and organic psychoses. A consideration of psychological, physiological, and genetic factors.

[16. **Reading of German Psychology.** Second term. Credit three hours. Prerequisite, consent of the instructor. Hours to be arranged. Assistant Professor KREEZER. Morrill, Psychological Laboratory. Not given in 1939–40.]
The accurate reading and translation of psychological texts and articles. The course presupposes a knowledge of grammar.

17. **Animal Psychology.** Second term. Credit three hours. Prerequisite, Psychology 1 and consent of the instructor. Assistant Professor KREEZER. M W F 10. Morrill 41.
A study of the behavior and the psychological capacities of animal forms, especially above the invertebrate level. Emphasis will be placed on the relation of research in this field to problems of human psychology.

[18. **Genetic Psychology.** Second term. Credit three hours. Prerequisite, Psychology 1 and consent of the instructor. Assistant Professor KREEZER. M W F 10. Morrill 40. Not given in 1939–40.]
A study of the individual life-career and the development of the psychological functions. Lectures and textbook assignments.

19. **Minor Research Problems.** Either term or throughout the year. Credit three hours a term. Prerequisite, courses 1, 3a and either 3b or 20, and the consent of the instructor. Professors WELD and DALLENBACH, Assistant Professor KREEZER, and Dr. RYAN. Hours to be arranged. Morrill, Psychological Laboratory.
Experimental, theoretical, and historical studies carried through under personal direction.

20. **The Correlational and Psychophysical Methods.** Second term. Professor DALLENBACH. M W F 2–4. Morrill, Psychological Laboratory.

[21. **Technique of Experimentation.** Second term. Professor DALLENBACH. T Th 2. Morrill, Psychological Laboratory. Not given in 1939–40.]
A study of the principles and processes of psychological research.

22. **Seminary in Psychology.** First term. Professors WELD and DALLENBACH, and Assistant Professor KREEZER. Hours to be arranged. Morrill, Seminary Room.

30. **Experimental Psychobiology.** Throughout the year. Credit three hours a term. The first term is not prerequisite to the second. Professor LIDDELL and Assistant Professor ANDERSON. Laboratory, T Th 1:40–4; class hour to be arranged. Stimson 28. Fee, $5 a term.
The principal biological mechanisms of behavior with special reference to man. The animal organism considered as an individual with respect to each of its physiological processes and their influence on the personality. First term: functions of the central nervous system including receptor, nerve, muscle and gland. Second term: activities of the cardiovascular system, respiration, metabolism, digestion and internal secretion.

31. **Endocrinology and Behavior.** First term. Credit three hours. Assistant Professor ANDERSON. M W 9. One hour to be arranged. Stimson 29.
The physiology of the glands of internal secretion with emphasis upon their relation to the behavior of the individual. Informal discussion, selected readings and demonstrations. For advanced students with consent of the instructor.

32. **The Conditioned Reflex.** Second term. Credit three hours. Professor LIDDELL. W 2–4. One hour to be arranged. Stimson 29.
A detailed consideration of the conditioned reflex and the experimental neurosis including a survey of recent advances in neurophysiology as they relate to the problems of behavior. For advanced students with consent of the instructor.

33. **Informal Study and Research in Psychobiology.** Throughout the year. Professor LIDDELL and Assistant Professor ANDERSON. Hours to be arranged. Cornell Behavior Farm.
Students may participate in the investigations in progress at the Cornell Behavior Farm.

TAXONOMY OF INSECTS

Comstock Hall; *Professor* J. C. BRADLEY.

Insect Taxonomy 1, 2, 3 (See under ENTOMOLOGY, p. 83)

VERTEBRATE TAXONOMY AND ECOLOGY

McGraw Hall; *Professors* A. H. WRIGHT and W. J. HAMILTON, JR., and *Doctor* E. C. RANEY.

Approved Major and Minor Subjects (key to symbols on p. 42)

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.* First term. Credit one hour.
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, Assistant Professor HAMILTON, and Dr. RANEY. Lectures, T Th 8. Laboratory, S 8–10:30. Not given in 1939–40.]

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 1939–40.]

[24. **Herpetology (Reptilia).** Second term. Credit three hours. Professor WRIGHT and Assistant Professor HAMILTON. Not given in 1939–40.]

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 S 8–10:30. Laboratory fee, $3.

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.

112. **Literature of Economic Zoology, Conservation, and Ecology.** Second term. Credit one hour. Professor WRIGHT, Assistant Professor HAMILTON, Dr. RANEY, 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 7:30 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.

300k. **Research in Vertebrate Taxonomy and Natural History.** Professor WRIGHT, Assistant Professor HAMILTON, and Dr. RANEY.

ZOOLOGY

McGraw Hall; *Professors* ————, ———— and B. P. YOUNG.

Approved Major and Minor Subjects (key to symbols on p. 42)

Experimental Zoology 1, 2, 3, 4
Invertebrate Zoology 1, 2, 3, 4
Protozoology 2, 3, 4
Vertebrate Morphology 1, 2, 3, 4
Zoology 1, 2, 4

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.* Throughout the year. Three hours a week.
2. *Comparative Anatomy.* Throughout the year. Three hours a week.

16. **Invertebrate Zoology.** Throughout the year. Prerequisite, course 1 or equivalent. Assistant Professor B. P. YOUNG. Lecture, M 12, McGraw 203. Laboratory, T Th 1:40–4; W 1:40–4 and S 8–10:20. McGraw 207.

A comprehensive consideration of the morphology, classification, development, and phylogeny of the invertebrates.

99. **Zoological Problems.** Professors ————, ————, 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 ————, ————, and B. P. YOUNG.

PLANT SCIENCES

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, C. S. PEDERSON, M. W. YALE, and A. W. HOFER.

Approved Major and Minor Subjects (key to symbols on p. 42)

Bacteriology 1, 2, 3, 4

(See also Pathogenic Bacteriology 1, 2, 3, 4, Moore Laboratory, *Professors* W. A. HAGAN, PETER OLAFSON, E. L. BRUNETT, and A. ZEISSIG, under VETERINARY MEDICINE, p. 194)

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. Laboratory fee, $15.

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

103. **Applied Bacteriology.** Second term. Credit six hours. Prerequisite, course 1, quantitative analysis, and organic chemistry. Professor SHERMAN and Mr. GUNSALUS, and assistants. Lectures, recitations, and laboratory practice, M W F 1:40–5. Dairy Industry Building 218 and 301. Laboratory fee, $15.

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.

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. Laboratory fee, $15.

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

210. **Physiology 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 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. WHITEHILL. M 11 and M W 1:40–5. Dairy Building. Laboratory fee, $15.

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

211. **Taxonomy of Bacteria.** Second term. Credit two hours. Prerequisite, course 1 and at least one additional course in bacteriology. Professor RAHN. Lectures, W F 11. 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 199.

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, E. F. HOPKINS, and L. F. RANDOLPH, and *Doctors* D. G. CLARK and E. M. PALMQUIST; at Geneva, *Professors* M. T. MUNN, B. R. NEBEL, and W. F. CROSIER.

Approved Major and Minor Subjects (key to symbols on p. 42)

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. Books in more constant use are available 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 economic botany, 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 any phase of botany 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. These awards carry exemption from the payment of tuition. In 1940–41 the fellowship will be awarded. One of the Henry Strong Denison Fellowships is awarded annually in the field of the plant sciences. This fellowship has a stipend of $1,000, but does not carry free tuition.

PLANT PHYSIOLOGY

Professors KNUDSON and CURTIS, *Assistant Professor* HOPKINS, and *Doctor* CLARK.

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, Assistant Professor HOPKINS, and Dr. CLARK.

PLANT ANATOMY

Professors EAMES and PETRY.

123. **Plant Anatomy.** Second 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

Professors Sharp and Randolph.

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. Laboratory fee, $5.

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.

[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 141. Laboratory and seminar, to be arranged. Not given in 1939–40.]

An advanced course dealing mainly with recent researches in cytogenetics.

Research in Cytology. Professors Sharp and Randolph.

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 201.

Morphology

Professors Eames 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 in 1939–40.]

An advanced course in the comparative morphology, life histories, and phylogeny of vascular plants.

Research in Morphology. Professors Eames and Petry.

Research Methods

125. **Microtechnical and Microscopical Methods.** Second term. Credit five hours. Prerequisite, permission to register. Dr. J. A. de Tomasi. Lectures and demonstrations, T Th 11–1. Plant Science 211. Three laboratory periods to be arranged to suit the class. Plant Science 219. Laboratory fee, $10. Additional supplies for special individual work to be paid for by the student.

A course for advanced students who require training in the preparation of plant and animal materials for histological or cytological study and desire a foundation in the field of microscopy as applied to biological problems.

Taxonomy

Professors Wiegand, Muenscher, and Eames.

13. **Trees and Shrubs.** First term. Credit four hours. Prerequisite, course 1 or its equivalent. Professor Muenscher. Lectures, T Th 8. Plant Science 143. Laboratory or field work, M W or T Th 1:40–4. Plant Science 211. Laboratory fee, $4.

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.

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. Laboratory fee, $4; deposit, $5.

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.

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, EAMES, and MUENSCHER.

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 201.

PALEOBOTANY

Professors PETRY and EAMES.

Research.

ECONOMIC BOTANY

Professor MUENSCHER.

53. **Poisonous Plants.** Second term. Credit one hour. Registration by permission. Professor MUENSCHER. Discussion and demonstrations, F 1:40–4. Plant Science 353. Laboratory fee, $1.

Special emphasis is placed on the identification, poisonous properties, and distribution of poisonous plants.

55. **Weed Identification and Control and Seed Analysis.** First term. Credit three hours. Prerequisite, course 1 or its equivalent. Professor MUENSCHER. Lecture, S 8. Plant Science 143. Laboratory, F 1:40–4 and S 9–11:20. Plant Science 353. Laboratory fee, $3.

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 171.

115. **Aquatic Plants.** Second term. Credit three hours. Prerequisite, course 1 or its equivalent. Professor MUENSCHER. Lecture, T 9. Plant Science 353. Laboratory, M W 1:40–4. Plant Science 353. Laboratory fee, $4.

A study of the taxonomy and ecology of fresh water plants, beginning with the algae and concluding with the aquatic angiosperms.

Research in Economic Botany. Professor MUENSCHER.

GENERAL BOTANY

Professor PETRY and instructors.

1. *General Botany.* Throughout the year. Two lectures and one laboratory period a week.

102. *Advanced General Botany.* First term. Dr. PALMQUIST. Lectures, T Th 9. Plant Science 141. Laboratory, T Th 10–12:30. Plant Science 228.

Other Courses

[161. **History of Botany.** Second term. No 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 1939–40.]

171. **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. Professors Wiegand, Knudson, Eames, L. W. Sharp, O. F. Curtis, Petry, Muenscher, and Randolph, and Assistant Professor Hopkins, and Doctors Clark and Palmquist. Hours by appointment.

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 is also available at Geneva. For further information see page 201.

GENERAL BIOLOGY

See under Animal Sciences, p. 86.

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. 42)

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 problems 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.* First term. Four hours a week.
103. *Plant Breeding.* Second term. Three hours a week.
150. *Special Problems.* First or second term. One or two hours.

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. Laboratory fee, $3; deposit, $2.

Group discussions of advanced principles of genetics, with special attention to methods of analysis as illustrated in problems on both hypothetical and experimental data. Laboratory studies on the artificial production of mutations in Drosophila by means of X-rays, with as complete a genetic analysis of these as time permits.

211. **Statistical Methods of Analysis.** First or second term. Assistant Professor LIVERMORE. Th 1:40–4. Plant Science 233. Laboratory fee, $2.

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

Seminary. Second term. Professors EMERSON, LOVE, MYERS, BUSSELL, FRASER, WIGGANS, and LIVERMORE, and Dr. DORSEY. W 11. Plant Science 404.

RESEARCH AT THE NEW YORK STATE EXPERIMENT STATION

Research in fruit breeding problems, is also available at Geneva. For further information see page 200.

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, K. G. PARKER, V. L. FRAMPTON, F. A. HAASIS, and A. W. DIMOCK; at Geneva, *Professors* O. A. REINKING, J. G. HORSFALL, W. O. GLOYER, J. M. HAMILTON, H. S. CUNNINGHAM, R. O. MAGIE, D. H. PALMITER, and R. F. SUIT.

Approved Major and Minor Subjects (key to symbols on p. 42)

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 12,000 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. Plant Science 336. 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 inoculation, incubation, infection, susceptibility, and host reactions 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. Correspondence as long as possible in advance of arrival in Ithaca is advised.

[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 in 1939–40.]

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. Given in alternate years.

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 usually in the following order, (1) Phycomycetes, (2) Ascomycetes, (3) Higher Basidiomycetes, (4) Rusts, Smuts, and 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. Correspondence as long as possible in advance of arrival in Ithaca is advised.

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, PARKER, FRAMPTON, HAASIS, and DIMOCK.

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 200.

PHYSICAL SCIENCES

ASTRONOMY AND GEODESY

Professor S. L. BOOTHROYD and *Doctor* R. W. SHAW.

Approved Major and Minor Subjects (key to symbols on p. 42)

Astronomy 1, 2, 4
Astrophysics 1, 2, 4
Geodetic Astronomy and Geodesy 1, 2, 3, 4

Note: Astronomy or Astrophysics may be chosen as a minor when the major is Geodetic Astronomy and Geodesy.

Candidates for the degree of Doctor of Philosophy in Astronomy or Astrophysics will be required to take one minor in Physics unless a divided major is granted. Candidates for the same degree in Geodetic Astronomy will be required to take one minor in Civil Engineering unless a divided major is granted. In special cases a major in Astronomy or Astrophysics may consist partly of selected courses in Physics. In such cases one minor need not be in Physics. Similar arrangements may be made in Geodetic Astronomy and Civil Engineering.

Candidates for the degree of Doctor of Philosophy, Master of Arts or Master of Science with major or minor in Astronomy or Astrophysics will be required to offer for admission the equivalent of Astronomy 187 and Astronomy 182 or 183. Candidates for the same degrees in Geodetic Astronomy and Geodesy must offer the equivalent of Astronomy 186 and Surveying 216.

Those electing a minor in the department may select such courses as meet their requirements provided the necessary prerequisites are offered.

For work in Practical Astronomy, the Observatory equipment includes a 12-inch equatorial by Brashear; an astronomical transit by Troughton and Simms; an astronomical transit and zenith telescope by Fauth; a Howard Sidereal Clock; chronographs and photographic equipment as well as smaller instruments. In addition the Geodetic equipment includes a Mendenhall Half-second Pendulum Apparatus of the pattern once used in the United States Coast and Geodetic Survey.

A sub-station of the Fuertes Observatory is located on the grounds of the Arizona State Teachers College at Flagstaff, Arizona. The equipment consists of an 8-inch Schmidt Camera of focal ratio f 1.5. The department has under construction a 24-inch reflecting telescope which is to be erected at the Arizona station for the study of ultra-violet stellar spectra. As auxiliary equipment a two-prism quartz spectrograph has been constructed.

In addition to the Observatory and its equipment the Astronomy Department has a laboratory for elementary instruction, an astrophysics laboratory, five dark rooms, a department library and two offices in Rockefeller Hall.

Fields of investigation in which members of the staff are particularly interested in directing research are as follows:

Professor BOOTHROYD, in geodetic astronomy and meteoric astronomy.

Dr. SHAW, in astrophysics.

180, 181. *Introductory Astronomy.* Three hours a week.

182. *Field Astronomy.* Two hours a week.

183. *Navigation and Nautical Astronomy.* Three hours a week.

[186. *Geodetic Astronomy.* Three hours a week. Not given in 1939–40.]

187. *Advanced Astronomy.* Throughout the year. Three hours a week.

[188. *Geodesy.* Two hours a week. Not given in 1939–40.]

189. *Informal Study.* One to three hours a week.

190. **Astrophysics.** Throughout the year. Credit three hours a term. Prerequisites, Astronomy 187 and Mathematics 6 or their equivalents. Dr. SHAW.

A detailed study of present-day problems and progress in planetary, stellar, and nebular structure and constitution.

[191. **Theoretical Astrophysics.** Throughout the year. Credit three hours a term. Prerequisites, Astronomy 190 and Mathematics 41. Dr. SHAW. Not given in 1939–40.]

Theoretical interpretation of the internal constitution of stars, theory of line contours, radiative transfer in stellar envelopes, and special problems.

195. **Astrophysics Laboratory.** Throughout the year. Credit variable. Prerequisites, Physics 105 or consent of the instructor. Professor BOOTHROYD and Dr. SHAW. Rockefeller 358.

The student will be given opportunity to familiarize himself with techniques involved in obtaining, reducing, and evaluating data of astrophysical interest. Attention is also given to the general problem of precision measurement of optical radiation without regard to astrophysical application. The laboratory work may be accompanied by lectures on method and technique.

[196. **Problems in Practical Astronomy.** Throughout the year. Credit three hours a term. Prerequisite, Astronomy 186. Professor BOOTHROYD. Not given in 1939–40.]

Theoretical and practical work in precision astronomy including stellar positions, photographic parallaxes, proper motions, double stars, geodetic positions, gravity determinations, and isostasy. Investigation of instrumental errors and the determination of observational errors by methods of least squares.

197. **Theoretical Astronomy.** Second term. Credit three hours a term. Prerequisite, consent of the instructor. Professor BOOTHROYD.

The study of celestial mechanics, orbital theory, tidal theory, theory of rotating fluids and internal structure of planets and stars. The content of the course will be chosen to meet the needs of the student.

199. **Advanced Study and Research.** Either term or throughout the year. Credit variable. Professor BOOTHROYD and Dr. SHAW.

Extended study or research in subjects similar to those noted in Astronomy 189 (see catalogue of College of Arts and Sciences) or others selected with the consent of the instructor. Upon sufficient demand work may be given formally.

CHEMISTRY

Professors A. W. BROWNE, T. R. BRIGGS, JACOB PAPISH, J. R. JOHNSON, C. W. MASON, M. L. NICHOLS, A. W. LAUBENGAYER, J. G. KIRKWOOD, and J. L. HOARD; *Doctors* W. F. BRUCE, W. T. MILLER, F. A. LONG, and D. P. MACMILLAN; at Geneva, *Professors* D. K. TRESSLER, A. W. CLARK, Z. I. KERTESZ, H. G. BEATTIE, G. L. MACK, and G. W. PEARCE.

Approved Major and Minor Subjects (key to symbols on p. 42)

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

A graduate student who desires to take either a major or a minor subject in chemistry should select any one of the above 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 102 and 104; 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 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 Announcements of the Colleges of Arts and Sciences and of Engineering.

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 for the last year of residence for the Doctorate.

All courses listed below are to be given in the Baker Laboratory of Chemistry.

Inorganic Chemistry

102. *General Chemistry.* Throughout the year. Credit six hours. Open only to students who have not had chemistry.

104. *General Chemistry.* Throughout the year. Credit six hours. For students who have had a course in chemistry.

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.

The elements are discussed in the order in which they appear in the Periodic System, with special attention to the bearing of atomic structure on the properties of elements and their compounds and on the relations between the group. The less familiar elements are treated in detail and the stereochemistry of inorganic substances is considered.

135. **Advanced Inorganic Chemistry.** Either term. Credit one to six hours. Prerequisite, Chemistry 305 and 310. Professors Browne and 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.

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.** Second term. 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.* First 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 1939–40.]

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. Not given in 1939–40.]

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. Not given in 1939–40.]

Laboratory practice in typical methods of both organic and inorganic quantitative microanalysis.

280. **Emission Spectroscopy in Chemical Analysis.** Second 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 six hours.

310. *Introductory Organic Chemistry.* Throughout the year. Credit three hours a term.

315. **Advanced Organic Chemistry.** Throughout the year. Prerequisite, Chemistry 305, 310, and 340, or the consent of the instructor. Professor JOHNSON, Doctors BRUCE and 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, Dr. MILLER, 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. First term, M W 11. Baker 207. Second term, T 4:15. Baker 204.

Lectures. A presentation and discussion of special fields and current theories of organic chemistry. For 1939–40, 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 1940–41: 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. MILLER 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 prepartion of solid derivatives are applied to the identification of unknown organic substances.

375. *Elementary Organic Chemistry.* Either 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.** Second term. Credit two hours. Prerequisite, Chemistry 405. Professor BRIGGS. T Th 11. Baker 7. Given in alternate years, not in 1939–40.]

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.** Throughout the year. 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. Given in alternate years.

Lectures. The theory of colloid chemistry and its application in the arts.

[435. **Chemistry of Solids.** Second term. Credit three hours. Prerequisite or parallel courses, Chemistry 405, and Chemistry 530 or 545, or special permission. Dr. HOARD and Professor MASON. Hours to be arranged. Given in alternate years, not in 1939–40.]

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.

440. **Molecular Structure.** Second term. Credit three hours. Open to qualified students by permission. Assistant Professor HOARD. Hours to be arranged. Given in alternate years.

Discussion of our present knowledge of molecular structure as derived from studies of crystal structure, molecular and Raman spectra, electron diffraction, and dipole moments. Some attention is given to the theoretical background of the methods. Applications of structural data in other fields are indicated.

445. **Introductory Electrochemistry.** Second term. Lectures, informal recitations, and laboratory. Credit three hours. Prerequisite, Chemistry 405. Professor BRIGGS and assistants. Lecture, 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 three hours. Prerequisite, Chemistry 445. Professor BRIGGS. M W F 11. Baker 7. Given in alternate years, not in 1939–40.]

Lectures. The electrolytic deposition and corrosion of metals; the electrolytic manufacture of organic and inorganic compounds; the theory and practice of storage cells; the electric furnace.

By taking Course 465 (two 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.

455. **Kinetics of Chemical Reactions.** Second term. Credit two hours. Prerequisite, Chemistry 405. Dr. LONG. Hours to be arranged.

A general discussion of rates of reactions including: types of reactions, methods of measurement, theories of reaction rates, application to problems.

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 BRIGGS and KIRKWOOD, Dr. HOARD, 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. Professor KIRKWOOD. M W F 9.

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.

475. **Theory of Solutions.** First term. Credit three hours. Prerequisite, Chemistry 470. Professor KIRKWOOD. M W F 12.

Exposition of modern theories of electrolyte and non-electrolyte solutions. Presentation of the Debye-Hückel theory and the calculation of the thermodynamic functions of electrolyte solutions from interionic forces. The Bjerrum theory of ion association. Correlation of the properties of non-electrolyte solutions with molecular distribution and intermolecular forces. Discussion of transport phenomena in solution including electrolytic conductance, diffusion, and viscous flow. Given in alternate years.

[480. **Statistical Mechanics.** Second term. Credit three hours. Prerequisite, first term Chemistry 470. Professor KIRKWOOD. Given in alternate years, not in 1939–40.]

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. Given in alternate years.

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. **Microscopical 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. Lectures, credit two hours. Laboratory optional, credit one or more hours. Prerequisite, Chemistry 545 and consent of the instructor. Professor Mason. Baker 377 and 384. Laboratory fee variable.

Lectures, conferences, and reports, on various topics in physical metallurgy. Laboratory work, arranged in accordance with the interests of the student, covering heat treatment and structures of ferrous or non-ferrous alloys, 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 determinations, 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.

Special Topics

910. **Special Topics in Chemistry.** First term. Credit one hour. Professors Mason and Rhodes. 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.** T Th 12. Baker 177.

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, 1939–40

To be announced.

Second Term, 1939–40

To be announced.

Chemical Engineering and Industrial Chemistry

For the announcement of courses in Chemical Engineering and Industrial Chemistry, see Chemical Engineering, page 158.

Biological Chemistry

See under Animal Sciences, p. 82.

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 199.

GEOLOGY AND GEOGRAPHY

Professors O. D. von Engeln, C. M. Nevin, J. D. Burfoot, Jr., and ————, and *Doctor* C. W. Merriam.

Approved Major and Minor Subjects (key to symbols on p. 42)

Regional Geography 1, 2
Mineralogy 1, 2, 3, 4
Economic Geology 1, 2, 3, 4
Paleontology 1, 2, 3, 4
Petrology 1, 2, 3, 4
Metamorphism 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
Commercial Geography 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, petrology, 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 authors' separates.

Special rooms are available for graduate students for carrying on research.

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.

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.** Professor Nevin.

Directed reading and original investigation adapted to the needs of the student.

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 geomorphology and glacial geology 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 an introductory course in economic geography. This, in correlation with physical geography and geomorphology, may be the prepa-

ration 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.** First term. Three hours a week. Prerequisite, Geology A. Professor VON ENGELN. Lectures, T Th 9. Laboratory, T 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.

206. *Commercial Geography.* Second term. Three hours a week.

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 PETROLOGY

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.

Any bracketed course in this branch of the Department may be given in any year if it is desired by a sufficient number of students.

Each major and minor in this branch of the Department will be required to be familiar with such subjects and readings as the professor in charge may prescribe. These requirements will be adapted to the needs of the student and to the degree for which he is a candidate.

311. *Elementary Mineralogy.* Either term. Three hours a week.

316. **Metamorphic Geology.** First term. Credit two hours. For advanced students. Registration by permission only. Assistant Professor BURFOOT. T Th 12.

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, M 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. **Petrology.** 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 1939–40.]

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. Prerequisite, Geology 317. Assistant Professor BURFOOT. Lectures, T Th 10. Laboratory, F 9–11:30. Mineralogy Laboratory, McGraw. Given in alternate years.

The methods of investigating the mineral composition, texture, and other physical characteristics of sedimentary rocks, and some of the applications of these methods to geological problems.

320. **Advanced or Special Work in Mineralogy, Crystallography, or Petrology.** 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 a sufficient number of 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.

401. *Ancient Life.* First term. Credit three hours.

402. **Stratigraphy.** First term. Credit three hours. Prerequisites, Geology 102, 103, 403. Dr. MERRIAM. Lectures, M W F 12. Two week-end field trips of two days each to be arranged.

Consideration of the fundamental factors upon which stratigraphic correlation and nomenclature are based.

403. **Introductory Paleontology.** Throughout the year. Credit three hours a term. Prerequisite, Geology A. Dr. MERRIAM. First term: lecture, T 10; laboratory, Th 1:40 and one additional period to be arranged. Second term: lecture, M 10; laboratory, M 1:40 and one additional period to be arranged.

406. **Paleontologic and Stratigraphic Problems.** Throughout the year. Credit variable. Prerequisite, 403. Dr. MERRIAM. Conferences and reports to be arranged. 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

Professors ———— and NEVIN.

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 ————. Lectures, T Th 11. 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. Not given in 1939–40.]

511. **Advanced or Special Work in Economic Geology.** Throughout the year. Credit variable. Prerequisite, dependent on the nature of the work. Professor ————. Day and hour to be arranged. McGraw.

512. **Economic Geology Seminar.** Throughout the year. Professor ——.

MATHEMATICS

Professors W. A. HURWITZ, W. B. CARVER, R. P. AGNEW, B. W. JONES, V. S. LAWRENCE, JR., W. W. FLEXNER, J. A. F. RANDOLPH, and R. J. WALKER; *Doctors* J. H. CURTISS, F. A. FICKEN, J. W. GIVENS, D. C. LEWIS, JR., and J. B. ROSSER.

Approved Major and Minor Subjects (key to symbols on p. 42)

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 1939–40, but are given from time to time.

1. *Solid Geometry.* Either term. Three hours a week.
2. *College Algebra.* Either term. Three hours a week.
3. *Plane Trigonometry.* Either term. Three hours a week.
5. *Analytic Geometry and Calculus.* Two terms. Five hours a week.
6. *Analytic Geometry and Calculus.* Four terms. Three hours a week.
10. *Mathematics for Students of Economics and Statistics.* First term. Three hours a week.
15. *Elementary Course in Higher Mathematics.* Throughout the year. Three hours a week.

[20. *Teachers' Course.* Second term. Three hours a week. Not given in 1939–40; to be given in 1940–41.]

Algebra

21. **Theory of Numbers.** Second term. Prerequisite, Mathematics 6a or the equivalent. Professor Hurwitz. T Th S 10. White 6.

Linear and quadratic congruences, primitive roots, and continued fractions.

23. **Modern Algebra.** First term. Prerequisite, Mathematics 6b or the equivalent. Assistant Professor Jones. T Th S 11. White 2.

A treatment of such topics as determinants, matrices, linear dependence, linear equations, and linear transformations.

31. **Algebraic Numbers.** Second term. Prerequisite, Mathematics 21. Assistant Professor Jones. T Th S 10. White 2.

Algebraic fields; ideals; cyclotomy and its relation to constructions with ruler and compasses; and other applications.

[**Foundations of Mathematics.** Not given in 1939–40.]

[**Symbolic Logic.** Not given in 1939–40.]

[**Theory of Groups.** Not given in 1939–40.]

[**Theory of Equations.** Not given in 1939–40.]

[**Algebraic Invariants.** Not given in 1939–40.]

[**Theory of Matrices.** Not given in 1939–40.]

[**Galois Fields.** Not given in 1939–40.]

[**Linear Algebras.** Not given in 1939–40.]

[**Representation of Groups.** Not given in 1939–40.]

Analysis

41. **Elementary Differential Equations.** Each term. Prerequisite, Mathematics 6c or the equivalent. Dr. ————, first term. M W F 9. White 24. Dr. Ficken, second term. T Th S 11. White 9.

42. **Advanced Calculus.** Throughout the year. Prerequisite, Mathematics 6c or the equivalent. Assistant Professor Randolph. M W F 11. White 1.

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 or the equivalent. Professor Agnew. M W F 11. White 6.

First term: an introductory study of convergent series of various types; second term: 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 6. Dr. Curtiss. T Th S 9. White 24.

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; Riemann surfaces; conformal mapping; integral functions; harmonic functions.

[**Functions of Real Variables.** Not given in 1939–40.]

[**Integral Equations.** Not given in 1939–40.]

[**Fourier Series and Integrals.** Not given in 1939–40.]

[**Calculus of Variations.** Not given in 1939–40.]

Geometry

60. **Projective Geometry.** Throughout the year. Prerequisite, Mathematics 6b or the equivalent. Professor Carver. M W F 9. White 10.

A first course in projective geometry, including both synthetic and analytic methods.

65. **Algebraic Geometry.** First term. Prerequisite, Mathematics 60 or the equivalent. Assistant Professor Walker. M W F 9. White 25.

A study of algebraic curves from the point of view of birational transformations.

67a. **Differential Geometry.** First term. Prerequisite, Mathematics 6c or the equivalent. Dr. Givens. M W F 10. White 9.

The theory of curves and surfaces in Euclidean space of three dimensions developed with the use of tensor calculus.

67b. **Riemannian Geometry.** Second term. Prerequisite, Mathematics 67a. Dr. Givens. M W F 10. White 9.

The theory of spaces with a metric defined by a definite or indefinite quadratic differential form. This course and Mathematics 67a will include an adequate treatment of tensor analysis.

74. **Elementary Topology.** Second term. Prerequisite, Mathematics 6b or the consent of the teacher. Assistant Professor WALKER. M W F 9. White 25.
An elementary treatment of the fundamental concepts of topology.

[**Introduction to Higher Geometry.** Not given in 1939–40.]
[**Analytic Geometry of Space.** Not given in 1939–40.]
[**Geometry of Hyperspace.** Not given in 1939–40.]
[**Topics in Topology.** Not given in 1939–40.]
[**Complex Projective Geometry.** Not given in 1939–40.]
[**Tensor Analysis.** Not given in 1939–40.]
[**Non-Euclidean Geometry.** Not given in 1939–40.]

APPLIED MATHEMATICS

83a. **Probability and Statistics.** First term. Credit three hours. Prerequisite, Mathematics 10 or 6a or the equivalent. Dr. FICKEN. T Th S 10. White 9.
A survey of those portions of the theory underlying modern Statistical Analysis which are accessible to a student without advanced mathematical training. Specifically the course will include a study of Bernoulli's theorem, the probability integral, the probability of causes, the law of large numbers, continuous probabilities, sampling fluctuations, and the Lexis theory.

84. **Dynamics.** First term. Prerequisite, Mathematics 42 or the equivalent. Dr. LEWIS. M W F 10. White 21.
An advanced course dealing with such topics as the problem of three bodies, the formal series of dynamics, stability of periodic orbits, recurrent motions, surfaces of section and their applications.

85. **Vector Analysis.** First term. Prerequisite, Mathematics 6b or the equivalent. Professor HURWITZ. T Th S 10. White 6.
The algebra and calculus of vectors with applications.

[**Differential Equations of Mathematical Physics.** Not given in 1939–40.]
[**Advanced Mathematical Statistics.** Not given in 1939–40.]
[**Orthogonal Functions.** Not given in 1939–40.]
[**Potential Functions.** Not given in 1939–40.]
[**Mechanics.** Not given in 1939–40.]
[**Hydrodynamics and Elasticity.** Not given in 1939–40.]
[**Relativity.** Not given in 1939–40.]

METEOROLOGY

Professor R. A. MORDOFF.

Approved Major and Minor Subjects (key to symbols on p. 42)

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.* Either term. Three hours a week.

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, R. F. BACHER, L. L. BARNES, H. A. BETHE, J. R. COLLINS, G. E. GRANTHAM, H. E. HOWE, E. H. KENNARD, C. C. MURDOCK, L. G. PARRATT, F. K. RICHTMYER, and L. P. SMITH; *Doctors* W. M. CADY, C. W. GARTLEIN, P. L. HARTMAN, G. PLACZEK, L. T. POCKMAN, and D. H. TOMBOULIAN.

Approved Major and Minor Subjects (key to symbols on p. 42)

Physics 1, 2, 3, 4
Experimental Physics 1, 2, 3, 4
Theoretical Physics 1, 2, 3, 4
Applied Physics 1, 2, 3, 4
Mathematical Physics 3
Biophysics 3, 4

Notes. The major and both minor subjects for the Ph.D. should not be chosen inside the field of physics.

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.

Applied Physics as a major for the Ph.D. must be accompanied by a minor subject in the field of physics.

Members of the staff will be especially interested in directing graduate research in the following fields.

Experimental Physics. Nuclear physics; atomic spectra, including nuclear effects; absorption spectra; x-rays; x-ray and electron diffraction; electronics, electrical phenomena in gases, and photoelectricity.

Theoretical Physics. Quantum mechanics; particularly the theory of radiation, of nuclei, and of solids.

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.

A Colloquium in general physics and a seminar in theoretical physics meet regularly and seminars in special fields as arranged.

3, 4. *Introductory Physics.* Three hours a week.

6, 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.* Either term. Two laboratory periods and a seminar each week.

109. *Seminar.* Both terms. One hour a week.

[111. **Mechanics.** First term. Credit three hours. Prerequisites, Physics 60, 61, and 62, and Mathematics 6, or their equivalents. Professor MURDOCK. Not given in 1939–40.]

Introductory analytical mechanics; material particles, systems of particles, and rigid bodies; oscillations.

[112. **Properties of Matter.** Second term. Credit three hours. Prerequisite, Physics 111 or its equivalent. Professor MURDOCK. Not given in 1939–40.]

Gravitation, crystalline state, mechanics of deformable solids and fluids, surface phenomena, and diffusion.

120. **Electricity and Magnetism.** Throughout the year. Credit three hours. Prerequisite, Physics 60 and 61, and Mathematics 6, or their equivalents. Professor MURDOCK. T Th S 9.

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. Credit three hours. Prerequisite, Physics 60 and 61, and Mathematics 6, or their equivalents. Professor HOWE. T Th S 8. Given in alternate years.

A study of lens systems, diffraction, interference, double refraction, and polarization.

[142. **Heat.** Second term. Credit three hours. Prerequisite, Physics 60 and 62, and Mathematics 6, or their equivalents. Professor COLLINS. T Th S 8. Given in alternate years, not in 1939–40.]

Temperature scales, specific heats, thermal conductivity, thermodynamics, thermal radiation, high-temperature measurement, and kinetic theory.

[162. **Wave Motion and Sound.** Second term. Credit three hours. Prerequisites, Physics 111 or the equivalent. Given in alternate years, not in 1939–40.]

The general properties of wave motion; a comparative study of elastic waves, waves on the surfaces of liquids and sound waves; a detailed study of sound phenomena.

170. **Introduction to Modern Physical Theories.** Throughout the year. Credit three hours a term. Prerequisite for part (a), six hours from Physics 105 to 142 inclusive, or the equivalent; for part (b), part (a) or the equivalent. Professor RICHTMYER. M W F 10. For seniors and first-year graduate students.

(a) First term. Early theories, electromagnetic theory, radiation and origin of quantum theory, specific heats, introduction to atomic structure and to atomic and molecular spectra.

(b) Second term. Vector model of the atom, x-rays, matter waves, radioactivity, the nucleus and nuclear disintegrations, and other topics selected from modern physics.

200. **Introduction to Theoretical Physics.** Throughout the year. Must be preceded or accompanied by Physics 111 and by the first term of Physics 120 or their equivalents. Part A, Professor BETHE. T Th S 11. Part B, Professor KENNARD.

Part A, three hours of lectures and problem work on certain fundamental and generally useful phases of theoretical physics, such as electrodynamics, optics, relativity, thermodynamics, analytical and statistical mechanics, kinetic theory, hydrodynamics; Part B, additional individual study of certain topics equivalent to a two-hour course. In general the two parts should not be separated.

213. **Theoretical Mechanics.** First term. Credit two hours. Prerequisite, the relevant part of Physics 200 or the equivalent. Professor KENNARD. W F 8. Given in alternate years.

Hamilton's Principle, Hamilton-Jacobi equation; hydrodynamics; elasticity.

[222. **Electrodynamics.** Second term. Credit two hours. Prerequisite, the relevant part of Physics 200 or the equivalent. Professor KENNARD. W F 9. Given in alternate years, not in 1939–40.]

A more thorough study of selected topics.

[233. **Theoretical Optics.** First term. Credit three hours. Prerequisite, Physics 200 or the equivalent. Professor COLLINS. T Th S 8. Given in alternate years, not in 1939–40.]

Electromagnetic theory, dispersion, absorption, optical properties of metals, diffraction, propagation in crystals.

254. **Kinetic Theory and Statistical Mechanics.** Second term. Credit two hours. Prerequisite, relevant parts of Physics 200. Professor KENNARD. W F 8. Given in alternate years.

Molecular theory of the principal phenomena in gases; the principles and certain applications of statistical mechanics.

271. **Introductory Quantum Mechanics.** First term. Credit three hours. Prerequisite, Physics 200 or the equivalent. Professor SMITH. M W F 9.

300. **Advanced Laboratory.** First and second terms. Credit three hours a term. Prerequisite, Physics 105 or the equivalent. Professor COLLINS, Assistant Professor PARRATT, Dr. CADY, and Mr. KRASIK. Two laboratory periods a week with outside work in reading and computation. Laboratory open T W Th F afternoons. Rockefeller 301. Laboratory fee each term, $10.

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. Credit one hour a term. Prerequisite, Physics 105 or the equivalent. May not precede Physics 300. 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. Credit two hours a term. Professor ————. Laboratory fee each term, $10. Given in alternate years, not in 1939–40.]

Introductory experimental procedure in: properties of neutrons, alpha particles and gamma rays, induced radioactivity, disintegration, high-voltage apparatus.

(b) Spectroscopy. Throughout the year. Credit two hours a term. Dr. CADY. Laboratory fee each term, $10. 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. Credit two or three hours. Assistant Professor PARRATT. Laboratory fee, $10. 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. Credit two or three hours. Assistant Professor PARRATT. Laboratory fee, $10. 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. Credit two hours. Professor MURDOCK. Laboratory fee, $10. Given in alternate years, not in 1939–40.]

A study of the experimental techniques and methods of computation involved in the determination of structure by diffraction.

[(f) High Temperature Measurements. Credit two hours. Professor COLLINS. Laboratory fee, $10. Given in alternate years, not in 1939–40.]

Application of radiation methods to the measurements of temperature.

405. **Mathematical Methods in Physics.** Throughout the year. Credit three hours a term. Prerequisite, Mathematics 6 or the equivalent. Professor SMITH. T Th S 9. Lectures and problem work designed to give the student a working knowledge of the principal mathematical methods used in advanced physics.

472. **Quantum Mechanics of Spectra and Radiation.** Second term. Credit three hours. Prerequisite, Physics 271. Professor KENNARD. T Th S 8. Given in alternate years.

Atomic and molecular spectra. The theory of radiation.

[476. **Quantum Mechanics of Solids.** Second term. Credit three hours. Prerequisite, Physics 271. Professor BETHE. T Th S 10. Given in alternate years, not in 1939–40.]

Quantum theory of crystals with particular reference to metals. Quantum statistics.

477. **Quantum Mechanics of Collisions.** First term. Credit two hours. Prerequisite, Physics 271. Professor BETHE. W F 9. Given in alternate years.

The general quantum theory of atomic collision phenomena such as scattering, excitation, ionization, and the stopping power of matter.

478. **Quantum Mechanics of Nuclei.** Second term. Credit two hours. Prerequisite, Physics 477. Professor BETHE. W F 9. Given in alternate years.

Theory of the nuclear forces and of the stationary states and transmutations of atomic nuclei.

[481. **Advanced Quantum Mechanics.** First term. Credit three hours. Prerequisites, Physics 271 and at least one of the courses 472, 476, 477, or their equivalents. Professor BETHE. Given on sufficient demand in alternate years, not in 1939–40.]

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. Credit three hours a term. Prerequisite, Physics 132 or its equivalent. Professor GIBBS and Dr. SHAW. M W F 11. Given in alternate years.

The nature, origin, and structure of atomic, molecular, and Raman spectra, and their interpretation according to current theories.

597. **X-Ray and Electron Diffraction.** First term. Credit three hours. Prerequisite, Physics 170(b) or its equivalent as regards x-ray and matter waves. Professor MURDOCK. M W F 10. Given in alternate years.

Space group and reciprocal lattice theory, diffraction by three dimensional gratings, extinction, interpretation of x-ray and electron diffraction data, structure factor, structure determination by Fourier synthesis, resolving power and diffraction by fluids.

598. **X-Rays.** Second term. Credit three hours. Prerequisites, Physics 120 and 170, or their equivalents. Assistant Professor PARRATT. T Th S 10. Given in alternate years.

Lectures and assigned readings on x-ray production, scattering, absorption and diffraction; the relation of these processes to modern concepts of atomic and solid structure.

[640. **Alternating Currents and Electronics.** Throughout the year. Credit three hours. Prerequisites, Mathematics 41 and Physics 300 (3 hours) and 320d, or their equivalents. Professor SMITH and Mr. KRASIK. Lectures and laboratory work. Laboratory fee each term, $7.50. Given in alternate years, not in 1939–40.]

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 Administration and Finance, Rural Economy.)

Professors G. N. Lauman, 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, F. A. Harper, L. C. Cunningham, P. S. Williamson, G. W. Hedlund, W. M. Curtiss, and T. N. Hurd; *Doctors* A. Van Wagenen and H. S. Tyler.

Approved Major and Minor Subjects (key to symbols on p. 42)

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 Administration and Finance 1, 2, 3, 4
Rural Economy 1, 2, 3, 4
Agricultural Economics 4

Business Management

Attention is directed to Administrative Engineering 3A23 (Business and Industrial Management), Geology 206 (Commercial Geography), and to the courses in Economics.

121. **Financial Statements.** First term. Credit three hours. Professor Powell. Lectures, T Th 9. Warren Hall 225. One discussion period to be arranged. Warren Hall 201. Fee for materials furnished, $2.
Introduction to personal and business finance; kinds of loans, lending agencies, insurance, savings and investment, and interpretation of financial reports of business.

122. **Accounting Method.** Second term. Credit three hours. Professor Powell. Lectures, T Th 8. Warren Hall 225. Practice period Th 1:40–4. Warren Hall 201. Fee for materials furnished, $1.
Recording business transactions, and deriving financial statements, analyses of costs and budgets.

126. **Farmers' Cooperatives.** Second term. Credit three hours. Professor Powell. Lectures, W F 8. Warren Hall 225. Discussion groups M at hours to be arranged. Warren Hall 201. Fee for materials furnished, $2.
What cooperatives have tried to do and what they have done; their special problems of organization, finance, and control by farmers.

127. **Business Law.** First term. Credit two hours. Mr. Allan H. Treman. Lectures, T Th 12. Warren Hall 225.
Consideration is given chiefly to legal problems of particular interest to persons who expect to engage in business, including contracts, liens, mortgages, and negotiable instruments; ownership and leasing of property; wills; estates; inheritance taxation; and other practical problems.

229. **Agricultural Credit.** First term. Credit three hours. Professor W. I. Myers. Lectures, T 10. Lecture and discussion, T 1:40–4. Warren Hall 125. Fee for materials furnished, $1.
A study of the credit institutions which serve Agriculture.

Farm Management

102. **Farm Management.** Second term. Credit five hours. Assistant Professor Warren and other members of the departmental staff. Lectures, M W F 10. Warren Hall 25. Laboratory, F 4–6. Warren Hall 101. Fee for materials furnished and for transportation on trips, $6.

Farming as a business; types of farming; size of business; rates of production; labor efficiency; combination of enterprises; farm layout; building arrangement; machinery; forms of tenure and leases; choosing and buying a farm; use of capital and credit; planning the organization and management of specific farms. One all-day trip and four half-day trips 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. Credit three hours. Assistant Professor Williamson. Lectures, T Th 8. Warren Hall 25. Laboratory, W 1:40–4. Warren Hall 101. Fee for materials furnished, $3.

Farm inventories; cash accounts; 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. Credit four hours. Prerequisite, course 102 or its equivalent. Professor Scoville. F 1:40–4, S 8–10. Warren Hall 101. Approximate expenses of trips, $20. Fee for materials furnished, $2.

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.

205. **The Appraisal of Farm Land.** First term. Credit two hours. Assistant Professor Warren. Lectures, Th 10. Laboratory, Th 1:40–5 (1:40–4 during the latter part of the term when no trips are taken). Warren Hall 140. Fee for materials furnished, $1.

A study of factors governing the price of land; methods of land valuation; the appraisal of land for use, for sale, for purposes of making loans, and for taxation.

206. **Land Economics.** Second term. Credit three hours. Professor Wehrwein. Lectures, T Th 11. Warren Hall 125. Laboratory, T 1:40–4. Warren Hall 140. Fee for materials furnished, $2.

The characteristics of land and their relation to population and public policies; the theory, methods, results, and use of land classification studies.

[207. **Research Methods in Farm Management.** First term. Credit one hour. Professor ————. Not given in 1939–40.]

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. Credit two hours. Professor Misner. Th 2–4. Warren Hall 140.

The course gives experience 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.

209. **Comparative Agriculture.** First term. Credit one hour. Professor Misner. Time and room to be arranged.

A study of the agriculture of various foreign countries with emphasis on the farm-management aspects.

History of Agriculture

171. **History of Agriculture.** First term. Credit three hours. Professor Lauman. Lectures, M W F 11. Warren Hall 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. Credit three hours. Professor LAUMAN. Lectures, M W F 11. Warren Hall 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. Credit two or three hours a term. Professor LAUMAN. Warren Hall 316.

279. **Agricultural History Seminar.** First and second terms. Professor LAUMAN. Th 2:30. Warren Hall 316.

MARKETING

[141. **Marketing Farm Products.** First term. Credit three hours. Professor ————. Not given in 1939–40.]

A study of problems in the marketing of farm products.

142. **Marketing Fruits and Vegetables.** First term. Credit four hours. Professor RASMUSSEN. Lectures, M W F 9. Warren Hall 25. Laboratory, T 4–6. Warren Hall 201. Fee for materials furnished, $3.

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.

242. **Methods and Results of Research in Marketing.** First term. Credit two hours. Professor RASMUSSEN. W 4–6. Warren Hall 225.

A critical study of research projects in marketing fruits and vegetables and practice in planning such research.

143. **Marketing Dairy Products.** Second term. Credit three hours. Professor SPENCER. Lectures, M W 9. Warren Hall 25. Discussion period, Th 4. Warren Hall 201. One all-day trip to visit milk plants is taken some time in May. Fee for materials furnished and for transportation on trips, $4.

A study of the marketing of fluid milk, and other dairy products; economic geography of the industry; demand; supply; surplus; price plans and policies; costs of distribution; cooperative marketing; trade organizations; public regulation.

243. **Methods and Results of Research in Marketing.** Second term. Credit two hours. Professor SPENCER. W 4–6. Warren Hall 201.

A critical study of research projects in marketing dairy products and practice in planning such research.

144. **Marketing Poultry Products.** Second term. Credit three hours. Dr. VAN WAGENEN. Lectures, T Th 10. Warren Hall 225. Laboratory, T 1:40–4. Warren Hall 201. Fee for materials furnished, $2.

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.

147. **Marketing Trip to New York City.** Second term. Credit one hour. Given only if twenty or more students register. Enrollment limited to 40. 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, poultry, fruits, vege-

tables, livestock and meat. A short series of introductory lectures will precede the trip—at hours to be arranged.

Registration fee, $6 to cover materials furnished and bus hire in New York City. Total cost of trip need not exceed $28, in addition to transportation to and from New York City.

Prices and Statistics

Attention is directed to Mathematics 10 (Elementary Mathematics for Statistical Workers), Mathematics 83a (Probability and Statistics), and to Mathematics 83b (Advanced Mathematical Statistics).

111. **Statistics.** First term. Credit three hours. Professor Pearson. Lecture, M 8. Warren Hall 125. Laboratory, M 1:40–4. Warren Hall 125 and 201. Fee for materials furnished, $3.

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. Credit three hours. Prerequisite, course 111. Professor Pearson. Lecture, M 8. Laboratory, M 1:40–4. Warren Hall 125. Fee for materials furnished, $3.

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. Credit three hours. Professor Pearson. Lectures, T Th 9. Laboratory, W 1:40–4. Warren Hall 25. Fee for materials furnished, $3.

A study of prices of farm products in relation to agricultural and industrial conditions.

Public Administration and Finance

135. **Local Government.** First term. Credit three hours. Professor Catherwood. Lectures, W F 8. Warren Hall 125. Laboratory, Th 1:40–4. Warren Hall 101. Fee for materials furnished, $2.

Historical development, organization, and operation of local government. Particular attention is given to receipts, expenditures, and administration of counties, towns, and school districts in New York.

138. **Taxation.** Second term. Credit three hours. Assistant Professor Kendrick. Lectures, M W F 11. Warren Hall 25. Fee for materials furnished, $2.

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.

[235. **Problems in Financial Administration.** First term. Credit three hours. Professor Catherwood. Alternates with course 236. Not given in 1939–40.]

Attention is given to a number of problems in governmental financial administration with special reference to New York, including accounting systems, budgetary procedure, borrowing procedure, and debt and tax limits.

236. **Problems in Public Administration.** First term. Credit three hours. Alternates with course 235. Professor Catherwood. Time and room to be arranged. Fee for materials furnished, $2.

Attention is given to a number of problems in public administration with special reference to New York including state and local planning, personnel administration, and administrative organization.

238. **Seminar in Public Finance.** First term and possibly continued in the second. Credit two hours. Assistant Professor KENDRICK. Time and room to be arranged.

RURAL ECONOMY

[151. **Public Problems of Agriculture.** Second term. Credit two hours. Professor ————. Not given in 1939–40.]

A discussion of some of the more important problems of agriculture that involve collective or governmental action.

157. **Urban Land Economics.** Second term. Credit two hours. Professor WEHRWEIN. Time and room to be arranged.

262. **Rural Economy, Elementary Course.** First term. Credit three hours. Professor LAUMAN. Lectures, M W F 9, and individual conferences. Warren Hall 325.

A study of the factors underlying the present conditions in rural communities at home and abroad, and of the forces at work in shaping the agriculture of the world, chiefly along economic lines.

263. **Rural Economy, Advanced Course.** Second term. Credit three or four hours. Prerequisite, course 262, or special permission. Professor LAUMAN. Lectures, M W F 9. Warren Hall 325.

A more extended study, primarily theoretical, of the general economic problems of agriculture.

264. **Planning for Agriculture.** Second term. Credit three hours. Professor LAUMAN. Lectures, T Th 9. Warren Hall 325.

A study of agricultural policies and plans for the rehabilitation and redirection of agriculture in various countries of the world.

269. **Rural Economy Seminar.** First and second terms. Professor LAUMAN. T 2:30. Warren Hall 316.

DEPARTMENTAL SEMINAR

299. **Seminar.** First and second terms. Departmental Staff. M 4. Warren Hall 401.

AGRICULTURAL ENGINEERING

Professors H. W. RILEY, B. B. ROBB, A. M. GOODMAN, J. C. MCCURDY, F. H. RANDOLPH, L. M. ROEHL, and F. B. WRIGHT.

Approved Major and Minor Subjects (key to symbols on p. 42)

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 fundamentals of the phase of Agricultural Engineering 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. Laboratory equipment available includes absorption and traction dynamometers, direct reading and recording electric meters, oil testing laboratory, shop facilities for constructing special equipment, farm power machines and tractors of many types and farm lands of typical Eastern soils and topography.

Air Conditioning of Animal Shelters and Crop Storages. For this work available equipment includes automatic recorder for 64 resistance thermometers, hand instrument for 48 stations, potentiometer for thermocouples, thermographs, hygrographs and hygrothermographs, anemometers, and other necessary equipment.

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.* Either term. Three hours a week.

101. *Electricity on the Farm.* Second term. Three hours a week.

102. *Farm Power Machinery.* Second term. Three hours a week.

10. *Household Mechanics.* Either term. Three hours a week. For women students.

21. *Farm Engineering.* Either term. Three hours a week.

121. *Farm Engineering, Advanced Course.* Second term. Two hours a week. Given in alternate years.

[122. *Drainage and Irrigation.* Two hours a week, second term. Given in alternate years, not in 1939–40.]

24. *Farm Concrete.* First term. Two hours a week.

31. *Farm Structures.* First term. Three hours a week.

40. *Farm Shop Work.* Both terms. Two hours a week.

41. *Shop Work for Rural High School Teachers.* Both terms. Three hours a week.

47. *Farm Blacksmithing.* Either term. One or more hours a week.

251. **Research in Agricultural Engineering.** Prerequisite, permission to register. Professors RILEY, ROBB, GOODMAN, MCCURDY, 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. Professor ROBB. M 4:30–5:45. Presentation and discussion of papers on special problems in agricultural engineering.

161. *Mechanism of Hotel Machines.* Either term. Four hours a week.

162. *Hotel Power Plants.* Second term. Three hours a week.

163. *Hotel Auxiliary Equipment.* First term. Three hours a week.

164. *Hotel Planning.* Second term. Three hours a week.

166. *Hotel Maintenance.* First term. One hour a week.

AGRONOMY

Professors R. BRADFIELD, J. A. BIZZELL, H. O. BUCKMAN, J. K. WILSON, B. D. WILSON, A. F. GUSTAFSON, F. B. HOWE, H. B. HARTWIG, E. V. STAKER, D. B. JOHNSTONE-WALLACE, R. F. CHANDLER, JR., and R. W. CUMMINGS; at Geneva, *Professor* H. J. CONN.

Approved Major and Minor Subjects (key to symbols on p. 42)

Soils 1, 2, 3, 4
Field Crop Production 1, 2, 3, 4

The laboratories of the Department are well equipped for chemical, physical, and microbiological investigations of soils and field crops. Greenhouses are available for soil and crop experimentation during the winter and a field, conveniently located and well equipped, is available for experiments on a larger scale during the summer. Special equipment can generally be supplied when needed. The Departmental library contains the more important journals, reference works, and experiment station literature.

Members of the staff will be especially interested in directing research in the fields as listed: Professor BIZZELL, in soil fertility, Professor BRADFIELD and Professor CUMMINGS in soil physics and physical chemistry, Professor BUCK-

MAN in soil genesis and geography, Professor HOWE in the morphology, classification, and cartography of soils, Professor J. K. WILSON and Professor H. J. CONN in soil microbiology, Professor STAKER in soil biochemistry, Professor B. D. WILSON in organic soils, Professor CHANDLER in forest soils, Professor GUSTAFSON in soil conservation, Professor HARTWIG in field crops production, and Professor JOHNSTONE-WALLACE in pasture management. Prospective students are urged to correspond with the member of the staff whose interests are most closely related to their own a few months in advance of the time they expect to enter upon their work, as only a limited number of students can be accommodated.

Students preparing for graduate work in Agronomy are urged to obtain a thorough knowledge of general physics, analytical, organic, and physical chemistry, general botany, bacteriology, plant physiology, and geology. Opportunity will be afforded for further study of some of these subjects after entering the Graduate School, but a student deficient in two or more of these foundation courses cannot expect to receive a degree in the minimum time required for residence. Some practical experience with soil and crop management problems is also desirable. Opportunity to acquire additional experience will be afforded a limited number of students majoring in the Department by summer employment on Departmental projects.

Students must consult professor in charge before registering for any course numbered above 100.

SOIL SCIENCE

1. *The Nature and Properties of Soils.* First or second term. Credit five hours.

101. **Origin, Morphology, Classification, and Mapping of Soils.** Second term. Credit three hours. Prerequisite, course 1. Professor HOWE. Lectures, T Th 10. Caldwell 100. Laboratory fee, $3.

A course dealing with the characteristics of the great soil groups with particular reference to those of the United States. Attention is given to the origin and classification of New York soils based upon their morphology. A field study of soils and mapping is a prominent feature of this course. Four all-day Saturday field trips.

102. **Soil Conservation.** Second term. Credit two hours. Prerequisite, courses 1 and 11 or their equivalents. Professor GUSTAFSON. Lectures, T Th 11. Caldwell 143. Laboratory fee, $4.

An analysis of the causes of the decline in the inherent productivity of soils and of practical methods of management which will permanently maintain their productivity. The causes of erosion and its control by agronomic methods will receive special emphasis. Two all-day Saturday field trips.

103. **Organic Soils.** First term. Credit two hours. Prerequisite, course 1, and Chemistry 201. Professor B. D. WILSON. Lectures, W F 8. Caldwell 143. To be given in alternate years.

A course designed primarily for students specializing in soil technology. Emphasis is placed on the composition and properties of organic soils.

[104. **Forest Soils.** First term. Credit two hours. Prerequisites, course 1 and Botany 31. Assistant Professor CHANDLER. Lectures, W F 8. Caldwell 492. Given in alternate years, not in 1939–40.]

Assigned readings and semi-weekly discussions of the more important forest soils literature. There will be occasional field trips.

106. **Soil Microbiology.** 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. Laboratory fee, $5.

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.

205. **Soil Fertility, Advanced Course.** First term. Credit three hours. Prerequisite, course 1 and Chemistry 201 or its equivalent. Professor BIZZELL. Lectures, T Th S 8. Caldwell 143.

The lectures are supplemented by reviews of literature and by the preparation of abstracts.

207. **Physical and Chemical Properties of Soils. Lectures.** Second term. Credit three hours. Prerequisite, course 1, Physics 3 and 4, Chemistry 201. A course in physical chemistry is recommended. Professor BRADFIELD. Lectures, T Th S 8. Caldwell 143.

A study of physical and chemical processes and changes which take place in soils with emphasis upon their practical application and significance.

208. **Physical and Chemical Properties of Soils. Laboratory.** Second term. Credit three hours. Must be preceded or accompanied by Agronomy 207. Enrollment limited. Professor BRADFIELD and Assistant Professor STAKER. Laboratory, M W 1:40–4. Caldwell 294. Laboratory fee, $5.

Laboratory practice in the use of physical and physico-chemical techniques used in soil investigations.

209. **Research in Soil Science.** Throughout the year. Professors BIZZELL, BRADFIELD, BUCKMAN, CONN, GUSTAFSON, J. K. WILSON, B. D. WILSON, and HOWE, and Assistant Professors CHANDLER, CUMMINGS, and STAKER.

FIELD CROPS

11. *Production of Field Crops.* First or second term. Credit four hours.

211. **Field Crops, Advanced Course.** Second term. Credit two hours. Prerequisite, Agronomy 11 and Botany 31 or their equivalent. Professor H. B. HARTWIG. Lectures and discussions, T Th 10. Caldwell 143. Given in alternate years.

A literature course organized to meet the needs of students specializing in field crops. Current problems involving crops other than pasture will be considered. The emphasis will be on forage crops. In addition to lectures, papers will be assigned for reading and abstracting.

212. **Pastures.** Second term. Credit three hours. Prerequisite, courses 1 and 11 or their equivalent. Assistant Professor JOHNSTONE-WALLACE. Lectures and discussions, T Th 9. Caldwell 143. Laboratory and field trips, Th 1:40–4. Laboratory fee, $4.

Special attention will be devoted to the principles involved in the improvement and management of pastures in humid, temperate climates. Current literature will be studied.

219. **Research in Field Crop Production.** Throughout the year. Professor HARTWIG and Assistant Professor JOHNSTONE-WALLACE.

290. **Seminar.** Throughout the year. Required of graduate students taking work in the Department. Professor BRADFIELD and departmental staff. S 11–12:30. Caldwell 143.

ANIMAL BREEDING

See under ANIMAL SCIENCES, p. 79

ANIMAL HUSBANDRY

Professors F. B. MORRISON, E. S. SAVAGE, L. A. MAYNARD, C. M. MCCAY, E. S. HARRISON, S. A. ASDELL, R. B. HINMAN, G. W. SALISBURY, J. P. WILLMAN, and J. I. MILLER.

Approved Major and Minor Subjects (key to symbols on p. 42)

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.* First or 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 Livestock Judging: Beef Cattle, Horses, Sheep, and Swine.* Second term. Two lecture and laboratory periods.

42. *Advanced Livestock Judging: Beef Cattle, Horses, Sheep, and Swine.* First term. Two lecture and laboratory periods a week.

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. **Endocrinology, Reproduction, and Lactation.** Second term. See **Animal Breeding.**

213. **Biochemistry of Lactation.** Second term. Given in alternate years. See **Animal Nutrition.**

215. **Animal Nutrition.** Advanced Course. First term. 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. Professors SAVAGE and HARRISON. Lecture, W 11. Practice, W 1:40–4. Wing E.

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, SAVAGE, HARRISON, HINMAN, MILLER, 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. 80.

BACTERIOLOGY

See under PLANT SCIENCES, p. 95, and NEW YORK STATE EXPERIMENT STATION AT GENEVA, p. 199.

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, D. C. CARPENTER, J. C. HENING, and J. C. MARQUARDT.

Approved Major and Minor Subjects (key to symbols on p. 42)

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.* Either term. Credit three hours a week.
5. *Technical Control of Dairy Products.* Second term. One hour a week.

102. **Market Milk and Milk Inspection.** Second term. Credit five hours. Prerequisite, course 1, and Bacteriology 1 or its equivalent. Professors ROSS and BRUECKNER and Assistant Professor AYRES. Lecture and laboratory practice, M W 12–5. Dairy Building 218 and 146. Laboratory fee, $10.

The scientific, technical, and sanitary aspects of the fluid milk industry.

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 10–3:30. Dairy Building 120. Laboratory fee, $10.

The principles and practice of making butter, cheese, and casein, including a study of the physical, chemical, and biological factors involved.

104. **Milk-Products Manufacturing.** Second term. Credit five hours. Prerequisite, course 1; should be preceded or accompanied by course 5. As-

sistant Professor AYRES. Lectures, recitation, and laboratory practice, F 12–5, S 8–1. Dairy Building 120. Laboratory fee, $10.

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.

111. **Analytical Methods.** Second term. Credit four hours. Prerequisite, quantitative analysis. Professor HERRINGTON and Mr. STEWART. Lecture, T Th 10. Laboratory practice, T 1–5. Dairy Industry Building 120. Laboratory fee, $10.

An advanced course in the chemical analysis of products and materials important in the dairy industry.

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 112 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 113. 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 200.

FLORICULTURE AND ORNAMENTAL HORTICULTURE

Professors E. A. WHITE, R. W. CURTIS, J. P. PORTER, R. C. ALLEN, KENNETH POST, and C. J. HUNN.

Approved Major and Minor Subjects (key to symbols on p. 42)

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 for research 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.* First term. Three hours a week.
2. *Amateur Floriculture.* Second term. Three hours a week.
3a. *Herbaceous Plant Materials.* Second term. Two hours a week.
3b. *Herbaceous Plant Materials.* First term. One hour a week.
7. *Plant Propagation.* First term. Three hours a week.
8. *Woody-Plant Materials.* Both terms and Summer Session. Four hours a week.
10. *A Brief Introduction to Landscape Design and Ornamental Horticulture.* Second term. Three hours a week.
101. *Commercial Floriculture.* Both terms. Four hours a week.
103. *Wholesaling and Retailing Flowers.* Second term. Two hours a week.
[104. *Conservatory Plants.* First term. Two hours a week. Given in alternate years, not in 1939–40.]
105. *Flower Arrangement.* Second term. One hour a week.
109. *Commercial Practice in Woody-Plant Propagation.* Both terms. Two hours a week.
112. *Lawn Making and Greenkeeping.* Second term. Two hours a week.
113. *Landscape Work on Small Properties.* First term. Three hours a week.
114. *Landscape Work on Small Properties.* Second term. Six hours a week.
115. *Planting Design.* First term. Two hours a week.
116. *Planting Design, Advanced Course.* Second term. Three hours a week.
117. *The Construction of Small Gardens.* First term. Three hours a week.
171. *Tree and Shrub Management.* Second term. Two hours a week.
Seminary. First term. Required of all graduate students.

FORESTRY

Professors R. S. HOSMER, A. B. RECKNAGEL, and E. F. WALLIHAN.

Approved Major and Minor Subjects (key to symbols on p. 42)

Forest Conservation 2, 4
Forest Products 2, 4
Forest Ecology 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 3713 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 WALLIHAN.

General Forestry

1. *Farm Woodlands.* First term. Three hours a week.

2. *Utilization of Farm Woodland Products.* Second term. Two hours a week.

3. *Conservation of Natural Resources.* Second term. Two hours a week.

4. *The Field of Forestry.* First term. Two hours a week.

23. *Establishment and Development of Farm Woodlands.* Second term. Three hours a week.

54. *Measurement and Management of Farm Woodlands.* First term. Three hours a week.

135. **Forest Ecology.** Second term. Credit two hours. Prerequisite, Botany 31 or its equivalent. Assistant Professor WALLIHAN. Lectures, M W 11. Fernow 206. Laboratory fee, $1 to cover expenses of one all-day field trip after spring recess.

General principles of ecology with special reference to their application to woodlands: the effects of environmental factors on the growth and development of forest vegetation; effects of the plants on environmental factors; plant succession. Intended primarily for students in botany, soils, and plant pathology.

166. **Wild Life Conservation in Relation to Forestry.** For graduate and undergraduate students. First term. Credit two hours. Prerequisite, Wild Life Conservation and Management 2. Professor HOSMER. Lectures, T Th 9. Fernow 122.

A consideration of the place of wild life conservation and management in the multiple purpose programs which govern the full and rounded use of national, state, and private forests.

291. **Seminar.** Both terms. Without credit. Professors HOSMER and RECKNAGEL and Assistant Professor WALLIHAN. Hours to be arranged. Field and classroom conferences.

POMOLOGY

Professors A. J. HEINICKE, L. H. MACDANIELS, JOSEPH OSKAMP, M. B. HOFFMAN, R. M. SMOCK, and DAMON BOYNTON; at Geneva, *Professors* RICHARD WELLINGTON, H. B. TUKEY, R. C. COLLISON, and B. R. NEBEL.

Approved Major and Minor Subjects (key to symbols on p. 42)

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 200.

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.* First or 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. Lectures, T Th 12. Laboratory, F 1:40–4. Plant Science 107. Given in alternate years.

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. Given in alternate years, not in 1939–40.]

A systematic study of the sources of knowledge and opinion as to practices in pomology. Experiences of the industry and research in pomology are discussed with reference to their application in the solution of problems in modern fruit growing.

231. **Special Topics in Experimental Pomology.** Second term. Professor HEINICKE. Conference periods, M W F 8. Plant Science 141. Given in alternate years.

In this course the student is expected to review critically and evaluate the more important original papers relating to pomological research. Interpretation of the literature will be made on the basis of the fundamental principles of plant biology. Modern experimental methods applicable to the field of pomology are fully considered.

[243. **The Functional Morphology and Anatomy of Fruit Plants and Their Products.** First term. Credit three hours. Prerequisite, adequate preparation in botany and permission to register. Professor MACDANIELS. Lectures and demonstrations, T Th 12. Laboratory, F 1:40–4. Plant Science 114. Given in alternate years, not in 1939–40.]

A course intended primarily for graduate students. The morphology of the flowers and fruits and the anatomy of these and other plant parts, particularly as related to physiological function, will be considered. Emphasis will be given the species important in temperate zone horticulture. The course should supplement rather than replace basic courses in general morphology and anatomy.

201. **Research Problems in Pomology.** Throughout the year. Professors HEINICKE, MACDANIELS, OSKAMP, HOFFMAN, SMOCK, and BOYNTON.

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, and *Doctor* LAMOREUX.

Approved Major and Minor Subjects (key to symbols on p. 42)

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. 79 and 80 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 three hours.
50. *Marketing Poultry Products.* Second term. Credit two hours.
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.

121. **Physiology of Avian Reproduction.** Second term. For details see Animal Breeding.

209. **Seminar in Poultry Biology.** Throughout the year. Members of departmental staff. F 4:15. Poultry Husbandry Building 201. Required of all graduate students in the department.

A survey of recent literature and research in poultry biology.

210. **Experimental Methods in Poultry Nutrition.** First term. For details see Animal Nutrition.

219. **Animal Nutrition Seminar.** First and second terms. 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

See under SOCIOLOGY, p. 73.

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. 42)

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, 225, 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. Laboratory fee, $2. Not given in 1939–40.]

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.

225. **Special Topics in Vegetable Crops.** First term. Credit three hours. Prerequisite, course 101 and Botany 31. It is recommended that Botany 231 and 232 precede or accompany this course. Professors THOMPSON, KNOTT, SMITH, and PLATENIUS. Discussions, M W F 9. East Roberts 223.

In this course, intended primarily for graduate students, the student is expected to review critically and to evaluate the more important research publications that deal with vegetable production, handling, and storage problems. In the discussions attention will be given to research methods and technique.

231. **Research.** Members of the staff are prepared to direct investigations in the various lines of vegetable production and handling.

232. **Seminar.** First and second terms. 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 201.

GRADUATE SCHOOL OF EDUCATION

EDUCATION AND RURAL EDUCATION

Professors H. R. ANDERSON, T. L. BAYNE, C. E. BINZEL, J. E. BUTTERWORTH, T. H. EATON, L. A. EMERSON, E. N. FERRISS, F. S. FREEMAN, E. R. HOSKINS, M. L. HULSE, P. G. JOHNSON, R. H. JORDAN, P. J. KRUSE, C. B. MOORE, R. M. OGDEN, E. L. PALMER, R. M. STEWART, F. M. THURSTON, and A L. WINSOR.

Approved Major and Minor Subjects for A.M., M.S., M.S. in Agr., and Ph.D.

(key to symbols on p. 42)

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 1, 2, 3, 4
Industrial Education 1, 2, 3, 4
Nature Study 1, 2, 3, 4
Rural Education 1, 3, 4
Rural Secondary Education 1
Science Education 1, 2, 3, 4
Secondary Education 1
Social Studies Education 1, 2, 3, 4
Supervision 1, 2, 3, 4
Theory and Philosophy of Education 1, 2, 3, 4
Vocational Education 1

There are two types of advanced degrees for which students in Education may become candidates, as follows:

1. The degrees of *Master of Arts, Master of Science, Master of Science in Agriculture,* and *Doctor of Philosophy,* administered by the Graduate School.
2. The degrees of *Master of Science in Education* and *Master of Education,* administered by the Graduate School of Education under the jurisdiction of the Graduate School.

A separate Announcement listing the offerings in Education may be obtained by writing to the Director of the Graduate School of Education, 211 Stone Hall.

Admission

A student may be admitted to candidacy for any of the degrees Master of Arts, Master of Science, Master of Science in Agriculture, or Doctor of Philosophy, with a major or minor, or both, in some phase of Education. For details of admission see page 11.

The requirements for admission to candidacy for Master of Science in Education are the same as for Master of Arts or Master of Science, except that there is no requirement in foreign language.

Requirements for admission to candidacy for the degree of Master of Education will be announced later.

Persons interested in becoming candidates for these degrees should address inquiries to the Director of the Graduate School of Education. Formal application for admission should be sent to the Dean of the Graduate School.

The Degree of Master of Education

A New Five-Year Program for the Preparation of Secondary School Teachers

The student who enters the University in the fall of 1939 with the intention of preparing for secondary school teaching will be expected to complete a five-year program. He will enter one of the undergraduate colleges and at the end of four years will normally receive a Bachelor's degree. Upon the satisfactory completion of the five-year program, a professional degree, Master of Education, will be awarded. Although the student who secures a Bachelor's degree before 1943 will not be required to follow this program, there will be opportunity for him to prepare himself on the basis of the new plan. Details regarding the admission of students to professional courses and to candidacy for the M.Ed. degree will be announced at a later date.

The Degree of Master of Science 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 at 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 deter-

mine 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 degree be granted. 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 advisory 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.

For information regarding rooms in which classes will be held see the Announcement of the Graduate School of Education.

GENERAL COURSES

[Ed. 20. **Seminar in Education.** First term. Credit two hours. Primarily for graduate students. Professor FREEMAN. Th 4–6.

Topics relevant to educational theory. Not given in 1939–40.]

Ed. 21. **Seminar in Education.** Second term. Credit two hours. Primarily for graduate students. Admission by permission of the instructor. Professor JORDAN. M 4–6.

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.

[R.E. 234. **Seminar.** First term. Credit two hours. Professor BUTTERWORTH. Not given in 1939–40.]

PSYCHOLOGY

Ed. 1. *Educational Psychology.* Either term. Credit three hours.

[Ed. 8. **Experimental Education.** Either term. Credit and hours to be arranged. Consent of the instructor is required. Education 7 or its equivalent should normally precede this course. Professor FREEMAN.

Problems of experimental education; the application of psychological and statistical methods to problems in educational psychology; chief results and bearings. Not given in 1939–40.]

[Ed. 17. **Mental Development.** First term. Credit two hours. Professor FREEMAN. Not given in 1939–40.]

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 ————. M 2–4, and a third hour to be arranged.

The nature, causes, and implications of individual differences in abilities, interests, and achievement. Study and observation of atypical and problem groups.

R.E. 110. *Psychology: An Introductory Course.* Either term. Credit three hours.

R.E. 111. *Psychology for Students of Education.* First 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.

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.

[R.E. 212. **Psychology of Learning.** Second term. Credit two hours. Professor KRUSE. Not given in 1939–40.]

R.E. 213. **Psychology of Learning in the School Subjects.** First term. Credit two hours. Prerequisite, a course in educational psychology and permission of the instructor to register. Assistant Professor BAYNE. Primarily for graduate students. S 9–11.

[R.E. 216. **Psychology of the Physically Handicapped Child.** Second term. Credit three hours. Prerequisite, R.E. 111 or R.E. 112 or equivalent. Dr. GARDNER. Not given in 1939–40.]

[R.E. 218. **Seminar in Educational Psychology.** Second term. Credit two hours. Professor KRUSE. Not given in 1939–40.]

R.E. 219. **Seminar in Personnel Administration.** Second term. Credit two hours. Open only to qualified seniors and graduate students. Prerequisite, R.E. 119. Professor WINSOR. Th 4:15–6.

METHOD

Ed. 4. *Methods, Practice and Extra-Instructional Problems.* Credit nine hours.

R.E. 31. *Planning for the Teaching of Agriculture.* Either term. Credit one hour.

R.E. 121. *Method and Procedure in Secondary School Teaching.* First term. Credit three hours.

R.E. 126. *The Teaching of Science in the Secondary School.* Either term. Credit two hours.

R.E. 127. *Observational Aids in Teaching.* Second term. Credit two hours.

R.E. 129. *Teaching Adaptations for the Atypical Child.* Second term. Credit three hours.

R.E. 131. *Introduction to Teaching in Vocational Agriculture.* Either term. Credit three hours.

R.E. 132. *The Teaching of Agriculture in the Secondary School.* Throughout a full year in two sequences beginning in either term.

R.E. 133. *Directed Teaching of Pupils in Vocational Agriculture.* Either term. Credit to be arranged.

R.E. 134. *Adult Education.* First term. Credit three hours.

[R.E. 134a. *Special Agricultural Education for Out-of-School Youth and Adults.* First term. Credit three hours. Not given in 1939–40.]

R.E. 134b. *Adult Homemaking Education. (Leadership in Home Economics.* H.E. 310 and H.E. 320.)

[Home Economics 310. First term. Credit three hours. Not given in 1939–40.]

Home Economics 320. Second term. Credit three hours.

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 four hours.

R.E. 137. *Extra-Instructional Problems.* Either term. Credit two hours.

R.E. 226. **Seminar in Science Teaching.** Either term. Credit one or two hours a term. Professor PALMER and Assistant Professor JOHNSON. M 4:30. Special problems in science teaching.

[R.E. 227. **Seminar in Elementary Education.** First term. Credit two hours. Professor MOORE. Not given in 1939–40.]

[R.E. 228. **Seminar in Behavior and Guidance.** (Family Life 350.) Second term. Credit two hours. For graduate students who have had some work in child guidance. Professor WARING. Not given in 1939–40.]

Ed. 230. **Seminar in Social Studies Education.** Either term. Credit as arranged. Assistant Professor ANDERSON. M 4:15.

Students working on theses, critical papers, or other research projects in this field may register for the course.

[R.E. 232. **Advanced Problems of Teaching in Vocational Agriculture.** Second term. Credit two hours. Assistant Professor HOSKINS. Not given in 1939–40.]

R.E. 233. **Apprentice Teaching in Vocational Agriculture.** Either term. Credit to be arranged. Assistant Professor HOSKINS in charge, assisted by other members of the staff in Agricultural Education.

Certain students with advanced experience in directed teaching may be permitted to accept regular teaching responsibilities in the schools under staff supervision.

[R.E. 240. **Cooperative Extension Work.** Second term. Credit three hours. Open to graduate students qualified in agriculture or home economics. Professor ————. Not given in 1939–40.]

PREPARATION OF TEACHERS FOR NORMAL SCHOOLS AND COLLEGES

R.E. 241. **The Preparation of Teachers for Normal Schools and Colleges.** Second term. Credit two hours. Professor MOORE. M 4–6.

To meet the needs of those responsible for the training of teachers for rural elementary and secondary schools.

[R.E. 245. **The College Preparation of Teachers of Agriculture for the Secondary School.** Second term. Credit three hours. Given in 1940–41. Professor STEWART. Not given in 1939–40.]

[R.E. 248. **The Preparation of Teachers of Home Economics for Secondary Schools.** Second term. Credit two hours. Professor ————. Not given in 1939–40.]

R.E. 249. **Seminar in Home Economics Education.** First and second terms. Credit two to four hours either term. Total credit for the year not to exceed four hours. Hours to be arranged. Professor ————.

Designed to meet the needs of graduate students who have had experience as home economics educators in schools, colleges, extension service, business, etc. Arrangements will be made for students to work on their individual problems. Courses in philosophy and principles of education, psychology, curriculum, and measurement are recommended as prerequisite or parallel.

R.E. 250. **Seminar in Agricultural Education.** Second term. Credit two hours. Open only to students whose progress in graduate study is satisfactory. Assistant Professor SMITH. T 4–5:30.

The selection, adaptation, and evaluation of materials of teaching.

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 ————. T Th S 9.

The nature of intelligence. History of the development of individual and group tests of intelligence; principles underlying their construction and application; the use of tests of intelligence in school problems with atypical children 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 credit. Prerequisite, a course in educational psychology. Assistant Professor BAYNE. M W F 8.

The use of aptitude and achievement tests and other measuring instruments in the classification and guidance of pupils, improvement of instruction and other activities of the teacher and school officer. Those class members who wish may make a study of their own aptitudes and achievements.

R.E. 253. **Statistics for Students of Education.** First term. Credit two hours. Primarily for graduate students in education. Open to a limited number of other students upon approval of the instructor. Assistant Professor BAYNE. T Th 10.

A study of common statistical procedure in relation to critical reading of technical studies, research, and writing reports of studies. As far as possible the work is related to the problems of the individual student.

ADMINISTRATION AND SUPERVISION

Ed. 10. **High School Administration.** Second term. Credit two hours. Professor JORDAN. W F 3.

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 high schools.

Ed. 11. **Extra-classroom Activities.** First term. Credit two hours. Professor JORDAN. M 4–6.

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.

Psychological, biological, and pedagogical bases for the Junior High School; fundamental principles, organization and administration; curricular content in detail; methods of instruction.

R.E. 246. **Problems in Industrial and Technical Education.** First and second terms. Credit four hours each term. Professor EMERSON. T Th 2–4.

Special problems in the administrative, supervisory, and curricular phases of industrial and technical education.

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 an additional hour to be arranged.

A course for students of experience dealing with the problems of organizing and administering education in the elementary and secondary schools of country and village districts.

R.E. 262a. **School Finance.** Second term. Credit two hours. Professor BUTTERWORTH. S 10–11:30.

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 is 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. Not given in 1939–40.]

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.

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. Not given in 1939–40.]

[R.E. 265. **Seminar for Principals.** Second term. Credit two hours. Required of all graduate students who are candidates for a principal's certificate. Professor FERRISS. Not given in 1939–40.]

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.

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 Vocational Agriculture in the Public Schools.** First term. Credit three hours. Should follow or accompany course 261. Professor STEWART. M W F 10.

Designed primarily for persons preparing to organize, administer and supervise agricultural education. Participation in teacher observation; special problems; and directed supervision make up a part of the program of work.

R.E. 269. **The Supervision of Home Economics Education.** Second term. Credit two hours. Students will need to consult instructor before registering. Professor ————. Time to be arranged.

For persons who are now engaged in the functions of supervision and in the education of teachers and leaders in service and for those who wish to prepare for such work.

R.E. 276. **Principles of Curriculum Building.** Second term. Credit three or four hours. Primarily for graduate students. Professor FERRISS. T Th 2–3:30 and an additional hour to be arranged for those wishing to carry further study of curriculum problems.

A consideration of major problems, principles and techniques in determining educational objectives and curriculum content and organization in elementary and secondary schools in the light of modern theory and practice.

R.E. 277. **Courses of Study in Vocational Agriculture.** Second term. Credit two hours. Assistant Professor HOSKINS. Th 4:15–5:45. Students should have had either 276 or 281.

An evaluation of curriculum studies in agricultural education as a basis for the reconstruction of vocational courses in agriculture for secondary schools; relationships to the long-time supervised practice programs.

R.E. 278. **Seminar in Rural Secondary Education.** Second term. Credit two hours. Professor FERRISS. M 4–6.

Designed for those desiring to study problems of secondary education in its adaptation to rural and village communities.

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 1939–40.]

Ed. 13. *History of American Education.* First term. Credit three hours.

Ed. 16. **Readings in the History of Education.** Second term. Credit two hours. Consent of the instructor is required. Assistant Professor HULSE. Hours to be arranged.

An advanced course, emphasizing the historic changes in aims and methods.

EDUCATIONAL THEORY

Ed. 2. *Principles of Secondary Education.* Either term. Credit three hours.

[Ed. 5. **Theory of Education.** Second term. Credit two hours. Prerequisite, Education 1 or the equivalent. Professor OGDEN. Not given in 1939–40.]

R.E. 181. *Principles of Education.* Either term. Credit three hours.

R.E. 194. *Principles of Vocational Education.* First term. Credit three hours.

R.E. 281. **Rural Secondary Education.** First term. Credit three hours. Primarily for graduate students. Professor FERRISS. M W F 9.

Consideration of some of the more basic problems in the functions, nature, organization, curriculum, and extension of secondary education in its adaptations to rural and village 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.

An examination of major concepts in education, and of material, spiritual, and social criteria of value in their bearings upon the aims and processes of education.

295. **Comparative Education.** First term. Credit two hours. Professors BUTTERWORTH, FERRISS, and MOORE. S 11–12:30.

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 and Miss GORDON. Not given in 1939–40.]

R.E. 209. **The Nature Movement and Its Makers.** First term. Credit two hours. Professor PALMER and Miss GORDON. M W 10.

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

S. C. HOLLISTER, *Chairman.*

W. R. 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.

THE EXECUTIVE COMMITTEE of this Division has general supervision of the graduate work falling within its jurisdiction, and its chairman and secretary are the same as for the Division.

Each of the main branches (Chem.E., 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 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 four subdivisions is as follows:

COMMITTEES ON GRADUATE WORK IN THE ENGINEERING DIVISION

CHEMICAL ENGINEERING—F. H. RHODES, *Chairman,* 74 Baker Laboratory; C. C. WINDING, *Secretary,* Baker Laboratory; C. W. MASON, Baker Laboratory.

CIVIL ENGINEERING—W. L. MALCOLM, *Chairman,* Lincoln Hall; R. Y. THATCHER, *Secretary,* 33-B Lincoln Hall; P. H. UNDERWOOD, 17 Lincoln Hall.

ELECTRICAL ENGINEERING—W. A. LEWIS, *Chairman,* Franklin Hall; W. C. BALLARD, jr., *Secretary,* Franklin Hall; R. F. CHAMBERLAIN, Franklin Hall.

MECHANICAL ENGINEERING—W. N. BARNARD, *Chairman,* 18 West Sibley; W. R. CORNELL, *Secretary,* 304 West Sibley; W. M. SAWDON, Mechanical Laboratory.

DIVISION REPRESENTATIVE on the General Committee of the Graduate School, and Chairman of Group E.—GEORGE B. UPTON.

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 Chemical Engineering (M.Chem.E.), Master of Civil Engineering (M.C.E.), Master of Electrical Engineer-

ing (M.E.E.), Master of Mechanical Engineering (M.M.E.), Master of Science in Engineering (M.S. in Engineering), Master of Science (M.S.), and Doctor of Philosophy (Ph.D.) are granted in the field of engineering. For the professional degrees, Chem.E., C.E., M.E., and E.E., see the Announcement of the College of Engineering.

The Degrees of M.Chem.E., 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 one of the engineering degrees (M.Chem.E., M.C.E., M.E.E., M.M.E., and M.S. in Engineering) are established and administered by the Engineering Division of the Graduate School.

For purposes of administration, the Engineering Division of the Graduate School has created four *Committees on Graduate Work*, one for each of the subdivisions (Chem.E., C.E., E.E., and M.E.). See page 151.

The Degrees of M.S. and Ph.D.

The rules governing admission to candidacy for, and those for graduation with, the degrees of Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) are established and administered by the Faculty of the Graduate School.[2] For further information concerning these degrees, see pp. 14 and 19.

Fellowships and Scholarships

See pages 33 to 39 of this Announcement.

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 12, but in addition, (a) a statement showing, if possible, his relative standing in his class, (b) a catalogue of the institution from which he graduated, with each subject that he has completed clearly marked therein, and (c) 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

[1] See page 11.

[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.

may be advised concerning the facilities and personnel available in those fields. See paragraphs 13 and 19 below.

(4) A prospective graduate student is urged to write to the office concerned (Chemical, Civil, Electrical, or Mechanical Engineering) for advice or information.

(5) Candidacy for M.Chem.E., 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 if any, and his chosen fields of advanced study will be considered in making adjustments if the candidate's undergraduate work has not been the exact equivalent of that required for the corresponding undergraduate degree at Cornell.

Candidacy for the degree M.S. in Engineering presupposes graduation from a school or college of recognized standing, with work, either prior to or subsequent to the bachelor's degree, which is equivalent to a recognized curriculum in engineering and which is adequate preparation for the field chosen for graduate work.

(6) A shortage, which does not exceed six university credit hours, may be made up as extra work. If an applicant's total shortage is more than six hours he may be required, and if more than eighteen hours he will be required, to enter an undergraduate school, and pay the undergraduate fees. See Par. 12 below.

(7) The Committees on Graduate Work will recommend for admission to the Graduate School only those applicants who show promise of outstanding ability to pursue graduate study and research, judged by previous record and training.

No applicant will be admitted to the Graduate School for work in Engineering unless he be in at least the upper half of his class. Exception may be made when an applicant can present further evidence which would demonstrate his fitness to carry on graduate work.

(8) See page 12 for language requirements for admission to candidacy for M.Chem.E., M.C.E., M.E.E., M.M.E., and M.S. in Engineering.

When a student's Special Committee considers that a reading knowledge of French or German or both is essential for satisfactory progress in his particular fields of study, the student will be required to demonstrate such knowledge before proceeding with this study.

(9) An applicant who does not care to meet the requirements either for entrance to candidacy for or graduation with an advanced degree may arrange for a program of work as a "non-candidate," provided only that he has had previous training which is adequate for advanced study in the fields of engineering in which he desires to work.

(10) A student whose mother tongue is other than English may be required by the Committee on Graduate Work to furnish satisfactory evidence of his ability to speak, write, and read English to a degree sufficient for satisfactory progress in his graduate work. The Committee may lengthen the minimum time of residence and prescribe

some study of English when a student's deficiency in this respect is deemed to place an undue burden upon him and upon the faculty members with whom he is to come in contact.

Registration

A graduate student in engineering must, at the beginning of each term of residence, register first in the Graduate School and then at the office of the Engineering School of whose faculty his major professor is a member.

RULES GOVERNING GRADUATE STUDY LEADING TO MASTERS' DEGREES IN ENGINEERING

(11) A Master's Degree in engineering shall be awarded only after the candidate has spent at least one full academic year, or the equivalent, in residence and study at the University.

(12) In general, a graduate student should remove his shortages before he enters his chosen fields of graduate work. Since it is not always practicable to do this, the student may receive permission from the Committee on Graduate Work to make up his shortages while doing his graduate work.

Arrangements can sometimes be made for making up deficiencies in the Summer Session preceding admission to the Graduate School. Sometimes graduate work may also be done in the summer, either in the Summer Session or by special arrangement under "personal direction." To be allowed to work under "personal direction," a student is expected to have spent one year in graduate study, here or elsewhere.

In making up shortages, a student is under the general supervision of the Committee on Graduate Work.

(13) (a) A student shall select a major field of study to which he shall devote not less than one-half nor more than three-fourths of his time. He must also select one or more secondary fields of study to which he shall devote the remainder of his time.

(b) A student shall select one Professor[1] who shall supervise his work in his major field. For each secondary (or minor) field to which he intends to devote not less than one-fourth of his time, he shall select one Professor to supervise his work in that field. The Professor or Professors thus selected shall be known as his *Special Committee.* The Professor in charge of the major field shall be Chairman of the Special Committee. If the student selects a secondary field to which he intends to devote less than one-fourth of his time, he shall in that field be under the supervision of the Committee on Graduate Work.

(14) A student shall select his program of study and his Special Committee with the advice and approval of the Committee on Gradu-

[1]Members of the Faculty who are qualified to supervise the work of graduate students are Professors, Assistant Professors, and those Instructors who hold the doctor's degree. For the sake of brevity any such member is herein referred to as "Professor".

ate Work in that subdivision (Chem.E., C.E., E.E., or M.E.) in which his major subject falls. No change in the program of study or 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.

(15) When a candidate for an advanced degree in Engineering takes a course specified by the Committe on Graduate Work or approved by his Special Committee, he must register in that course and must conform to all the requirements of that course, including the examinations.

(16) If, in the opinion of the Special Committee, a candidate at any time during his residence shows insufficient preparation in any subject or subjects, he may be required to register in and take the work of specified undergraduate courses. His residence requirement will be increased accordingly.

(17) 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.

(18) When a student has satisfied all the requirements set by his Special Committee, including a satisfactory final examination, the Special Committee will so certify to the Committee on Graduate Work. The Committee on Graduate Work will then review the student's record and if the student has fulfilled all scholastic requirements imposed upon him, he will be duly recommended for his degree.

FIELDS OF GRADUATE INSTRUCTION IN ENGINEERING

(19) A candidate for the Master's degree (M.Chem.E., M.C.E., M.E.E., M.M.E., or M.S. in Engineering) must select his major field in Engineering. He will be allowed considerable latitude in the selection of his minor field or fields, and any field may be chosen which includes a sufficient amount of graduate work, and provided his entire program shows a unified purpose. For instance, a student might select some phase of structural engineering as his major field and economics as his minor field if he could show that his study of economics had a definite purpose consistent with a well-rounded training as an engineer. The major and minor fields available in the College of Engineering are listed on pages 156 and 157. Graduate courses in engineering are described in the following pages. For opportunities in other fields of graduate study, see elsewhere in this Announcement.

Approved Major and Minor Subjects[1] (key to symbols on p. 42)

In Chemical Engineering

Chemical Engineering 1, 2, 4

(Candidates for the degree of Master of Chemical Engineering will be expected to be thoroughly familiar with the general field of Chemical Engineering. Candidates for this degree will be required to select a minor in some other field of engineering or in a related science.)

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
- Water Purification 2, 3, 4

Soil Mechanics 1, 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

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

[1]Any of the basic sciences are also available as minors.

Fluid Mechanics 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, G. R. HANSELMAN, and H. J. LOBERG.

3A21. *Economic Organization.* Either term. Credit three hours.
3A23. *Business and Industrial Management.* Either term. Credit four hours.
3A31. *Accounting for Engineers.* Either term. Credit three hours.
3A35. *Industrial Organization.* Either term. Credit two hours.

3A32. **Accounting for Engineers.** Second term. Credit three hours. Prerequisite 3A31.

Continues the work of 3A31, covering the extension of proprietorship; bond and stock issues and valuation; negotiable instruments; income tax; the variable budget; good will; depreciation; reserves, sinking funds, actuarial science; flexible budget; controversial accounting subjects; consolidated statements; statement analysis.

3A34. **Corporation Finance.** Either term. Credit three hours. Prerequisites, 3A21 and 3A31. 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.** 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.

3A42. **Human Nature and Management.** First term. Credit two hours. Professor BANGS.

A study of human nature in business and industry involving the psychological approach. Case demonstrations of business and industrial situations are used to illustrate the more important problems.

3A44. **Industrial Marketing.** First term. Credit three hours. 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.

3A48. **Business and Industrial Problems.** Second term. Credit two hours. Prerequisites, courses 3A21, 3A23, 3A31, 3A32, 3A41, 3A43, and 3A44. Professor GARRETT.

A series of case studies of problems occurring during the launching and conduct of a small manufacturing enterprise. The attempt is made in this

way to tie together the work previously taken in economics, statistics, accounting, marketing, business law, and human relations.

3A49. *Industrial Relations.*

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.

3A52. *Industrial Salesmanship.*

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

Professors G. B. UPTON and C. W. TERRY.

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.* Second term. Two recitations a week.

3B46. *Airplane Design.* First term. Two recitations a week.

3B47, 3B48. *Airplane Computations.* 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.

AGRICULTURAL ENGINEERING

See under AGRICULTURE, p. 129.

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, or on the chassis dynamometer; 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, 3B43. *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.

3B42, 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.

CHEMICAL ENGINEERING

Professors F. H. RHODES, C. W. MASON, O. J. SWENSON, A. W. LAUBENGAYER, and C. C. WINDING.

To qualify for admission as a candidate for the degree of M.Chem.E., a student must hold the degree of B.Chem.E., or the equivalent thereof, and must have completed satisfactorily a course substantially equivalent to the course leading to the degree of B.Chem.E., at Cornell University.

The work for the thesis may be in the specific fields of:

Unit Operations.
Unit Processes.
Chemical Engineering Economics.
Chemical Plant Design.

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 Assistant Professor WINDING.

715. **Unit Processes of Chemical Engineering.** Second term. Credit three hours. Prerequisite or parallel course, Chemical Engineering 705. Assistant Professor WINDING. 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, Chemical Engineering 705. Assistant Professor WINDING. 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, Chemical Engineering 705. Professors RHODES and SWENSON and Assistant Professor 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, Chemical Engineering 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. Not given in 1939–40.]

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.

DESCRIPTIVE GEOMETRY AND DRAWING

(In Civil Engineering)

Professor H. T. JENKINS.

202. *Drawing.* Sophomore. First term. Credit one hour.
203. *Drawing.* Sophomore. Second term. Credit two hours.
204. *Descriptive Geometry.* Sophomore. First term. Credit three hours.

205. **Advanced Drawing.** Second term. Credit three hours. Assistant Professor JENKINS.

Perspective drawings, rendered in pencil, ink, and washes, of buildings, concrete bridges, dams, and other engineering works; building details of window frames, doors, stairs, and other simple units, to give the student some insight into detailing parts of plans, and further to familiarize him with

reading working drawings. Problems in concrete, structural, topographical, highway and sanitary drafting; engineering drawings, rendered in color, to enable the student to supplement ordinary working drawings with artistic representations so portrayed as to be readily intelligible to non-technical persons.

ELECTRICAL ENGINEERING

Professors W. A. LEWIS, 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: 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

410, 411, 412. *Elements of Electrical Engineering.*

420. *Circuit Analysis.*

421–422. **Electrical Practice.** Throughout the year. Three hours a term. Prerequisites, 411, 412, and 431. Professor LEWIS and instructors.

Practical aspects of the advanced electrical theory, as applied to various types of apparatus and to some manufacturing and operating problems.

481–2. **Engineering Mathematics.** Throughout the year. 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.

485–486. **Heaviside's Operational Analysis.** 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, integral equations, and Laplace and Fourier transforms. 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

431. *Electrical Laboratory.*

450. *Electronics.*

423–424. **Advanced Electrical Theory.** Throughout the year. Credit two hours a term. Prerequisites, 421, 423. Assistant Professor MALTI and instructors.

Laws of the magnetic circuit with application to machine design.

442. **Electrical Design.** Second term. Credit four hours. Prerequisites, 421 and 423. Assistant Professor M. G. NORTHROP.

Fundamental principles underlying the design of direct and alternating current machinery.

433–434. **Advanced Electrical Laboratory.** Throughout the year. Credit four hours a term. Prerequisites, 412, 431, and 450. Professor CHAMBERLAIN and Assistant Professor BURCKMYER. Two recitations and one laboratory period with a report each week.

Theory and Characteristics of Electrical Machinery. Prerequisites, general knowledge of the theory and testing of electrical machinery.

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, so arranged that it may be operated either as converter or 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, 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.

453. **Theory of Communication Networks.** First term. Credit three hours. Must be accompanied or preceded by 451. 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.

456. **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 and wave analyzer.

Complete equipment for the manufacture and exhaustion of experimental electron tubes, both of high vacuum and vapor types, is available for the construction of special apparatus.

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, 431, and 450. Assistant Professor M. G. NORTHROP.

Selection and arrangement of Power Plant Equipment.

463. **Electrical Power Transmission and Distribution.** First term. Credit three hours. Must be accompanied by 421–423 and 433. Assistant Professor M. G. NORTHROP.

444. **The Economics of Public Utilities.** Second term. Credit three hours. Professor CHAMBERLAIN.

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.

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, is complete in every respect and is used for tests and inspection.

APPLICATIONS OF ELECTRIC POWER

462. **Industrial Application and Control of Electricity.** Second term. Credit two hours. Prerequisites, 423 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. 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. 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).

Electrical Testing. Prerequisites, 421–2–3–4 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, V. R. GAGE, W. C. ANDRAE, J. O. JEFFREY, and J. R. MOYNIHAN.

Numerous laboratories and shops are available for carrying on the many activities in Experimental Mechanical Engineering, as follows:

The Materials Testing Laboratory, for determination of the physical properties of engineering materials under different kinds of stress and heat treatment; the Photo-Elastic Laboratory, for instruction and research in Photo-Elastic work; the Steam Laboratory, for instruction and research involving steam power; the Internal-Combustion Engine Laboratory, for work with this type of power equipment; the M. E. Hydraulic Laboratory, a pump operated laboratory for hydraulic problems; the Lubrication Laboratory for determination of the physical properties of lubricants; the Refrigeration Laboratory, for the study of refrigeration; the Cement Laboratory, for the testing of cement and concrete; the Fuel Testing Laboratory for determination of the composition and calorific value of all types of fuel; the Belt Testing Laboratory, for measurement of belt tension, power transmitted, and slip; the Introductory Engineering Laboratory, for demonstrating the principal operations in forging, welding, soldering, brazing, etc.; the Heat Transfer, Heating, Ventilating, Air Conditioning Laboratories; a series of Research Laboratories; the Forge Shop, Woodworking and Pattern Shop, Machine Shop, Foundry, and Boiler House.

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, and 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. Two hours a week. Prerequisites, 3D31, 3D32, 3D33, 3P31 and 3P32 and must be accompanied or preceded by 3P41 and 3P42. Professor BARNARD.

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.** Second term. Two hours a week. Prerequisites, 3P31 and 3P32, or 3P33 and 3P34. Professor MACKEY.

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.

3P49. **Refrigeration.** First term. Two hours a week. Prerequisite, 3P32, or 3P34. Professor ELLENWOOD.

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. Two hours a week. Prerequisite, 3P32, or 3P34. Professor BARNARD.

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. Two hours a week. Prerequisite, 3P32 or 3P34. Assistant Professor CLARK.

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. Two hours a week. Prerequisites, 3D31, 3D32, 3D33, and 3P32 or 3P34. Assistant Professor CLARK.

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. Two hours a week. Prerequisites, 3D31, 3D32, 3D33, and 3P32 or 3P34. Professor HOOK.

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.** First term. Two hours a week. Prerequisites, 3D31, 3D32, 3D33 and 3P32 or 3P34. Professor MACKEY.

Slide rules; construction of net work charts and alignment charts for the solution of equations; 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

Professors W. L. CONWELL and GILMORE D. CLARKE.

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.

In addition to the scheduled courses for the graduate student, there is much graduate work of an independent character which requires investigation by the student and frequent conferences with staff members. Occasional field trips are also made.

Note: For courses in design of highway structures such as large bridges, see Structural Engineering.

265. *Highway Engineering.* Either term. Credit three hours.

265-A. **Low Cost Roads.** Either term. Credit three hours. Prerequisite, course 265 or its equivalent. Professor CONWELL.

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.

Non-bituminous and bituminous materials are tested. Subgrade soils are sampled and their properties examined; subgrade stabilization admixtures are also tested and studied. Bituminous mixtures are designed and their properties examined.

266-A. **Advanced Highway Laboratory.** Either term. Credit three hours. Prerequisites, courses 265 and 266. Professor CONWELL. Two laboratory periods a week.

Non-bituminous and bituminous materials are tested and their characteristics studied. Soils are sampled and examined, and investigations made of the behavior of mixtures of soils with bituminous and non-bituminous materials. Special investigations and tests are made to determine the properties of various combinations of materials and the effects of modifications in design.

267. **Advanced Highway Engineering.** Second term. Credit three hours. Prerequisite, course 265 or its equivalent. Professor CONWELL. This course is conducted as a seminar. Meetings are held once each week at hours to be arranged.

The topics for assignment and discussion include the economics of highway engineering, highway finance, legislation, regulation, traffic, design, construction, and maintenance of highways, the latest research programs and reports, labor and plant organization for various kinds of highway contracts with especial emphasis on the economics of contracting, etc.

268. **Modern Highway Planning and Design.** Second term. Credit three hours. Prerequisite, course 265 or its equivalent. Professors CLARKE and CONWELL.

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). **Highway Engineering Design.** Either term. Credit three or more hours. Prerequisites, courses 265, 270, 271, and 280. Professor CONWELL. Conferences to be arranged.

The problems are those encountered in the selection, location, design, and construction of highways. They include the following: economic selection of routes, economic location, design of highways, highway intersections, culverts, highway bridges, retaining walls, and other highway structures. Bills of materials and estimates of cost are usually required, also plant layouts and methods of executing work.

297 (g). **Research in Highway Engineering.** Either term. Credit three or more hours. Prerequisites, courses 265 and 266. Professor CONWELL. Hours to be arranged.

Studies of traffic and traffic regulation and legislation may be made. The field of economics of highway engineering offers a wide variety of problems. Laboratory investigations of subgrade soils, subgrade stabilization, and the effects of modifications in design of bituminous and non-bituminous mixtures provide a wide range of topics for research.

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, or the entire minor work may consist of such courses accompanied by special work and reports as may be arranged with the faculty members of the special committee.

A candidate for the degree of Master of Civil Engineering (or of Science), or Doctor of Philosophy, 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.

HYDRAULICS

Professor E. W. SCHODER.

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, during the first term of residence.

240. *Hydraulics* (including laboratory work). Either term. Credit four hours.

241. **Advanced Hydraulics.** Second term. Credit three hours. Prerequisite, Hydraulics 240 or the equivalent. Professor SCHODER. Lectures, recitations, and problems. Three hours a week.

Topics selected from the following list are taken up, subject to changes to suit group requirements: stability of flotation; barometric levelling; flow over weirs and dams, free and submerged; backwater and non-uniform flow in open channels; the hydraulic jump; water hammer; surges in pipes and canals; viscous flow of fluids and flow of air in pipes; hydraulic similitude and flow in models; some introductory elements of hydrodynamics; impulse wheels and turbines; centrifugal pumps.

242. **Hydraulic Measurements.** First term. Credit three hours. Prerequisite, Hydraulics 240 (including the laboratory) or the equivalent. Professor SCHODER. Three periods a week in laboratory or computing room.

Experimental studies involving usually (as time permits): current meters and floats in canal or river; Pitot tubes in pipes; water meters; weirs; the

hydraulic jump; special features of orifices, nozzles, Venturi meters, pipe moder studies; such other occasional experimental measurements as opportunity offers in the laboratory or in the neighborhood of Ithaca; the determination of efficiency, capacity, and characteristics of hydraulic machinery by tests.

297 (c). **Hydraulic Research.** Professor SCHODER.
The subject and scope of the investigations in experimental or theoretical hydraulics should be selected by conference at the beginning of the term if not previously arranged. It is often desirable and is permissible for two students to work together on the same investigation. Written reports are required but the test need not be typewritten in thesis style. These reports are kept by the department. In most cases it is necessary to arrange a definite schedule for work in the laboratory to avoid conflicts.

HYDRAULIC ENGINEERING

Professor F. J. SEERY.

For the master's degree with major work in Hydraulic Engineering the thesis requirement of the Graduate School may 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. The requirement may not be satisfied by the so-called descriptive type of thesis with only rather vague design based on assumed data.

Ordinarily a candidate for the Ph.D. degree who elects most of his work in the general fields of hydraulic engineering and hydraulics is required to select his thesis in experimental or theoretical hydraulics. Only when the candidate has an adequate background of practical experience and mature judgment will a doctor's thesis in hydraulic engineering be permitted.

230. *Water Supply.* Either term. Credit three hours.

231. **Hydraulic Construction.** Second term. Credit three hours. Prerequisite, course 230 or the equivalent. Professor SEERY.
This is a computing and designing course dealing with problems of water storage and the design and construction of dams by means of lengthy problems to be solved by graphical and analytical methods and involving the economics of water storage at a given site; the design of a high masonry dam by Wegmann's Method and the tests for safety and stability of design, and the analysis of stresses and stability.

232. **Water Power.** Either term. Credit three hours. Prerequisites, courses 230 and 240, or the equivalent. Professor SEERY. Three lectures and recitations a week and the working of three lengthy problems during the term.
The subject matter of the course covers the technique of hydraulic turbines, the analysis of test data, study of the adaptation of turbine types to working conditions, unsteady flow and surging in long conduits, governing, and the analysis of the power available at a low head millsite.

233. **Hydraulic Engineering.** First term. Credit three hours. Prerequisite, course 230 or the equivalent. Professor SEERY. Lectures, recitations, and abstracting of references.
Theory of percolating water, ground water development, recent developments in soil technology and the design and construction of earthen dams and levees; theory of design of gravity and arch masonry dams and distribution of stresses in such structures; spillway design; preparation of dam sites; construction methods and plants.

234. **Conservancy and Reclamation Problems.** Second term. Credit three hours. Prerequisites, courses 230 and 240, or the equivalent. Professor SEERY. Lectures, recitations, and abstracting of references.

Flood flow estimates; planning for and designing of food protection structures, irrigation and drainage works. The Maimi Conservancy work will be the chief source of material for the course.

236. **Water Power and Pumping Plants.** Second term. Credit three hours. Prerequisite, course 232. May be taken concurrently with course 232. Professor SEERY.

This is a computing and designing course devoted to the problems of designing and detailing power and pumping plants.

291c. **Hydraulic Engineering Design.** Second term. Credit three hours. Prerequisite, course 240. For best results Hydraulic Design should be preceded by course 230, but the two may be taken concurrently. Professor SEERY.

The purpose of the course is to go more into detail in selected phases of hydraulic engineering and is not to duplicate in large part work regularly given in the scheduled courses in hydraulic and structural 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 subjects. 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 lectures a week.

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.

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 C. I. MILLARD.

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.

Formal graduate courses are offered and 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, 3I43, 3I44, and 3A31. Students desiring to take a minor in this field may enroll for the following courses for which they have had the necessary prerequisites.

3I43, 3I44. *Industrial Engineering.* Throughout the year. One lecture and two computing periods a week.

3I48. *Industrial Engineering.* Second term. Two recitations or discussion periods a week.

3I51. **Advanced Industrial Engineering.** Either or both terms. Credit one hour for forty hours of actual work. Open to a limited number of seniors and graduates. Assistant Professor MILLARD and Mr. MANNING.

Special problems and investigations which are carried on under the direction of members of the department staff.

3I52. **Industrial Auditing.** First term. One lecture and one computing period a week.

3I53. **Advanced Industrial Relations.** Second term. Two discussion periods a week.

3I54. **Micro-motion Laboratory.** Either term. Two laboratory periods 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.
Economic control of quality in production.

MACHINE DESIGN AND DRAWING

Professors C. D. ALBERT, F. S. ROGERS, C. E. TOWNSEND, E. F. GARNER, S. F. CLEARY, and F. H. BLACK.

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.* Second 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.* Second term. Credit two hours.
3D36. *Machine Design, Drawing.* Second term. Credit one hour.
3D51. *Mechanical Technology.* Second term. Credit two hours.

3D52. **Advanced Kinematics and Kinetics.** Second term. Prerequisites, 3D21, 3D23, and 3D24 or 3D25 and 3D26. Professor ROGERS or ————. Two lecture and discussion periods and one laboratory period a week.

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 3M24. Assistant Professor BLACK. 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 BLACK and ————. 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, CARL CRANDALL, J. E. PERRY, 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. Credit three hours.

290. *Engineering Law.* Either term. Credit three hours.

293. *Engineering Management.* Either term. Credit three hours.

290-A. **Advanced Engineering Law.** Second term. Credit three hours. Prerequisite, course 290. Professor BARNES and Assistant Professors CRANDALL, PERRY, and THATCHER. Lectures and recitations, three hours a week.

Some of the topics treated in course 290 are here enlarged upon and extended, particularly laws relating to the various phases of construction contracts, employer-employee relationship, workman's compensation, mechanics liens, patents, copyrights, trademarks, and insurance. Among other subjects covered are suretyship, conditional sales, bailments, trusteeship, and taxation. Actual cases are used for illustrating the above and reference is also made to recent court decisions regarding engineering matters.

295. **Valuation Engineering.** Second term. Credit three hours. Prerequisites, courses 264 and 290. May be taken concurrently with course 290. Assistant Professor CRANDALL. Lectures, recitations, and reports.

Theory and practice of valuation or appraisal for purposes of utility rate making, purchase or sale, eminent domain or condemnation cases, mergers or joint ownership, taxation and assessment, issuance of securities, bank loans, insurance, uniform system of accounting and improved management. Topics considered include scientific systems of real estate assessment, federal railroad valuation, rate disputes, court rulings, computation of actual rates for gas, telephone, electrical supply and street railways, valuation of land, mines,

water power, factories, railroads, toll bridges, buildings, and all kinds of property both tangible and intangible. Detailed examples of forms and methods with outline of typical valuation reports.

297 (h). **Research in Management Engineering.** Either term. Credit three hours or more. Professor BARNES.

Special problems relating to the economic, legal, and financial aspects of engineering construction projects, management of public works and appraisals.

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.

297 (b). **Engineering Research in Materials.** Either or both terms. Credit one hour for forty hours of actual work. Prerequisites, courses 225 and 226 or their equivalents. Professor SCOFIELD.

Special investigations of an advanced nature of the properties of structural units and the materials of construction. The aim of the course is to secure results by proper investigational methods which are of the caliber and scope deemed essential for publication.

(In Mechanical Engineering)

Professors A. C. DAVIS, J. R. MOYNIHAN, J. O. JEFFREY, 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 200,000-lb. machine, an Olsen 100,000-lb. three-screw machine, an Amsler 100,000-lb. hydraulic machine, a Baldwin-Southwark 50,000-lb. universal machine, together with several other machines varying in capacity from 10,000 to 100,000 pounds. There are an Olsen torsion machine of 200,000 inch-pounds capacity, two Upton-Lewis fatigue testing machines, a R. R. Moore high-speed fatigue tester, and an Amsler-Charpy-Izod impact testing machine. The other equipment includes hardness testing machines, metallographic microscopes, polishing equipment, 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. Assistant Professor J. O. JEFFREY.

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 and E. V. HOWELL, and *Doctors* CUYKENDALL and HAWKINS.

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.
220-A and 220-B. *Mechanics Laboratory and Computations.* First term. Credit two hours.
221. *Mechanics of Materials.* Second term. Credit four hours.
221-A. *Mechanics Laboratory.* Second term. Credit one hour.

222. **Advanced Mechanics.** Either term. Credit three hours. Prerequisites, courses 220 and 221. Professor GEORGE. Three recitations a week.

Following a brief general review of fundamental topics in Mechanics of Materials, this course covers: induced stresses, torsion; unsymmetrical bending; torsion of prisms of non-circular section; hoops; flat plates; localized stresses; theory of least work; internal work and its derivatives.

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. Three recitations a week.

An elementary course in ordinary differential equations with applications to engineering problems. Trigonometry, calculus and algebra are dealt with in so far as this is necessary for a clear understanding of the treatment of differential equations. The purpose of this course is to lay the foundation for the more advanced courses in engineering mathematics.

224-B. **Advanced Engineering Mathematics.** Second term. Credit three hours. Prerequisite, course 224-A.

This course is an introduction to the mathematics used in the solution of advanced engineering problems. Special emphasis is given to partial differentiation. Fourier Series, line integrals, formation of partial differential equations, integration in form of infinite series of several of the partial differential equations arising in engineering problems, vector notation, conformal representation, determinants, theory of the complex variable, development of function into series, etc., are reviewed in so far as a knowledge of these are essential to the course.

224-C. **Advanced Differential Equations.** First term. Credit three hours. Prerequisites, courses 224-A and 224-B or their equivalents. Dr. CUYKENDALL.

A systematic study of differential equations. Partial differential equations and their solutions are emphasized.

224-D. **Special Mathematical Topics.** Second term. Credit three hours. Prerequisites, courses 224-A and 224-B. Dr. CUYKENDALL.

The content of this course depends largely upon the needs and the interests of those enrolled. Generalized coordinates, vector analysis, and the calculus of variation are three subjects to be considered.

228. **Theory of Elasticity.** Second term. Credit three hours. Prerequisites, courses 224-A and 224-B. Three hours a week.

Theories of elastic breakdown. Fundamental relations of stress and strain, Airy stress functions. Problems in two-dimensional and three-dimensional stress and strain. Analogies and their applications to solutions of engineering problems in elasticity.

228-A. **Engineering Physics of Metals.** Second term. Credit three hours. Dr. CUYKENDALL.

An introduction into the physical basis of matter in relation to its elastic and plastic behavior. Topics for discussion include: Atomic basis of generalized Hooke's Law, atomic cohesive forces and potential troughs, the yield value, primary bonds, dipole and Van der Waal's forces, influences of temperature on elastic properties, thermoelastic basis of internal friction, experimental and theoretical strength of crystals, distortion of the lattice, Smekal's criticism of Born's lattice theory of metals, evidence of submicroscopic structure, elementary concepts of the cooperative phenomena in metals.

229-A. **Elastic Foundations and Thin Structural Shells.** First term. Dr. HAWKINS. Credit three hours.

Study of the properties of elastic foundations and the application of the elastic foundation theory to the analysis of large diameter, low head tanks, hemispherical domes, hemispherical headers on large pipes, and thin shell pipes under flexure.

(In Mechanical Engineering)

Professors F. G. SWITZER, W. R. CORNELL, G. N. GOODIER, H. C. PERKINS, and C. W. ARMSTRONG.

In addition to the regular laboratory equipment, there are also available facilities for the study of balancing problems, and for photo-elastic investi-

gations. 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 the last six weeks of second term. Repeated in first term, two hours a week.

3M23. *Hydraulics.* Five hours a week for six weeks of second term.

3M24. *Applied Mathematics.* First and second term. Three hours a week.

3M33. *Fluid Mechanics.* First term. Three recitations and one lecture a week.

3M55. **Photoelasticity.** First term. Prerequisite, 3M22b. Professor SWITZER. Two lectures or laboratory periods 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.

3M56, 3M57. **Applied Elasticity.** Throughout the year. Credit three hours each term. Prerequisites, courses 3M32 or 224-A or Mathematics 41 for first term and 224-B for second term. Either term may be taken separately. Elective for graduates, but open to qualified undergraduates. Professor GOODIER. Three lectures a week.

The first term will be devoted to topics in stress-analysis, elastic vibrations, and elastic stability, which can be treated by elementary mathematical methods, such as those employed in simple tension, bending, and torsion. These topics will include effects of sudden loading; the propagation of waves of stress; the approximate determination of vibration frequencies and buckling loads; bending of beams on elastic foundations; bending of flat strips and circular plates; stress in thin shells due to internal pressure and due to heating; the concentration of stress by holes and notches; the relation of stress-analysis to fatigue testing.

In the second term more critical discussion, using more advanced methods, will be given to further problems according to the requirements of the group.

3M58. **Mechanics of Vibration.** First term. Credit three hours. Prerequisite, course 3M24 or its equivalent. Professor GOODIER.

The characteristic phenomena of mechanical vibrations encountered in engineering, and their quantitative investigation, illustrated by a group of typical vibrating systems. Representation of simple harmonic motion. Combination of several simultaneous motions. Simple cases of free and forced vibrations, with damping. Resonance. Principles of transmission and isolation of vibration. Systems of variable mass and variable elasticity. Vibrations of taut wires, bars, beams, rings, membranes and plates. Relation of vibration and noise. Detection and measuring instruments. Examples of diagnosis and preventive measures.

TOPICS SUGGESTED FOR ADVANCED WORK

Vibration problems.
Theory of Elasticity.
Photo-elastic stress analysis.

RAILROAD ENGINEERING

Professors F. A. BARNES, W. L. CONWELL, CARL CRANDALL, J. E. PERRY, 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.* Credit one hour. One week during summer vacation following sophomore year.

260-B. *Route Surveying and Drawing.* Second term. Credit three hours.

261. **Railroad Maintenance of Way.** First term. Credit three hours. Prerequisite, course 260-B. Professor BARNES and Assistant Professor PERRY. Lectures and recitations three hours a week.

The subjects treated are track materials (with special reference to the section, method of manufacture and composition of steel rails, to the economics of tie preservation and the use of metal ties, and to the effect of quality of ballast upon maintenance); machine and other methods of grading for second track; drainage; track laying by both machine and hand methods; ballasting and bringing new track to line and grade; turnouts and switches; derailing switches; side tracks and yard tracks; sorting and terminal yards; track maintenance; track tools, work trains; action of car wheels on curves; widening of gage; double tracking; separation of grades; and improvement in grades and alinement.

262. **Railroad Operation and Management.** Second term. Credit three hours. Prerequisite, course 260-B. Professor BARNES and Assistant Professor PERRY. Lectures and recitations three hours a week.

Under organization, the following subjects are treated: general principles underlying organization and the effect of each on efficiency; principal departments of railway service with a brief outline of the work of each; departmental and divisional systems of organization, with examples on various roads and discussion of adaptability of each. The duties of officers and the work of the different departments are taken up in considerable detail. The most important laws affecting railroads are given in discussing the work of the legal department. Freight traffic, freight houses, classification yards, car service rules, accounting, etc., are among the topics considered under operation. Signaling and interlocking and train rules are also considered.

263. **Route Location.** Second term. Credit three hours. Prerequisites, courses 260-A and 260-B. Professor BARNES. Lectures and recitations with problems involving investigations of projects, revisions and comparisons of alternate routes. Three hours a week.

A detailed study is made of the economic principles and other factors governing the location of new routes for both railroads and highways, and the revision of existing lines to effect the most efficient and satisfactory transportation. Some of the topics treated are estimation of traffic and revenue; costs and rates; steam, electric and other locomotive and motor operation; gradients, distance, curvature and rise and fall; line and grade revisions; grade crossing eliminations; location surveys and estimates.

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.

291 (e). **Railroad Engineering Design.** Either term. Credit three or more hours. Professor BARNES and Assistant Professor PERRY.

The problems are those encountered in the location and construction of railroads, and include the following subjects: economic location of railroads; culverts; bridges; retaining walls; tunnel and subway design; small depot buildings; freight houses; water supply and coaling plants; icing stations; turntables and engine-houses; gravel washing plants; track layouts with details of signals and interlocking; yard and terminal design, etc. Bills of material and estimates of cost are usually required. The field is so broad that the interest of the student is given consideration in assigning problems.

297 (e). **Railroad Engineering Research.** Either term. Credit three or more hours. Professor BARNES.

Special problems in the economics of location, construction, maintenance, and operation of railroads, comparison of transportation agencies, traffic studies, and economics of various systems of transport.

Note: For the larger railway structures see STRUCTURAL ENGINEERING.

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.

SANITARY ENGINEERING

Professors C. L. WALKER and WILLIAM E. STANLEY.

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.* First term. Credit three hours.

251. *Sanitary Biology.* First term. Credit two hours.

251-A. *Analysis of Sewage and Water.* First term. Credit two hours.

252. *Sewerage and Sewage Disposal.* Either term. Credit three hours.

253-A. *Treatment of Water.* Second term. Credit two hours.

253. **Control and Treatment of Water Supplies.** Second term. Credit three hours. Professor STANLEY. Two recitations and one computation period a week.

This course comprises a comprehensive study of the general principles and methods involved in furnishing safe water supplies of satisfactory quality. The topics studied include the character of surface and underground water supplies; inspection of sources; relation of communicable diseases to water supplies; standards of quality and safety of supplies; water treatment methods including coagulation, sedimentation, aeration, slow and rapid sand filtration, tastes and odor control, softening and iron removal, corrosion control, sterilization and miscellaneous treatment methods. Also study of the design and operation of water treatment plants is included.

254. **Sewerage Works.** First term. Credit three hours. Prerequisite, course 252. Professor STANLEY. Two recitations and one computation period a week.

A comprehensive study of principles and methods involved in the design, construction and operation of sewers and sewage treatment works including reference to existing typical plants. In general, the study includes the determination of capacity and design of sewers; the disposal of sewage by dilu-

tion and broad irrigation; stream pollution and self purification; sewage treatment methods including preparatory devices, sedimentation, chemical precipitation, intermittent sand and trickling filters, activated sludge, sludge digestion, sludge dewatering and incineration and miscellaneous treatment methods.

255. **Treatment of Wastes.** First term. Credit three hours. Prerequisite, course 252. Professor WALKER. Three lectures or recitations a week.

The treatment of municipal and industrial wastes such as garbage, and the wastes from tanneries, packing-houses, mines, canning factories, textile mills, paper and pulp mills, creameries, cheese factories, condensaries, etc. Flow or process charts are used to show the general character of the waste, and methods of treatment applicable are considered. Special attention is given to experimental studies of waste treatment. Numerous references, bulletins, reports.

255-A. **Trade Waste Analysis.** Second term. Credit two hours. Prerequisites, courses 250, 251-A, 255. Professor WALKER.

Advanced work in the analysis of trade wastes.

256. **Municipal Administrative Engineering.** First term. Credit three hours. Professor STANLEY. Lectures, reports, and readings. Three periods a week.

A study of civic government and the relationships between the civil engineer in public service and various city, county, state, federal and special governmental bodies, with which he may become associated; the limitations on the activities of the public works agency usually imposed by law or regulations and the effect of these on the activities of the engineer; methods of financing governmental operations including bond issues, sinking funds, special assessments, service and rental charges.

256-A. **Public Health Engineering.** Second term. Credit three hours. Professor STANLEY. Lectures, reports, and readings. Three periods a week.

A study of the relation between engineering and public health. Organization and operation of Boards of Health, vital statistics, public health laws and the sanitary code.

256-B. **Rural Sanitation.** Second term. Credit two hours. Professor WALKER. Lectures, reports, and recitations. Two periods a week.

A course dealing with the sanitation of rural areas, trailer and other camps, summer hotels, and swimming pools. Attention is given to water supply, sewage and garbage disposal, and to the problem of milk sanitation.

257. **Conference on Present Methods of Water Treatment.** Either term. Credit three hours. Professor STANLEY. Readings, investigations, inspections, and reports. Hours to be arranged.

A critical study of specific problems in water treatment, control of watersheds; the construction and operation of existing water treatment plants.

258. **Conference on Present Methods of Sewage Disposal.** Either term. Credit three hours. Professor STANLEY. Readings, investigations, inspections, and reports. Hours to be arranged.

A critical study of specific problems in sewage disposal; sewage treatment methods; the construction and operation of existing sewage treatment plants.

259. **A Laboratory Course for Graduates.** Professors WALKER and STANLEY. Hours to be arranged.

A course devoted to some problems of water or sewage or trade waste, such as the operation of a water filtration plant, a sewage disposal plant, the detection, measurement and purification of trade wastes, the value of disinfection, etc.

291 (d). **Sanitary Engineering Design.** Either term. Credit three hours. This course should be preceded by courses 252 and 253-A or equivalent courses. Professors WALKER and STANLEY.

The purpose of the course is to teach methods of determining the capacity basis of design, computations, sketches and general plans and profiles involved in the design of sewerage works.

Problems such as the design of a separate or combined sewerage system, an intercepting sewer, a municipal or an institutional sewage treatment plant, a plant for the treatment or disposal of an industrial waste, or a plant for the treatment of an industrial, institutional, or municipal water supply, may be elected.

297 (d). **Sanitary Engineering.** Either term. Prerequisites for work in this field will depend upon the particular problem to be pursued, but in general will include work in water analysis, bacteriology, and courses in Hydraulics and Sanitary Engineering dealing with the field in which the work is to be undertaken. Professors STANLEY and WALKER. Hours, credit for work, prerequisites and other questions relating to contemplated research in this field will be arranged by conference.

STRUCTURAL ENGINEERING (INCLUDING SOIL MECHANICS)

Professors L. C. URQUHART, C. E. O'ROURKE, E. N. BURROWS, H. T. JENKINS, and C. M. PENDLETON.

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.

The Soil Mechanics Laboratory is fully equipped for work by graduate students. The freezing room and humid room are available for research work in investigating the physical properties, bearing capacity, permeability and stability of soil, and the flow of water through earth dams. There is also a shop for use in the building of new equipment.

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. *Stress Analysis and Structural Design.* Either term. Credit four hours.

271. *Structural Design.* Either term. Credit three hours.

280. *Concrete Construction.* Either term. Credit three hours.

281. *Foundations.* Either term. Credit three hours.

287. *Soil Mechanics.* Either term. Credit three hours.

272. **Advanced Structural Analysis.** Either term. Credit three hours. Prerequisite, course 270. Professors URQUHART and O'ROURKE. Three recitations a week.

Stress analysis of continuous beams, framed bents and rigid frames. Horizontal as well as vertical loading considered. Redundant structures including the braced two-hinged arch. Displacement diagrams for trusses and arches and analytical computation of deflections of such structures.

273. **Steel Buildings.** First term. Credit three hours. Prerequisites, courses 220, 221, and 271, or their equivalents. Professor BURROWS. Reports and drawings. Three two-hour periods a week.

This course comprises the design of the steel framework for buildings of the prevailing type used in power house or shop construction. Dead, snow, and wind stress diagrams are drawn for the roof trusses. Provision is made for an electric crane moving the full length of the building and the stresses in the framework due to the movement of the crane are determined. The effect of the wind and the eccentric load due to the crane girder are considered in the design of the columns.

274. **Bridge Design.** Second term. Credit three hours. Prerequisite, course 271 or the equivalent. Assistant Professor BURROWS. Computations and drawing, three two-hour periods a week.

Computations and drawings for the complete design of a railroad bridge of six or seven panels or a heavy highway bridge. The computations to determine the stresses and sections of all members, pins, pinplates, splices, deflection, camber, and other details as well as of connecting rivets are to be written up in the form of systematically arranged reports. The drawings consist of general detail plans showing the location of all rivets as well as the composition and relation of all members and connections. The final report is to give a full list of shapes and plates, and a classified analysis of weight for the span.

275. **Investigation of Existing Bridges.** Second term. Credit three hours. Prerequisite, course 271 or the equivalent. Assistant Professor BURROWS.

Inspection of existing structures for the determination of sizes and conditions of plates and shapes. After full data have been obtained in the field, computations will be made to determine either the unit stresses under a specified load, or the safe load or rating according to standard specifications.

282. **Reinforced Concrete Building Design.** Either term. Credit three hours. Prerequisite, course 280. Professors URQUHART and O'ROURKE. Seven and one-half hours a week.

Design of a reinforced concrete flat-slab building and investigation of various other types of floor systems for commercial buildings. Complete detail design for one building, including stairway, elevator shafts, penthouses, etc. Working drawings and steel schedules.

283. **Fixed Arches.** First term. Credit three hours. Prerequisites, courses 270, 271, and 280. Professors URQUHART and O'ROURKE. Lectures, recitations, and computations. Six hours a week.

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. **Highway Bridges.** Second term. Credit three hours. Prerequisite, course 280 or the equivalent. Professor O'ROURKE.

Design of short span bridges and their abutments. Comparison of the economy of steel and reinforced concrete superstructures for bridges of this type. Reports and drawings.

285. **Reinforced Concrete Design.** Either term. Credit three hours. Prerequisite, course 280. Professors URQUHART and O'ROURKE. Two two-hour periods a week.

Design of footings: single and multiple columns of reinforced concrete, I-beam grillages. Design of bins and tanks, subsurface and supported on towers. Reports and sketches.

288. **Applied Soil Mechanics.** Second term. Credit three hours. Prerequisite, course 287 or its equivalent. Professor JENKINS.

Advanced application of soil mechanics, based on the principles and physical studies of course 287. The plastic flow theory; the consolidation theory; stability of earth slopes; flow of water through earth structures; theories of earth pressure on retaining walls, caissons, and tunnels. Review of modern soil mechanics research.

291 (f). **Structural Engineering Design.** Either term. Prerequisite, courses 270, 271, and 280. Professor URQUHART and Assistant Professor BURROWS.

The student may select a problem such as the following: (a) an arch bridge of steel, (b) a cantilever bridge, (c) a rigid frame bridge, (d) a special problem in steel or concrete building design, (e) the design of any other structure of particular interest to the student provided he has had the proper

preparation for such design. The work is submitted in the form of reports. Drawings of typical details must accompany reports.

297 (f). **Research in Structural Engineering.** Second term. Professor URQUHART.

Students wishing to pursue one particular branch of bridge engineering further than can be done in any of the regular courses may elect work in this field. The prerequisite courses depend upon the nature of the work desired. The work may be in the nature of an investigation of existing types of construction or theoretical work with a view to simplifying present methods of design or proposing new methods.

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 104.

182. *Elements of Field Astronomy.* Either term. Credit two hours. (Given in Department of Astronomy.)

211. *Advanced Surveying.* First term. Credit three hours.

213. *Summer Survey: Topographic, Hydrographic,* and *Geodetic Survey: Camp.* Five weeks during end of summer following sophomore year. Credit four hours.

214. *Mapping.* First term. Credit two hours.

215. *Problems in Adjustment of Observations.* First term. Credit one hour.

216. **Least Squares: Adjustment of Observations.** First term. Credit two hours. Prerequisites, Calculus and Physics. Professor UNDERWOOD. Two recitations and lectures a week as may be arranged.

The course is designed for students who have experimental investigations in view. 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. Credit two hours. Prerequisite, course 213. Professor UNDERWOOD. Lectures, recitations, and assigned readings. Two hours a week.

Economics of surveying methods. Surveys for special purposes, such as extensive construction work; storage and distribution of water for irrigation; earth work on a large scale; lines of communication, topographic reconnaissance, etc.; photographic surveying.

219. **Photographic and Aerial Surveying.** Second term. Credit three hours. Prerequisite, course 211. Professor UNDERWOOD. Recitations, lectures and collateral reading. Three hours a week.

The principles of photographic surveying; surveys with camera stations on the ground, including stereoscopic methods; aerial surveys and the making of maps from such surveys; ground control.

297 (i). **Research in Geodetic Engineering.** Either term. Credit three or more hours. Prerequisites will depend upon the line of work to be pursued. Professor UNDERWOOD.

Special problems in least squares, reduction of triangulation and photographic surveying as may be arranged.

HOME ECONOMICS

Courses offered in the College of Home Economics are numbered in accordance with the following plan: courses numbered below 300 are undergraduate courses; courses numbered 300 to 400 are for seniors and graduate students; courses numbered above 400 are for graduate students. The full description of the undergraduate courses, listed in italics, will be found in the Announcement of the College of Home Economics.

ECONOMICS OF THE HOUSEHOLD AND HOUSEHOLD MANAGEMENT

Professors HELEN CANON and ELLA M. CUSHMAN, and *Doctor* ALIDA HOTCHKISS.

Approved Major and Minor Subjects (key to symbols on p. 42)

Economics of the Household and Household Management 1, 2, 4

130. *Economic Conditions as They Affect the Welfare of Families.* Second term. Credit three hours.

160. *Marketing Problems from the Consumer's Viewpoint.* First or second term. Credit three hours.

300. **Special Problems.** First or second term. Credit and hours to be arranged individually.

310. *Management in Relation to Family Living.* First or second term. Credit three hours.

320. *Management Aspects of Household Equipment.* Second term. Credit two or three hours.

330. *Management of Personal and Family Finances.* Second term. Credit three hours.

400. **Review of Research in Management.** First term. Credit two hours. For advanced students in home management. Prerequisite or parallel, Economics of the Household 112. Assistant Professor CUSHMAN and Department Staff. Hours to be arranged. Room G 19-A. Fee, $2. The instructor should be consulted before registering.

The literature in the field is reviewed. Outside speakers who are specialists in various phases of management participate in the discussion from time to time. Occasional trips are made to homes, stores, factories, and other institutions to observe and analyze management practices. Methods of research are evaluated.

410. **Economic Problems of Families.** Second term. Credit two hours. Professor CANON. Hours to be arranged. Room 121. Fee, $1. 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.

420. **Seminar.** First and second terms. Department Staff. T 4:30–6. 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. 42)

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 the other areas of the field of Home Economics—foods and nutrition, textiles and clothing, housing and furnishing, home finance and management, and institutional management;

Graduate work in Family Life—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.* Either term. Credit two hours.

110. *Health of the Family.* Either term. Credit two hours.

120. *Child Care and Home Nursing.* Either term. Credit three hours.

140. *Creative Materials in Child Development.* Either term. Credit three hours.

150. *Children's Literature.* Second term. Credit one hour.

210. *Principles of Child Guidance.* Either term. Credit three hours.

220. *Family Relationships and Personality Development.* Either term. Credit three hours.

300. **Special Problems.** First or second term. Credit and hours to be arranged individually.

310. *Woman and the Family.* Second term. Credit two hours.

320. **Marriage.** Second term. Credit three hours. Open to graduate students by permission of the instructor. Professor ROCKWOOD. M W F 11. Martha Van Rensselaer Hall 339. Fee, $5.

This course considers: social and economic changes which to-day are influencing the relations of men and women before and after marriage; courtship and engagement; choice of a mate; marriage adjustment; and adjustment to parenthood.

330a, 330b. **Participation in Nursery School.** Either term. Credit three or four hours. 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. Fee, $7.50.

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.

340. **Principles of Child Guidance.** Advanced Course. Second term. Credit three hours. 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. Fee, $5.

Observing the behavior and guidance and analysing narrative records of young children for trends in the personality which indicate the conditions under which guidance may be effective.

[350. **Seminar—Child Guidance.** (Rural Education 228.) Second term. Credit two hours. Prerequisite, some work in family life. Professor WARING. F 4–6. Martha Van Rensselaer G-58. Given in alternate years, not in 1939–40.]

400. **The Home and Family Life.** Advanced Course. Second term. Credit three hours. Open to graduate students with adequate training in family life. Professor FOWLER and Miss WOODRUFF. T Th S 9. Martha Van Rensselaer Hall, Amphitheatre. Fee, $5.

This course is planned to give advanced students some experience 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.

410. **Principles of Child Guidance.** First or second term. Credit three hours. Open to qualified graduate students. Professor WARING. Lecture and discussion, M W F 8. Martha Van Rensselaer Hall 124. Observation in the Nursery School. Fee, $5.

Application of psychology to the understanding of the behavior of young children and to the working out of principles of guidance. Each student makes a detailed study of an individual child in the Nursery School.

420. **Family Relationships and Personality Development.** First term. Credit three hours. Graduate section of Family Life 114. Professor ROCKWOOD. T 2–4 and Th 2. Martha Van Rensselaer Hall 124. Fee, $5.

Deals primarily with the influence of family life on the personality development of children. Since family relationships can be understood only in terms of the culture in which the family lives, some study is made of our own culture and of family life in other cultures.

430. **Studies in Family Life.** First and second terms. Prerequisite, Family Life background for research. Professors WARING and ROCKWOOD. 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 1:40–3:15 is held provisionally for group activities.

[440. **Seminar—The Family.** First and second terms. Two hours credit. T 2–4. Not given in 1939–40.]

121. **The Family.** See Rural Social Organization 121.

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, CATHERINE PERSONIUS, L. A. MAYNARD, and C. M. MCCAY; and *Doctor* MILICENT HATHAWAY.

Approved Major and Minor Subjects (key to symbols on p. 42)

Foods and Nutrition 1, 2, 3, 4
Nutrition 1, 2, 3, 4
Foods 2, 3, 4

As a basis for graduate work in foods and nutrition, elementary courses in the various divisions of Home Economics and courses in inorganic and organic chemistry are expected. A knowledge of quantitative chemical analysis, biological and physical chemistry, physiology, bacteriology, and physics is highly desirable.

Before applying for admission to the Graduate School a prospective student is advised to communicate with a member of the faculty in that field of foods

and nutrition in which he wishes to do research: Foods, Professor PFUND, Assistant Professors FENTON or PERSONIUS; Human Nutrition, Professors MONSCH or HAUCK or Dr. HATHAWAY; Animal Nutrition, see p. 80.

The Department of Foods and Nutrition offers the following courses:

100. *Food Preparation in Relation to Meal Planning.* First or second term.
110. *Science Related to Food Preparation.* Throughout the year.
130. *Food Selection: Nutrition and Dietetics.* First or second term.
200. *Meal Planning and Preparation.* First or second term.
210. *Food Preparation: Principles and Comparative Methods.* First term.
230. *Food Selection: Nutrition and Dietetics.* First or second term.
240. *Food Preparation, Advanced Course.* First or second term.

300. **Special Problems.** First or second term. Credit and hours to be arranged individually. For students recommended by advisers and approved by the head of the department for independent, advanced work on a problem not dealt with by other courses in the department. Fee determined by the problem.

310. **Science Related to Foods.** Throughout the year. Credit two hours a term. Open to graduate students and to certain students with advanced standing from other institutions. Professor PFUND and Assistant Professor PERSONIUS. Attendance at Foods and Nutrition 2 lectures required. One hour to be arranged. Fee, $2.

A study of scientific principles necessary to the understanding of modern theory and practice in the field of food preparation, and the application of these principles to the analysis and interpretation of cookery practices.

[320. **Science Related to Foods. Advanced Laboratory Course.** First or second term. Credit three hours. Open to graduate and upperclass students with adequate training. (Foods and Nutrition 2 or 9 and 109 or 111, or its equivalent). Registration by permission of instructor. Professor PFUND and Assistant Professor PERSONIUS. Two three-hour laboratory periods and one class hour to be arranged with the instructor before registration. Martha Van Rensselaer Hall 357. Fee, $10 or more depending upon the nature of the work. Not given in 1939–40.]

Independent laboratory work on special problems in food preparation. Students are introduced to methods of experimental cookery and to some of the objective methods used commonly in judging quality of food products. Questions in regard to food preparation sent to the college, which cannot be adequately answered, frequently form the basis for problems in this course. Students are encouraged to take initiative in planning their own work; a written report organizing and critically analyzing experimental results is required.

330. **Diet Therapy.** Second term. Credit two hours. Prerequisite, Foods and Nutrition 122 or its equivalent. Professor HAUCK. Lecture, discussion, and laboratory. T 11; Th 11–1. Martha Van Rensselaer Hall 426. Fee, $6.

A study of diet in those diseases in the treatment of which choice of food is important.

340. **Family Nutrition, with Special Emphasis on Child Feeding.** First or second term. Credit for lecture, two hours; for each laboratory, one hour. Any laboratory may be taken either in the same term with the lecture or in any term following the lecture. Three hours advised for teachers; two hours advised for all students. Prerequisite, Foods and Nutrition 121 or 122. Professor MONSCH and Miss ————.

Lecture and discussion, T 2–4. Martha Van Rensselaer Hall 339. Laboratories: infant feeding, limited to sixteen students, Th 2–4:20, Martha Van Rensselaer Hall 426, homes in Ithaca and a well-baby clinic; feeding of preschool children, limited to six students in each section, section 1, W 10–12, section 2, Th 10–12, Martha Van Rensselaer Hall 301, Nursery School and homes in Ithaca; feeding of school children, limited to ten students, F 2–4:20,

Martha Van Rensselaer Hall 301, public schools, and homes in Ithaca. Fee, $7 for each laboratory credit hour, $1 for lecture.

A study of family nutrition, with special emphasis upon the nutritional needs of the child. Relation of nutrition to physical growth and development. Experience in actual family situations through private homes, the Nursery School, and the public schools.

400. **Advanced Nutrition.** First term. Credit two hours. Registration by permission of instructor. Professor HAUCK. Discussion, M W 2. Martha Van Rensselaer Hall 301. Fee, $1.

This course emphasizes the experimental data on which the principles of human nutrition are based, and a critical review of current literature in this field.

410. **Research in Foods and Nutrition.** First or second term. For graduate students with training satisfactory to the instructor. Professors MONSCH, MAYNARD, MCCAY, PFUND, and HAUCK, and Assistant Professors FENTON and PERSONIUS, and Dr. HATHAWAY. Hours to be arranged. Fee, from $5 to $25.

Individual research in foods, human nutrition, and animal nutrition.

420. **Seminar in Foods and Nutrition.** Second term. Emphasis upon foods. Credit one hour a term. Professors PFUND and HAUCK, and Assistant Professors FENTON and PERSONIUS. Required of graduate students specializing in Foods and Nutrition. Hours to be arranged. Martha Van Rensselaer Hall 301. Fee, $1.

In addition to the above, the following courses in Nutrition are offered in the Laboratory of Animal Nutrition (see p. 80), and research at the New York State Experiment Station at Geneva (see p. 199).

110. **Animal Nutrition.** Professor MAYNARD.

111. **Animal Nutrition, Laboratory Course.** Professor MCCAY.

219. **Animal Nutrition. Seminar.** Professors MAYNARD, MCCAY, and NORRIS.

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. 42)

Textiles and Clothing and Household Art 2, 4

Graduate work for the Master's degree is offered in Textiles and Clothing and Household Art. Emphasis may be placed either upon Textiles and Clothing or upon Household Art.

TEXTILES AND CLOTHING

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.

100. *Introduction to the Clothing Selection and Construction.* First or second term. Credit two hours.

110. *Clothing Construction. Textiles and Construction.* First or second term. Credit three hours.

130. *Textiles: Clothing Fabrics.* First or second term. Credit two hours.

200. A, B, C. *Fitting and Pattern Making; Flat Pattern Work, Modeling.* First or second term. Credit one hour for each unit. By permission of the department.

210. *Dress Design.* First or second term. Credit two hours.

220. *Commercial Clothing and Advanced Practice in Construction.* First or second term. Credit three, four or five hours.

300. **Special Problems.** First or second term. Credit and hours to be arranged. Professor BLACKMORE and members of textiles and clothing staff. Martha Van Rensselaer Hall.

310. *Household Textiles.* First or second term. Credit two or three hours. By permission of instructor.

320. *Consumer Problems in Buying Clothes.* First or second term. Credit three hours.

400. **Dress Design. Advanced Course.** Second term. Credit three to five hours a term. Prerequisite, Textiles and Clothing 110. Mrs. FULLER. Hours to be arranged. Martha Van Rensselaer Hall 216. Laboratory fee, $5. Estimated cost of material, $15–$30.

Advanced draping with emphasis on the experimental manipulation of fabric and the fine use of line, color, texture, and decoration in dress. Designs will be executed in cloth.

410. **Seminar.** Second term. Credit one hour by arrangement. Department staff.

HOUSEHOLD ART

Before entering upon advanced work in Household Art the student should have had basic courses in color and design, house planning and house furnishing, family life and household management. Whether a student's preparation is adequate for advanced study can be determined only by special consideration of each case.

100. *Color and Design.* First or second term. Credit two hours.

110. *Problems in Color and Design in the studio for Handicrafts.* First or second term. Credit one hour.

120. *Home Furnishing.* First or second term. Credit two hours.

140. *House Planning.* First or second term. Credit three hours.

150. *Housing from the Viewpoint of Home Economics.* First term. Credit two hours.

160. A, B, C, D. *Appreciation of Everyday Art.* First or second term. Credit one to four hours. May be taken in consecutive terms.

200. *Advanced Color and Design.* Credit two hours.

210. *Problems in Color and Design in the Studio for Handicrafts.* First or second term. Credit one to three hours.

220. *Home Furnishing.* First or second term. Credit two hours.

300. **Special Problems.** First or second term. Credit and hours to be arranged. Professor MORIN and members of Household Art staff. Martha Van Rensselaer Hall.

320. *Home Furnishing.* First term. Credit two hours.

HOTEL ADMINISTRATION

Professors H. B. MEEK, F. H. RANDOLPH, LOUIS TOTH, A. L. WINSOR, JOHN COURTNEY, and C. I. SAYLES.

Approved Major and Minor Subjects (key to symbols on p. 42)

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.* Throughout the year. Credit eight hours.

85. *Tea Room and Cafeteria Accounting.* First or second term. Credit three hours.

87. *Restaurant Cost and Sales Analysis.* Second term. Credit two hours.
181 and 182. *Hotel Accounting.* Throughout the year. Credit six hours.
183. *Auditing.* First term. Credit two hours.
184. *Food and Beverage Control.* Second term. Credit three hours.
187. *Tax Computation.* First term. Credit two hours.
284. *Problems in Food Control.* First or second term. Credit one hour.
288. *Accounting Machines in Hotels.* First or second term. Credit one hour.
151. *Hotel Operation.* First term. Credit two hours.
160. *Introductory Hotel Engineering.* First term. Credit four hours.
161. *Mechanical Service Equipment.* Second term. Credit four hours.
162a. *Hotel Power Plants, Lectures.* First term. Credit two hours.
162b. *Hotel Power Plants, Laboratory.* First term. Credit two hours.
163a. *Hotel Auxiliary Equipment, Lectures.* Second term. Credit two hours.
163b. *Hotel Auxiliary Equipment, Laboratory.* Second term. Credit two hours.

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. Materials fee, $3.

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.

165. **Hotel Engineering Problems.** Second term. Credit one hour. Prerequisites, Hotel Engineering 162b and 163b and consent of the instructor. Professor RANDOLPH.

The discussion and solution of practical problems involving the selection, use, and revision of mechanical and electrical equipment in hotels. Cases are based on actual problems encountered. Costs are given primary consideration.

166. **Hotel Structures and Maintenance.** First term. Credit two hours. Prerequisite, mechanical drawing. Assistant Professor SAYLES. Lectures, T Th 11. East Roberts 223. Materials fee, $1.

Materials and methods of building construction; specification and repair of furniture; the usual methods employed by the trades in the alteration of hotel structures.

167. **Building Costs.** Second term. Credit one hour. Prerequisite, Hotel Engineering 166. Assistant Professor 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 Professor COURTNEY and Mr. FOX. W 11–1. West Bailey.

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 Professor COURTNEY and Mr. FOX. W 1:40–4. West Bailey.

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 G-1.

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. Mr. MAXFIELD.

153. **Seminar in Hotel Administration.** Second term. Credit two hours. Prerequisite, Hotel Administration 151 or its equivalent. Registration limited. Professor MEEK. Hours to be arranged.

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 or recruitment, selection, placement, maintenance, organization, and government of employees are analyzed with particular reference to the hotel industry.

219. **Seminar in Personnel Administration.** Second term. Credit two hours. Prerequisite, course 119. Assistant Professor WINSOR. Th 4:15–6. East Roberts 223.

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, G. H. ROBINSON, H. D. LAUBE, W. H. FARNHAM, J. W. MACDONALD, L. W. MORSE, A. J. KEEFFE, and G. T. WASHINGTON.

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. 42)

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 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 professional practice or teaching experience after obtaining a first degree in law.

A number of furnished offices are provided in the Law School building, Myron Taylor Hall, for graduate students in law.

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 Division.

For the procedure to be followed by a candidate for LL.M. see p. 17 of this Announcement, and for J.S.D. see p. 18.

For more detailed information regarding graduate work in law and description of courses see the current Announcement of the Law School.

50. **Jurisprudence.** First term. Two hours. Professor LAUBE. Required for all graduate students in law and elective for other graduate students. 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.

The following courses are elective for graduate students:

51. **Administrative Law.** Second term. Two hours. Professor MACDONALD.

[53. **Problems in Jurisprudence.** Second term. One hour. Professor LAUBE. Not given in 1939–40.]

54. **Problems in Taxation.** Second term. Two hours. Professors STEVENS and WHITESIDE.

55. **Directed Studies in Legal History.** Professors WHITESIDE, THOMPSON, and ROBINSON, and Assistant Professor WASHINGTON.

57. **Problems in Federal Practice.** Second term. Two hours. Assistant Professor KEEFFE.

58. **Seminar in Election of Remedies.** First term. Two hours. Professor WILSON.

60. **Seminar in Business Regulation II.** First term. Time and credit to be arranged. Prerequisite: Constitutional Law, Business Regulation I, or a course in the Law of Public Utilities. Professor THOMPSON and Assistant Professor WASHINGTON. Seminar based on assigned material and research reports.

61. **Problems in Trusts and Estates.** Second term. One hour. Professor WHITESIDE.

62. **Seminar in Legislation.** Second term. Two hours. Professor MACDONALD.

63. **Directed Studies in Procedure.** Professors MACDONALD and WILSON, and Assistant Professor KEEFFE.

VETERINARY MEDICINE

Approved Major and Minor Subjects (key to symbols on p. 42)

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. 79.

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.

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 other libraries of the University.

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. F 9–1. A conference hour to be arranged. Laboratory fee, $10. Not given in 1939–40.]

A laboratory course in mammalian and avian physiology.

17. **Special Problems in Chemical Physiology.** Both terms. Registration by permission. Professor HAYDEN. Hours to be arranged. Laboratory fee, $2 a credit hour.

This course will be adapted to the needs of students and will consist of laboratory work, conferences, collateral readings, and reports.

18. **Research.** Both terms. Hours to be arranged. Professors DUKES and HAYDEN.

ANIMAL PATHOLOGY, BACTERIOLOGY, AND IMMUNOLOGY

(See also under BACTERIOLOGY, p. 95)

Professors W. A. HAGAN, PETER OLAFSON, E. L. BRUNETT, A. ZEISSIG, and C. W. BARBER.

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. The Flower Library, in James Law Hall, has 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. T Th 1:40–4. Laboratory fee, $10. Not given in 1939–40.]

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. Since the number of graduate students who can be accommodated is limited, a personal interview is required of all applicants *before the filing of forms.* For a description of the work in the Medical College 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.

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 at present contains about 25,000 volumes.

ANATOMY

Professors C. R. Stockard,* J. F. Nonidez, C. V. Morrill, G. N. Papanicolaou, and C. L. Yntema.

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.

*Deceased April 7, 1939.

Experimental Morphology. Professor STOCKARD.
Anatomy of the Infant and Postnatal Development. Professor STOCKARD.
Experimental Embryology. Professor YNTEMA.

BACTERIOLOGY AND IMMUNOLOGY

Professors JAMES M. NEILL, JOHN Y. SUGG, and THOMAS P. MAGILL.

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

Professors V. DU VIGNEAUD and R. W. JACKSON.

Opportunity is offered for advanced work and research in various phases of biochemistry. Adequate chemical and physical equipment and fundamental library facilities are provided for the investigation of a considerable variety of problems in the chemistry of the plant or the animal organism or of the human organism in health and disease.

Graduate students expecting to pursue investigations in biochemistry should have adequate preliminary training in inorganic, organic, analytical, and physical chemistry.

Students electing biochemistry as a minor subject are expected to complete the regular medical course in biochemistry, or its equivalent, as a minimum requirement.

PATHOLOGY

Professors EUGENE L. OPIE, ROBERT A. MOORE, and JACOB FURTH.

The departmental laboratories are suitably equipped for carrying on graduate study and research problems in 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 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 investigation of some problem, and may be credited towards the applicant's graduate degree.

Preliminary requirements: 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.

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 WILSON G. SMILLIE, JOHN C. TORREY, and MORTON C. KAHN.

The Department of Public Health and Preventive Medicine does not offer formal graduate courses in Public Health or in Preventive Medicine, and the University does not grant advanced degrees in Public Health. The department welcomes graduate students who wish to register in special fields. Each application will be considered on its merits, and the work may be arranged in accordance with the desires and purposes of the candidate after consultation with the members of the department.

The laboratories are well equipped for research in public health epidemiology, serology, and parasitology. Facilities at the Kips Bay-Yorkville District Health Center are available to a limited number of graduate students for the study of certain social aspects of Preventive Medicine and Public Health.

It is preferred that the candidate for advanced work in the Department of Public Health and Preventive Medicine should have a medical degree; he should also possess credit for or the equivalent of the basic course in Public Health given to the third year medical students in Cornell.

This course in Public Health, as well as the course in Parasitology given to the second year students, is acceptable as a minor requirement for students who may major in other departments of the University, and Parasitology may be taken as a major course.

THE AGRICULTURAL SCIENCES

AS PRESENTED IN THE NEW YORK STATE EXPERIMENT STATION AT GENEVA.

P. J. PARROTT, *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 A. W. HOFER.

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 and HUCKER.
Cheese Ripening. Professor YALE.
Soil Bacteriology. Professors CONN and HOFER.
Biological Stains. Professor CONN.
Food Poisoning. Professor HUCKER.
Food and Fermentation Bacteriology. Professor PEDERSON.
Taxonomy of Bacteria. Professor BREED.

CHEMISTRY

Professors D. K. TRESSLER, A. W. CLARK, Z. I. KERTESZ, H. G. BEATTIE, G. W. PEARCE, and G. L. MACK.

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 BEATTIE.
Vitamins of Animal Feeds. Professor CLARK.
Plant Enzymes. Professor KERTESZ.
The Chemistry of Pectin. Professor KERTESZ.
Insecticides and Fungicides. Professor PEARCE.
Chemistry and Technology of Wine Manufacture. Professor TRESSLER.

DAIRYING

Professors A. C. DAHLBERG, D. C. CARPENTER, J. C. HENING, and J. C. 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:

Milk Processing. Professors DAHLBERG and HENING.
Ice Cream Manufacture. Professors DAHLBERG and HENING.
Cheese Making. Professor MARQUARDT.
Dairy and Protein Chemistry. Professor CARPENTER.
Plastics. Professor CARPENTER.

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 following fields: 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.

Insect Pests of Nursery and Ornamental Plants. 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, R. O. MAGIE, D. H. PALMITER, and R. F. SUIT.

The Division offers oportunities 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, PALMITER, and SUIT.

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, B. R. NEBEL, and G. D. OBERLE.

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 of horticultural plants. No formal courses are offered but students may register for work on problems as indicated below:

Fruit Breeding Problems. Professors WELLINGTON and OBERLE.
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.

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.

Effect of Fertilizers on Yield and Quality of Vegetables for Manufacture. Professor SAYRE.
Fertilization and Nutritional Studies with Vegetables. Professor SAYRE.
Variety Studies of Vegetables. Professor TAPLEY.
Vegetable Breeding Problems. Professor TAPLEY.
Vegetable Canning Crop Research Problems. Professor SAYRE.

FELLOWS: SCHOLARS: ROSTER OF DEGREES

FELLOWS AND GRADUATE SCHOLARS IN 1938–39

RESIDENT DOCTORS

José M. Gonzalez Andrés, Eng. of Agronomy, University of Buenos-Aires, 1931.
Hans Barth.
Walter Hyman Cerf, Ph.D., University of Bonn, 1933.
Harold Ernest Fischer, B.S., College of the City of New York, 1934, M.S., Ph.D., Cornell, 1936, 1939.
Berndt Olof Groenblom.
James Bishop Harrington, Ph.D., University of Minnesota, 1924.
Tseh Liang Kwan, B.S., University of Nanking, 1934, Ph.D., Cornell, 1938.
Johann Friedricks Ludloff.
Merritt Joseph Murray, B.S., A.M., Indiana University, 1930, 1934, Ph.D., Cornell, 1938.
Everett Pepperell Wheeler, A.B., M.S., Ph.D., Cornell, 1923, 1926, 1930.

ENDOWED AND UNIVERSITY FELLOWS

The Anna Cora Smith Fellowship in Home Economics: Marion Thomas Long, B.A., University of California at Los Angeles, 1933, M.A., Mills College, 1936.
The Charles Bull Earle Memorial Followship in Mechanical and Electrical Engineering: Theodore Marion Hoefer, B.S. in E.E., Clemson College, 1938.
The Clinton DeWitt Smith Fellowship in Agriculture: Stewart McNeil Johnson, B.S., Wisconsin, 1935, M.S., Vermont, 1937.
The Cornell Fellowship in English: Robert Mark Gorrell, A.B., Cornell, 1936.
The Cornell-Brookings Fellowship in Economics: Robert John Landry, A.B., Amherst, 1935, A.M., Cornell, 1938.
The Edgar J. Meyer Memorial Fellowship in Engineering Research: Lawrence Thomas Wright, Jr., B.S. in M.E., Texas, 1938.
The Erastus Brooks Fellowship in Mathematics: Sara Louise Nelson, B.S., Georgia State College for Women, 1926, M.S., Cornell, 1930.
The Fellowship in American History: Albert Hess Leisinger, A.B., Cornell, 1937.
The Fellowships in Greek and Latin: Gordon Macdonald Kirkwood, B.A., Toronto, 1938; Frances Ellenor Marguerite Swallow, B.S., M.A., University of Alberta, 1936, 1938.
The Fellowship in Political Economy: Paul Byron Simpson, A.B., Reed College, 1936.
The George C. Boldt Fellowship in History: Arthur Bowles Ferguson, A.B., Western Ontario, 1935.
The Goldwin Smith Fellowships in Botany, Geology, or Physical Geography: Mary A. Tingley, B.S., M.S., New Hampshire, 1933, 1937; Henry Johnson Tyler, A.B., Syracuse, 1938.
The McGraw Fellowship in Civil Engineering: Douglas Kent Jones, B.S., M.S., Utah, 1932, 1933.
The duPont Fellowship in Chemistry: Ben Elwood White, A.B., Montana, 1935.
The President White Fellowship in Modern History: Carl Gustav Gustavson, A.B., Augustana College, 1937, A.M., Illinois, 1938.
The President White Fellowship in Physics: Robert Eugene Marshak, A.B., Columbia, 1936.
The President White Fellowship in Political and Social Science: George Manner, A.B., Cornell, 1936.
The Sage Fellowship in Chemistry: Paul Latrell Barrick, B.S., Illinois, 1935.
The Schuyler Fellowship in Animal Biology: Martha Sarah Walker, A.B., Agnes Scott College, 1933.

The Sibley Fellowships in Mechanical and Electrical Engineering: Dimitry Morkovin, B.S. in B.A., M.B.A., B.S. in M.E., University of Southern California, 1934, 1935, 1937, M.M.E., Rensselaer Polytechnic Institute, 1938; Louis Leslie Otto, M.E., Cornell, 1933.

The Susan Linn Sage Fellowships in Philosophy: William Warner Hammerschmidt, B.A., M.A., Ohio State University, 1936, 1937; Paul Welsh, B.S., Bowdoin College, 1937.

The Susan Linn Sage Fellowship in Psychology: Oliver Lilburn Lacey, B.A., British Columbia, 1938.

The University Fellowship in Agriculture: Alexander James Wood, B.S.A., M.S.A., British Columbia, 1935, 1938.

The University Fellowship in Architecture or Landscape Architecture: John Davison Anderson, B.Arch., Cornell, 1938.

The University Fellowship in German: Francis Andrew Brown, B.S., Hamilton College, 1937.

The University Fellowship in Romance Languages: LeRoy Clinton Breunig, Jr., A.B., DePauw, 1936.

SPECIAL TEMPORARY FELLOWS

American Cyanamid Fellowship: Olen Branford Garrison, B.S., Clemson Agricultural College, 1933, M.S., Louisiana State, 1934.

American Nature Association Fellowships: Charles Winfield Quaintance, B.S., Arizona, 1933, M.A., California, 1937; Matt F. Vessel, B.E., State Teachers College (St. Cloud, Minnesota), 1936.

Dairy Products Industrial Research Fellowship: Harry Brooks Naylor, B.S., Minnesota, 1938.

Freeport Sulfur Company Fellowship Number 2: Bert Lorin Richards, Jr., B.S., Utah State Agricultural College, 1935.

Frosted Foods Fellowship Number 4: William I. Zimmerman, B.S., M.S., Pennsylvania State College, 1930, 1931.

Frosted Foods Fellowship Number 5: James Charles Moyer, B.S.A., Ontario Agricultural College, 1936, M.S., Toronto, 1938.

Frosted Foods Fellowship Number 6: Jennie Amabel McIntosh, B.Sc., New Brunswick, 1936, M.S., Maine, 1938.

G. L. F. Poultry Fellowship: Charles Dirxon Caskey, Jr., B.S., Oklahoma A. and M., 1929.

Lederle Fellowship: Donald Rolfe Cordy, B.A., California, 1934, D.V.M., Iowa State, 1937, M.S., Cornell, 1938.

Nassau County Farm Bureau Association Fellowship: Orson Silver Cannon, B.S., M.S., Utah State Agricultural College, 1935, 1937.

National Association of Audubon Societies Fellowship: James Taylor Tanner, B.S., M.S., Cornell, 1935, 1936.

New York Florists' Club Fellowship for the Investigation of Diseases of Carnations: Jack Mayson Bickerton, B.S.A., British Columbia, 1934.

New York Florists' Club Fellowship for the Investigation of the Diseases of Roses Grown under Glass: Wilbur Dwight McClellan, B.S., California, 1936.

Procter and Gamble Fellowship: Herbert Henry Nordsieck, B.S., Butler, 1934, M.S., Texas A. and M., 1936.

Silver Producers Fellowship for the Investigation of the Fungicidal Properties of Silver: Lowell Wendell Nielsen, B.S., M.S., Utah State Agricultural College, 1935, 1937.

Staten Island Growers' Association Fellowship: Manson Bruce Linn, A.B., Wabash College, 1930.

Texas Gulf Sulfur Company Fellowship Number 1: Eugene Marshall Stafford, B.S., M.S., California, 1933, 1935.

Texas Gulf Sulfur Company Fellowships for the Study of the Insecticidal and Fungicidal Properties of Sulfur: Karl Douglas Butler, B.S., M.S., Arizona, 1932, 1934; Glenn Elwin Carman, B.S., Iowa State, 1936.

Westinghouse Economic Fellowship: George Elmer Brandow, B.S., Cornell, 1935.

Wilbur White Fellowship: Leonard Leslie Morris, B.S. in Agr., Purdue, 1937.
Yeast and Molasses By-product Fellowship: Paul Edwin Johnson, A.B., Park College, 1934, A.M., Missouri, 1936.

SCHOLARS

The Comstock Graduate Scholarships: Albert Raymond Mead, B.S., University of California, 1938; Dorothy Alice Fisher, B.S., Keuka College, 1933, M.S., Cornell, 1934.
The Graduate Scholarship in Animal Biology: Hun Kyu Kim, B.S., Union Christian College, 1934, M.S., Hokkaido Imperial University, 1937.
The Graduate Scholarships in Architecture: (Second term) George William Atkinson, B.L.A., Cornell, 1939; (Second term) James Freer, B.Arch., Cornell, 1939; Brooks Edward Wigginton, A.B., Marietta College, 1934, B.F.A., Ohio State, 1937.
The Graduate Scholarship in Botany, Geology, or Physical Geography: Albert Irwin Ingham, B.S., Pennsylvania State College, 1938.
The Graduate Scholarship in Civil Engineering: (First term) John Wilcox Gaul, C.E., Cornell, 1938.
The Graduate Scholarships in Greek and Latin: Mary Louise Carlson, B.A., Buffalo, 1938; Mary Ann Tibbetts, A.B., Wheaton College, 1938.
The Graduate Scholarship in History: Arthur Robert Douglass Ford, B.A., Western Ontario, 1938.
The Honorary Scholarships in Education: (First term) James William Hatch, B.S., M.S., Cornell, 1928, 1937; (Second term) Everett Courter Lattimer, B.S., Cornell, 1934; (First term) Alice Amelia Pierce, B.S., Syracuse, 1930, A.M., Cornell, 1932.
The Phi Kappa Phi Scholarship: Sol Luis Descartes, A.B., Puerto Rico, 1932, M.S., Cornell, 1934.
The Susan Linn Sage Scholarships in Philosophy: Todd Sterling Simon, A.B., Western Reserve, 1937, M.A., Ohio State, 1938; Edgar Franklin Wells, A.B., North Carolina, 1937.
The Susan Linn Sage Graduate Scholarship in Psychology: Margaret Russell Hubbard, A.B., Vassar College, 1937, M.A., Hobart College, 1938.

TUITION SCHOLARS

George Robert Bishop, B.S., Illinois, 1930, A.M., Colorado State Teachers College, 1933.
Henry Weston Blaser, B.S. in Ed., A.M., Temple, 1931, 1933 (First term).
Myrtice Augusta Blatchley, A.B., Rochester, 1938.
Arthur Wayne Brown, B.A., St. Thomas College, 1937.
Helen Evelyn Bush, A.B., Mount Holyoke, 1925, A.M., Columbia, 1937.
Catherine Nancy Dobbin, B.S. in Ed., M.S., Washington, 1932, 1933.
John Littell Eaton, A.B., Cornell, 1935.
David Maldwyn Ellis, A.B., Hamilton, 1938.
Beatrice Iva Fessenden, B.A., Cornell, 1936.
Karl Frank, B.S., George Washington, 1939.
Benedict Arthur Hall, A.B., Albany State Teachers College, 1938.
Allan Gibson Holaday, A.B., Miami, 1938.
Karl vonVorse Krombein, B.S., A.M., Cornell, 1934, 1935.
Monroe Richard Lazere, A.B., Cornell, 1938 (First term).
Ching-hai Li, B.S.C.E., Chiao-Tung, 1934.
Kung Hsiang Lin, B.S., Fukien Christian College, 1934.
Ta-chung Liu, B.S. in C.E., Chiao-Tung, 1936, M.C.E., Cornell, 1937.
Louis Kao Hui Lu, B.S., Soochow, 1934, M.S., Cornell, 1937.
Morris Malin, B.S., Cornell, 1938 (First term).
Walter Rue Murray, B.S., Colgate, 1929, M.S., Cornell, 1932.
Michael Nuttonzon, B.S., M.S., California, 1932, 1933.
William Tuthill Payne, A.B., Cornell, 1930 (First term).

Celesta Henrietta Pirwitz, A.B., Northwestern, 1921, A.M., Cornell, 1931.
Clinton L. Rossiter, III, A.B., Cornell, 1939 (Second term).
Irene Samuel, A.B., A.M., Cornell, 1935, 1936.
Arnold Edward Schulze, S.B., Chicago, 1934.
Ke Sung, B.A. in Ed., Great China University, 1933, M.S. in Ed., Cornell, 1938 (Second term).
John C. Swartley, B.S. in Ed., Pennsylvania, 1930.
Afif Ishak Tannus, B.A., American University of Beirut, 1929, M.A., St. Lawrence University, 1938.
Robert Traub, B.S., College of the City of New York, 1938.
Katherine Tsanoff, B.A., Rice Institute, 1938.
Charlotte Farrington Walker, A.B., Cornell, 1937.
Charles Benjamin Wheeler, A.B., Westminster College, 1937.

ADVANCED DEGREES CONFERRED IN 1937–38

MASTERS OF ARTS

CONFERRED SEPTEMBER 29, 1937

Harriette Fisher Allen, A.B.; Modern History, English History. Thesis: Study of Marriage Customs in Tudor and Stuart England.
Arthur Seymour Bates, A.B.; French Literature, French Philology. Thesis: Annotated Edition of *Germinie Lacerteux* of the Goncourt Brothers.
Zelma Olga Baker Becker, A.B.; Dramatic Literature, Dramatic Production. Thesis: The Treatment of War in Recent and Contemporary Drama.
Dirck Benson, A.B.; Ornithology, Entomology. Thesis: Studies in the Ecology of the Black Duck (*Anas rubripes* Brewster).
Russell Haynes Broadhead, A.B.; Rural Education, Rural Social Organization. Thesis: A Critical Analysis of Theories of Civic Education.
Fevzi Yahya Ertem, B.S.; Education, Psychology. Thesis: Educational Trends and Possibilities in Turkey.
Stewart Irwin Gay, A.B.; Latin, Education. Thesis: The Vitalization of the Second and Third years of Latin by Means of *Emotional Appeal.*
Robert Lovell Grennell, B.S.; Education, Zoology. Thesis: A Suggested Course of Study in General Science for the Seventh Grade in Relation to Industrial Arts.
Anna Louise Hoffman, A.B.; Education, German. Thesis: A Survey of the Typical Errors in English Composition Made by Seniors and Graduate Students of Cornell University in the Years 1927–28, 1929–30, 1930–31, and 1931–32.
Elverta Groves Hutchinson, B.S. in Ed.; Botany, Entomology. Thesis: A Botanical Survey of Mount Airy Forest Park at Cincinnati, Ohio.
Ramon Lawrence Irwin, A.B.; Rhetoric and Public Speaking, Dramatic Production. Thesis: A Survey of the Principles of Disposition in Speech-Making.
Louise Annetta Jacobs, A.B.; Dramatic Production, Dramatic Literature. Thesis: Sarah Siddons: As a Shakespearean Interpreter.
Mabel Frances Lewis, A.B.; Education, History. Thesis: A Study of the History of and the Opportunities for the Use of Visual Instruction in the Field of History.
Ella Murdock Moore, A.B.; French, German. Thesis: Victor Cherbuliez and his Novels with Special Reference to *Le Comte Kostia.*
Egbert Ray Nichols, A.B.; Dramatic Production, Dramatic Literature. Thesis: David Garrick—The First Modern. The Contributions of David Garrick to the Theatre and Drama.
Marion Cecilia O'Connor, A.B.; Public Speaking, Dramatic Literature. Thesis: Nervousness in Public Speaking.
Gilbert Jerome Perlow, A.B.; Experimental Physics, Theoretical Physics. Thesis: Lα Satellites: Relative Intensities in the Atomic Number Range 42 to 28.

John Foster Potts, A.B.; History, Education. Thesis: A History of the Growth of the Negro Population of Gary, Indiana.

Delroy Morton Root, A.B.; Sixteenth Century English Literature, American Literature. Thesis: Henry Reynold's *Mythomystes.* Edited with Introduction and Notes.

Harold Baker Shaw, A.B.; Dramatic Production, Dramatic Literature. Thesis: The History and Technique of Stage Effects.

Marion Bartz Shaw, A.B.; Elizabethan Literature, Tudor Stuart History. Thesis: The Second Part of *If You Know Not Me, You Know Nobodie* by Thomas Heywood, 1606. Edited with Introduction and Notes.

Arnold LeRoy Wilkes, A.B.; Dramatic Production, Dramatic Literature. Thesis: Joseph Jefferson and his Art of the Stage.

CONFERRED FEBRUARY 9, 1938

Lewis Eldred, A.B.; Educational Psychology, Mathematics. Thesis: Characteristics of Cornell University Students Preparing for Secondary School Teaching Classes of 1935, 1936, and 1937.

Earle Ernst, A.B.; Dramatic Production, Dramatic Literature. Thesis: Arthur Symons on the Drama and the Theatre.

Richard Alfred Jensen, A.B.; Administration, Rural Social Organization. Thesis: A Proposed Centralization of the Moravia Area.

Robert John Landry, A.B.; Labor and Industrial Relations, Economic Theory. Thesis: Some Relationships Between Technical Change and Employment Opportunities in the Iron and Steel Industry, 1919–1935.

Oswald Henry Laubenstein, A.B.; German Literature, Education. Thesis: The Social and Political Philosophy of Wilhelm Heinrich Riehl.

Russell Willard Ludlum, A.B.; Educational Administration, Secondary Education. Thesis: Development of Compulsory Education in New York State during the Nineteenth Century.

Georgiana Josephine von Tornow, A.B.; Dramatic Production, Dramatic Literature. Essay: Drama on a Community Basis.

CONFERRED JUNE 20, 1938

Grace Evelyn Abrahams, B.A.; Elizabethan Literature, Old English. Thesis: The Letters of Erasmus of Rotterdam to Willibald Pirckheimer from March, 1520, to September, 1529, Translated and Edited.

Ellen Rose Albertini, A.B.; Dramatic Production, Dramatic Literature. Thesis: The Dance and the Drama.

Robert William Anderson, A.B.; Government, American Governmental Institutions. Thesis: Powers of the Securities and Exchange Commission.

Michael Richard Barton, B.A.; Prices and Statistics, Marketing. Thesis: Restriction and Other Factors Influencing the Price of Rubber.

Le Roy Clinton Breunig, Jr., A.B.; Modern French Literature, Spanish Literature. Thesis: Emile Zola's Treatment of the Crowd.

Arthur Wayne Brown, A.B.; Elizabethan Literature, Dramatic Literature. Thesis: Some Latin Letters of Roger Ascham (1559–1568) Translated from the Latin with Introduction and Notes.

Francis Andrew Brown, B.S.; German Literature, German Philology. Thesis: The Philosophy of Individualism as Found in the Works of Waldemar Bonsels.

Mabel Dorothy Burr, A.B.; American History, Modern European History. Thesis: History of the Disposal of Military Reservations, 1819–1858.

Mary Corbin Caldwell, A.B.; Modern European History, Education. Thesis: The Westernization of Turkish Women.

Rita Carey, A.B.; Greek, Comparative Study of Literature. Thesis: The *Euxenippos* and *Epitaphios* of Hypereides Rendered into English with an Introduction.

John Loomis Chamberlain, Jr., Graduate U.S.M.A.; French Philology, Modern French Literature. Thesis: The Influence of the Russian Social Consciousness upon the French Realists of the XIX Century.

William Kenneth Christian, A.B.; Rhetoric and Public Speaking, Dramatic Production. Thesis: Some Theories of Mass Persuasion Held by Ancient and Modern Writers.

Annie Quick Drake, B.A.; French, German. Thesis: Children in the Rougon-Macquart Novels.

Donald Mack Easton, B.S.; Rhetoric and Public Speaking, Rural Social Organization. Essay: Use of Ethical and Emotional Proof in Demosthenes' Speech *On The Chersonese.*

William Einset, Examenartium; International Relations, Modern European History. Thesis: Scandinavia and the League of Nations.

Helen Margaret Euler, A.B.; French Literature, French Language. Thesis: The Lyric Poetry of Jean-Antoine de Baif.

Esther Fried, A.B.; Rhetoric and Public Speaking, English. Thesis: Standards of Proof in Contemporary Public Discussion.

Robert Edward Gard, A.B.; Playwriting, Dramatic Literature. Thesis: Dramatic Technique in Relation to the Creation of a Modern Tragedy.

Dorothy Emma Gedney, A.B.; Modern European History, American History. Thesis: The Attitude of the *London Times* toward Germany from 1904 to 1909.

Charles Clifford Gregg, A.B.; Physical Chemistry, Inorganic Chemistry. Thesis: The System: Rubidium Iodide, Iodine, and Water at 25° and 0° C.

Francis Ellsworth Griffin, A.B.; School Administration, Sociology. Thesis: A Study of Certain New York State Common School Districts of Small Enrolment.

Harold Emery Hammer, A.B., B.D.; Rural Social Organization, Rural Economy. Thesis: The Rural Churches of Cortland County, New York.

Iva Louise Handy, A.B.; American Literature, Elizabethan Literature. Thesis: Emily Dickinson: A Study of Her Kinship with Childhood, with Nature, and with God.

Joseph Fish Haseman, A.B.; Economic Geology, Paleontology. Thesis: The Effect of Different Electrolytes on the A. F. A. Clay Determination.

Edward Herbert Haweeli, A.B.; Elizabethan Literature, Eighteenth Century Literature. Thesis: *The Ile of Gvls,* 1606, by John Day, edited with Introduction and Notes.

Earl Lawrence House, B.S.; Histology and Embryology, Anatomy. Thesis: The Development of the Pars Tuberalis of the Hypophysis in the Cat.

Armand Wells Kelly, A.B.; Finance, Economic Theory. Thesis: The Work of the Reconstruction Finance Corporation in Relation to Banks and Trust Companies.

Aida Lando, B.A.; Education, French. Thesis: The Role of Realia in Foreign Language Classes in High Schools of New York State.

Albert Hess Leisinger, A.B.; American History, Modern European History. Thesis: The Federal Act to Encourage Immigration, July 4, 1864.

William Gilman McCollom, A.B.; Dramatic Production, Dramatic Literature. Thesis: The Theatre of Maurice Maeterlinck.

Eleanor Frances Murphy, A.B.; Geomorphology, Mineralogy and Petrography. Thesis: Laboratory Experiments on the Development of Shoreline Features and Processes.

Sybil Blanche Saxton, A.B.; Literary Criticism, Old English. Essay: Wordsworth's Theory and Practice in Poetic Diction.

Sylvia Schutz, A.B.; Bacteriology, Histology, Biochemistry. Thesis: The Local Lesions and the Immunity Produced in Mice by the Inoculation of Vaccine Virus in Different Regions of the Skin and on the Cornea.

Ruth Upson, A.B.; American History, Government. Thesis: The Early Development of Four Finger Lakes Counties Being the Settlement and Agricultural History of Schuyler, Seneca, Tompkins and Yates Counties, New York from 1790 to 1870.

Charles Zachariah Wahl, A.B.; French Literature, French Language. Thesis: The Social Religion of Zola and the Relation of His Style.
Margaret Woodbridge, B.A.; German Literature, German Philology. Essay: The Life and Work of Agnes Miegel.

MASTERS OF ARTS IN EDUCATION

CONFERRED SEPTEMBER 29, 1937

Fred Augustus Bennett, A.B. Thesis: The Development of the Supervisory District in New York State.
Alfred Loren Colburn, A.B.
Edward VanCleft Cushman, A.B.
Morris Clinton Miller, A.B.
Charles Enos Wingo, A.B. Thesis: A Study of Methods Used by Employers in Selecting High School Principals.
Nelson Chester Wood, B. S.

CONFERRED FEBRUARY 9, 1938

Raymond Tandy Byrne, A. B.

MASTERS OF SCIENCE

SEPTEMBER 29, 1937

Russell Byron Ace, B.S.; Animal Husbandry, Farm Management. Thesis: I. The Effect of Quality and Variety of Hay on the Amount Consumed by Dairy Heifers. II. An Attempt to Determine the Additional Amount of Concentrates Required in Feeding Low Quality Hay as Compared to that of High Quality in Producing Equal Gains with Dairy Heifers.
Ti Hua Cheng, A.B.; Plant Breeding, Agronomy. Thesis: Studies in Cotton Breeding for the Improvement of Fiber.
Ti Chiu Chiang, A.B.; Plant Breeding, Agronomy. Thesis: A Statistical Analysis of Field Technique Used in Cotton Improvement.
Alfred Knute Clark, A.B.; Plant Physiology, Cytology. Thesis: The Effect of a Temperature Gradient on the Distribution of Water in the Fruits of Apples, Tomatoes, and Oranges and the Tubers of Potatoes.
Mary Purnell Dupuy, B.S.; Rural Social Organization, Rural Education. Thesis: Sociology of a Neighborhood Group.
Mark Bancroft Ford, B.S.; Bacteriology, Dairy Industry. Thesis: A Microscopic Method for the Differentiation of Living and Dead Bacteria in Milk.
Elizabeth Gowen, B.S.; Zoology, Education. Thesis: A Comparison of the Appendicular Skeleton of *Zapus* and *Napaeozapus*.
Homer Alexander Jack, B.S.; Nature Study, Vertebrate Zoology. Thesis: Biological Field Stations, Their History, Organization, Educational Contributions and Conservation Relations.
Dorothy Jewett, B.S.; Botany, Ornithology. Thesis: A Botanical Survey of the South Mountain Reservation, Essex County, New Jersey, with Reference to the Woody Flora.
Leonard James Kezer, A.B.; Vertebrate Zoology, Chemistry. Thesis: A Preliminary Survey of the Fish, Amphibians, Reptiles and Mammals of an Area in the Vicinity of Summit, New Jersey.
Carl Lamanna, B.S.; Bacteriology, Cytology. Thesis: The Role of the Coat in the Resistance to Moist Heat of Bacterial Endospores as Indicated by Modes of Germination.
Erma Ruth Lewis, B.S.; Economics of the Household, Foods and Nutrition. Thesis: A Study of Institution Buyers' Preferences for Potatoes with Regard to Their Selection and Use.
Reha Johnson Loosli, B.S.; Family Life, Economics of the Household and Household Management. Thesis: A Comparison of Life History and Questionnaire Methods in the Study of Family Relationships.

Paul Raymond Matvey, A.B.; Analytical Chemistry, Physical Chemistry. Thesis: The Conductometric Titration of Mixtures of Nitric and Sulfuric Acids.

Harold Grove Meyers, B.S.; Botany, Geology. Thesis: The Genundewa Limestone.

Edwin Theodore Moul, B.S.; Entomology, Ornithology. Thesis: The Membracidae of York County, Pennsylvania, with Notes on Their Distribution and Biology.

Grace Agnes Petersen, B.S.; Mycology, Pomology. Thesis: An Annotated Check List of the Erysiphaceae of the Cayuga Lake Basin.

Ralph Goodwin Roop, B.S.; Marketing, Prices and Statistics. Thesis: A Study of the Cost of Operation of Farmer-Owned Motor Trucks in the Marketing of Fruits and Vegetables.

William Martin Smith, Jr., B.S. in Agr.; Rural Social Organization, Rural Education. Thesis: Organization and Uses of Rural Community Buildings in New York State.

Nellie Frances Tidline, B.S.; Economics of the Household, Family Life. Thesis: A Study of the Participation in Household Tasks by Ten Negro Girls in Ithaca, New York, 1937.

Leendert Abraham VanMelle, B.S.; Plant Breeding, Cytology. Thesis: A Study of Wheat-Rye Hybrids.

Marion Aurelia Wood, B.S.; Household Management, Foods and Nutrition. Thesis: A Study in Quality and Economy in the Selection of Potatoes for Institutions.

FEBRUARY 9, 1938

Francois Andre Blanchard, L.S.A.; Farm Management, Marketing. Thesis: A Statistical Study of the Agricultural Problems of the Province of New Brunswick, Canada.

William George Bodenstein, B.S.; Taxonomic Entomology, Vertebrate Zoology. Thesis: A Revision of the Nearctic Cuckoo-wasps (Hymenoptera: Chrysididae) of the Tribe *Elampini* and The Genotypes of the Chrysididae of the World.

Alfred Roland Camirand, B.S. in Agr.; Marketing, Dairy Industry. Thesis: An Economic Study of Creamery Operation in Quebec, with Particular Reference to the Proposal for Consolidation of Creameries.

Mary Eleanor Davis, A.B.; Insect Ecology, Vertebrate Zoology. Thesis: A Preliminary List of the Odonate Fauna of the Virginia Peninsula.

Ruth Elaine Henderson, B.S.; Economics of the Household and Household Management, Family Life. Thesis: A Study of Dishwashing as a Routine Household Task.

Eleanor Fisher Horsey, A.B.; Agricultural Chemistry, Biochemistry. Thesis: A Study of Some Factors Influencing the Physical and Chemical Constants of Milk, in Particular the Acidity.

Jerome Russell Hurd, B.S.; General Science in Secondary Schools, Educational Psychology. Thesis: An Evaluation of Certain General Science Textbooks on the Basis of Their Contributions to Health Education.

Charles Alfred John, B.S. in Ed., M.Ed.; Plant Physiology, Plant Breeding. Thesis: Temperatures in Plant Tissues and Factors Influencing Them.

Eleanor Elaine Knowles, B.S.; Economics of the Household and Household Management, Family Life. Thesis: The Most Tiring Household Tasks as Reported by 582 Homemakers, New York, 1937.

Henry Richard Kreisel, D.V.M.; Animal Pathology, Neuroanatomy. Thesis: A Comparative Study of the Manifestations and Histopathology of Canine Distemper and Experimental Fox Encephalitis Infection in Dogs.

Wallace Hudson Rankin, B.S. in Ed.; Ornithology, Nature Study. Thesis: The Life History and Distribution of the Chipping Sparrow, *Spizella passerina* passerina (Bech.).

Victor Rodriguez-Rosas, Doctor; Pathogenic Bacteriology, Animal Pathology. Thesis: Observations upon the Occurrence of Pasteurelia in a Herd of Calves after an Outbreak of Hemorrhagic Septicemia.

Merle Laurence Rogers, B.S.; Rural Education, Farm Management. Thesis: A Statistical Study of Vocational Education in the Central Rural Schools of New York State.

Henderika Jacoba Rynbergen, B.S.; Physiology, Biochemistry. Thesis: Respiratory Metabolism in Fructosuria.

Robert Russell Scidmore, B.S.; Chemistry, Education. Thesis: An Improved Method for the Quantitative Determination of Copper in Foods.

Sidney Joseph Silverman, B.S.; Bacteriology, Biochemistry. Thesis: A Study of the Lactobacilli of Human Feces.

John Ezra Trainer, B.S.; Ornithology, Vertebrate Zoology. Thesis: The Pterylography of the Ruffed Grouse.

Carlton Eugene Wright, B.S. in Ag.; Agricultural Engineering, Agricultural Education. Thesis: A Study of the Needs for Training in Farm Shop in High School Departments of Vocational Agriculture in the State of Vermont.

CONFERRED JUNE 20, 1938

George Willard Berry, A.B.; Structural Geology, Economic Geology. Thesis: The Relation of Fracture Cleavage to Faults.

Luis Bramão, Eng. of Agronomy; Soils, Physical Chemistry. Thesis: A Study of Some of the Morphological, Physical, and Chemical Characteristics of the Ontario Loam Profile.

Robert Lewis Brandaur, B.S.; Inorganic Chemistry, Analytical Chemistry. Thesis: The Deposition of Boron from the Hydrides of Boron and from Boron Tribromide.

Robert Avery Butcher, B.S.; Prices and Statistics, Marketing. Thesis: Index Numbers of Prices, Received by Producers for Basic Commodities in Mississippi, 1909–1938.

Gordon Mann Cairns, B.S.; Animal Husbandry, Veterinary Physiology. Thesis: The Relative Net Energy Values of Distillers Corn Dried Grains and Brewers Dried Grains for Fattening Lambs.

Donald Fergus Campbell, B.S.; Economic Geology, Structural Geology. Thesis: Geology of the Bonanza King Mine, Humboldt Range, Pershing County, Nevada.

Donald Rolfe Cordy, B.A., D.V.M.; Pathogenic Bacteriology, Animal Pathology. Thesis: A Study of the Intradermal Allergic Test for Brucellosis in Guinea Pigs.

Robert Lee Crowell, B.S. in Ed.; Medical Entomology, Limnology. Thesis: Study of the Flight Range of *Anopheles quadrimaculatus* Say. Experimental Results Obtained at Town Creek, Alabama.

Henry Meade Doremus, A.B.; Vertebrate Zoology, Parasitology. Thesis: Winter Food Habits of the Cottontail Rabbit in the Vicinity of Ithaca, N. Y.

Frank Leslie Dorn, B.S.; Bacteriology, Dairy Chemistry. Thesis: An Experimental Proof of the Four Temperature Optima of Bacteria.

Elizabeth Winifred Eckert, B.S.; Vertebrate Zoology, Nature Study. Thesis: The Circulatory System of the Thoracic Region of the Muskrat (Ondatra zibethica) with Special Reference to Its Homologies in the White Rat (Rattus norvegicus).

Johannes Stephanus Frick, B.Comm.; Prices and Statistics, Farm Management. Thesis: The Influence of Rainfall on Wheat and Corn Yields in Kansas and Nebraska.

Louise Evangeline Greer, B.S.; Economics of the Household, Family Life. Thesis: Efficiency in the Arrangement of Equipment and Materials for the Performance of a Common Task in Food Preparation.

Helen Hecht, A.B.; Plant Physiology, Genetics. Thesis: The Relation of Stomatal Behavior to Yield in Inbred and Crossbred Corn.

James Arnold Henderson, B.V.Sc.; Diseases of Large Animals, Animal Nutrition. Thesis: Observations on Reproduction and Associated Conditions in a Herd of Dairy Cattle.

Robert Francis Holland, B.S.; Dairy Industry, Administrative Engineering. Thesis: A Study of Composite Milk Samples.

Benwyll Chao-Ming Hung, B.S.; Bacteriology, Animal Physiology. Thesis: The Relationship between the A Factors of Bovine and Human Origin and the Forssman Antigen.

Margaret Philbrick Kellogg, B.A.; Histology and Embryology, Cytology. Thesis: The Development of the Periovarial Sac in the White Rat.

Frank Leon Le Roy, A.B.; Geography, Economic Geology. Thesis: Outlet History of Peri-glacial Cayuta Lake.

Harry Alexander MacDonald, B.S.; Field Crop Production, Plant Breeding. Thesis: A Study of the Effect of Fertilizer Applications on Change of Botanical Composition of Pasture Swards.

Ethelbert Cowley Martin, B.S.A.; Apiculture, Insect Morphology. Thesis: The Hygroscopic Properties of Honey.

Sheldon Rhodes Merritt, B.S. in Agr.; Rural Education, Farm Management. Thesis: The Achievements of Certain Cornell University Students Who Offered Entrance Credit in Vocational Agriculture. A Comparison with a Similar Group of Students with Traditional Entrance Credit.

Elizabeth Pittman Neuschwanger, B.S.; Child Nutrition, Family Life. Thesis: Eczema in Infants and Young Children. A Review of Some Literature and A Summation of Cases Which Have Come under The Care of a Nutritionist.

Mabel Frances Pavek, B.S.; Animal Husbandry, Farm Management. Thesis: Complete Dairy Herd Records.

Robert Ryer, III, B.S.; Zoology, Histology and Embryology. Thesis: Contributions to the Life History of *Notropis cornutus cornutus* (Mitchill).

Maud Schaeffer, B.S., B.S. in Agr.; Nature Education, Meteorology. Thesis: A Study of the Consideration Given Color in Elementary Science Programs with Suggestions Associated with the Teaching of This Subject.

Eleanor B. Schempf, B.S.; Child Nutrition, Family Life. Thesis: The Stimulating Effect of Cocoa.

John Charles Scholes, B.S.A.; Animal Breeding, Histology and Embryology. Thesis: Artificial Induction of Hypertermia in Chicks.

Hsien Yao Shen, B.S.; Farm Management, Prices and Statistics. Essay: Crop Reporting in China. A Study of the Present Scope and Work with Possible Future Development.

Henry Thomas Skinner, B.S.; Ornamental Horticulture, Plant Physiology. Thesis: Experiments in the Propagation of Rhododendrons and Other Ericaceous Plants by Cuttings.

Theodore Doremus Slocum, A.B.; Anatomy-Neurology, Physiology. Thesis: An Atlas of The Histological Structure of the Muskrat Brain.

Lucile Grant Smith, B.S.; Ornamental Horticulture, Floriculture. Thesis: Teaching Floriculture and Ornamental Horticulture in New York State through the Use of Local Leaders.

Robert Dean Sweet, B.S. in Ed.; Vegetable Crops, Plant Physiology. Thesis: Root Distribution of Carrots, Lettuce, and Onions in Peat Soils.

James Howard Watson, D.V.M.; Diseases of Small Animals, Veterinary Obstetrics. Thesis: Some Observations on Allergic Skin Reactions in Dogs.

Lien Ken Yin, B.S.; Farm Management, Rural Social Organization. Thesis: An Economic Study of Land Utilization in the Town of Ellington, Chautauqua County, New York.

MASTERS OF SCIENCE IN EDUCATION

CONFERRED SEPTEMBER 29, 1937

Erwin Kenneth Allen, B.S. in Ed.
Gordon Forrest Allen, A.B.
Harold Linton Baine, A.B.
Irma Meredith Bates, B.S.
Anthony George Borzelle, B.S. in Ed.
Clarence VanDusen Cripps, B.S.
Richard Collier Crosby, B.S. Thesis: A Study of the Status of the Critic Teacher of Science in the Cooperating Public Secondary Schools of the Eastern United States.
Ward Rogers Ellsworth, B.S.
Katherine Margaretha Findeisen, B.S.
Elswood Smart Hill, B.S. in E.E.
George Owen Hollibaugh, B.S. in Ed.
Francis Samuel Hungerford, B.S.
Maude Marian Mitchell Jeffers, A.B.
Harold Frank McGraw, A.B.
Gertrude Smith Mapes, B.S.
Leonidas James Smith, B.Sc.Agr. Thesis: A Building Program for the Massillon Public Schools, Massillon, Ohio.
Alden Taylor Stuart, B.S.
Roscoe C. Tarbell, Jr., B.S. in Bus. Adm.

CONFERRED FEBRUARY 9, 1938

Grace Jenny Bowell, B.S.
George Edgar Lattin, B.S.
Clifford Merle Peck, A.B.

CONFERRED JUNE 20, 1938

Irma Leona Coleman, B.S.
Charles Franklin Eshelman, A.B.
Ernest Carl Grant, B.S. in Agr.
Raymond Morrison Handville, B.S.
Earl Hampton McClenney, B.S.
Helen Virginia MacGregor, B.S. in Com.
Earl Fletcher Martin, B.S. Ed. Ag.
John Robert Neely, B.S.; Thesis: A Study of Arithmetic Accomplishment in the Nichols Schools.
Forrest Everett Pratt, B.S.
Lawrence Carlyle Ross, A.B.
George Haxton Salisbury, B.S.
Kenneth Albert Wright, A.B.

MASTERS OF SCIENCE IN AGRICULTURE

CONFERRED SEPTEMBER 29, 1937

Metellus Eugene Cravens, Jr., B.S. in Agr.; Marketing, Farm Management. Thesis: An Economic Study of Retail Chain Store Preferences for Potatoes in Cleveland, Ohio.
Lester Eugene Hanson, B.S.; Animal Husbandry, Animal Nutrition. Thesis: Vitamin A and D and Protein Supplements for Growing and Fattening Fall Pigs in Dry Lot.
Cheng-yao Lin, B.S.; Plant Breeding, Agronomy. Thesis: The Technique Involved in the Breeding of Sugar Cane.
Hollis Eldon Throckmorton, B.S.; Marketing, Rural Education. Thesis: An Economic Study of the Marketing of Potatoes in Ohio, 1933.

CONFERRED FEBRUARY 9, 1938

Horace Cotten Holmes, B.S. in Agr.; Farm Management, Marketing. Thesis: A Study of Farm Organization in Southeastern Gibson County, Tennessee, 1935.

Vicente Medina-Bem, B.S. in Agr.; Farm Management, Marketing. Thesis: Economic Aspects of the Coffee Industry of Puerto Rico.

CONFERRED JUNE 20, 1938

Frank Victor Beck, B.S.; Farm Management, Marketing. Thesis: A Study of the Agricultural Conservation Program in Wyoming County, New York, 1937.

Paul Eugene Doyle, A.B., B.S. in Agr.; Marketing, Statistics. Thesis: The Marketing of Potatoes in the Province of Quebec.

John Dennett Guthrie, B.S.; Agronomy, Plant Breeding. Thesis: Placement of Fertilizers with Respect to Certain Field and Vegetable Crops.

Waller Calhoun Hurley, B.S.A.; Animal Husbandry, Dairy Industry. Thesis: I. The Effect of Quality and Variety of Hay on the Amount Consumed and Gains Made in Weight by Dairy Heifers. II. Effect of Six Pounds of Concentrates and Low Quality Hay Compared with Effect of Three Pounds of Concentrates and High Quality Hay on Gains Made by Dairy Heifers.

Lewis Ivy Jones, B.S.; Agronomy, Farm Management. Thesis: The Effects of Green Manure Crops on Soil Fertility.

Kenneth John McCallister, B.S. in Agr. Bus.; Farm Management, Prices and Statistics. Thesis: An Economic Study of Poultry Farming in Western Washington 1936 and 1937.

Jean-Marie Martin, A.B., B.S.A.; Marketing, Prices. Thesis: A Study of the Receipts and Purchasing Power of Hogs on the Chicago, Winnipeg, Toronto, and Montreal Markets, 1923–1937.

George Claggett Sprinkle, B.S. in Agr.; Vegetable Crops, Pomology. Thesis: Growing Tomato Plants for Field Setting. An Annotated Bibliography.

Clay McAllister Webb, Jr., B.S.; Vegetable Crops, Soils. Thesis: The Effect of Certain Environmental Conditions on the Development of Blackheart of Celery.

MASTERS OF FORESTRY

CONFERRED SEPTEMBER 29, 1937

Herbert Joseph Mols, B.S.; Forest Utilization, Marketing. Thesis: Hardwood Utilization in the Adirondacks.

Robert Arthur Van Order, B.S.; Forest Management, Silviculture. Thesis: An Analysis of the Growing Stock in Permanent Sample Plots at the Arnot Forest.

Fred Everett Winch, Jr., B.S.; Silviculture, Forest Management. Thesis: The Establishment, Survival, and Early Development of Broadleaved Plantations in New York State.

CONFERRED FEBRUARY 9, 1938

Frank Alorino Rotundo, B.S.; Forest Policy, Forest Management. Thesis: The Recreational Management of Public Forests Including a Recreational Management Plan for the Ten Mile River Reservation, New York.

MASTER OF LAWS

CONFERRED JUNE 20, 1938

J. Edward Collins, A.B., LL.B.; Public Law, Jurisprudence, Organization and Control of Industry.

MASTERS OF CHEMISTRY

CONFERRED SEPTEMBER 29, 1937

Seaman Joseph Tanenhaus, B.Chem.; Physical Chemistry, Organic Chemistry. Thesis: Electrolysis of Potassium Acetate.

CONFERRED JUNE 20, 1938

George Edward Pellissier, Jr., B.Chem.; Metallography, Industrial Chemistry. Thesis: An Investigation of the Alleged High-Temperature Modication of Tin by X-Ray Analysis and Microscopical Examination at Elevated Temperatures.

MASTER OF ARCHITECTURE

CONFERRED JUNE 20, 1938

Donald Trotter Houpt, B.Arch.; Architectural Design, Architectural Construction.

MASTER OF FINE ARTS

CONFERRED SEPTEMBER 29, 1937

Margaret Louise Schramm, A.B.; Dramatic Production, Dramatic Literature. Thesis: The Art of the Mise en Scène. An Essay on the Aesthetics of the Theatre, Being a Translation of L'Art de la mise en scène, Essai d'esthetique theatrale by L. A. V. Becq de Fouquières.

MASTER OF LANDSCAPE ARCHITECTURE

CONFERRED JUNE 20, 1938

Richard Leroy Yeager, A.B., B.Fine Arts; Landscape Design, City Planning. Thesis: The Design of a Recreational Park for Columbus, Ohio.

MASTERS OF SCIENCE IN ENGINEERING

CONFERRED SEPTEMBER 29, 1937

Bartholomew Joseph Conta, B.S.; Experimental Mechanical Engineering, Mathematics. Thesis: Individual Coefficients of Heat Transmission in the Condensation of Steam.

Ku Shung Hu, B.S. in C.E.; Structural Engineering, Architectural Design. Thesis: The Design of a High School Building.

Clinton Ellicott Pearce, S.B.; Machine Design, Mechanics. Thesis: Analysis of Articulated Connecting Rod Assemblies.

George John Tauxe, Jr., B.S.; Soil Mechanics, Mechanics. Thesis: Shear Tests on Soils.

Hsien Yu Tsai, B.S. in C.E.; Structural Engineering, Railroad Management. Thesis: Design of a Manufacturing Plant.

Kyi Ngauh Waung, B.S. in C.E.; Structural Engineering, Railroad Engineering. Thesis: The Investigation of Reinforced Concrete Building Design.

CONFERRED FEBRUARY 9, 1938

Cecil Werner Armstrong, B.S. in M.E., M.E.; Mechanics, Mathematics. Thesis: The Effect of Temperature on the Physical and Optical Properties of Photoelastic Materials.

CONFERRED JUNE 20, 1938

Walter Hayes Fush, B.S.; Electric Power Generation, Transmission and Distribution; Electric Power Applications. Thesis: A Study and An Analysis of a Ratio Differential Relay Used for the Protection of Transformers.

Oscar Ilagan Ilustre, B.S.C.E.; Sanitary Engineering, Highway Engineering. Thesis: The Development of Sanitary Conditions in the Philippines.
S-Yoen Kuai, B.S. in C.E.; Railroad Engineering, Highway Engineering. Thesis: A Study of Maintenance of Way.
Cheng-hsi Shi, B.C.E.; Hydraulic Engineering, Railroad Engineering. Thesis: Design of Lock.

MASTERS OF CIVIL ENGINEERING

Conferred September 29, 1937

Hsia-Shih Hsu, B.S.; Structural Engineering, Hydraulic Engineering. Thesis: Analysis and Comparison of Multi-span Arch and Double Rigid Frame Bridges.
Ping-Cheng Lee, B.S. in C.E.; Railway Engineering, Structural Engineering. Thesis: Study on Railway Location and Its Application to Chinese Railways.
Chen-hsu T'ang, B.S.C.E.; Hydraulic Engineering, Railroad Engineering. Thesis: The Design and Construction of Earth Dam Embankment.

Conferred February 9, 1938

Ting Chien, B.S.C.E.; Structural Engineering, Railroad Engineering. Thesis: Reinforced Concrete Building Design.
Yueh Chow, B.S.C.E.; Structural Engineering, Regional Planning. Thesis: Comparative Designs of a Two-Hinged Steel Arch and a Two-Hinged Concrete Arch.
Kabir Mohammad Ludin, C.E.; Hydraulic Engineering, Structural Engineering. Thesis: A General Review of the Problems in Irrigation.
Hsing Wang, B.S. in C.E.; Structural Engineering, Railroad Engineering. Thesis: Analysis and Design of Rigid Frame Bridge.
William Chen Yu, B.E.; Structural Engineering, City and Regional Planning. Thesis: Comparative Designs of a Rigid Frame Bridge and a Hingeless Arch.

Conferred June 20, 1938

Quentin Willet Bernhard, C.E.; City and Regional Planning, Organization and Control of Industry. Thesis: Causes and Effects of Railway Abandonment in Relation to Transportation Problems.
Chiu Cheng Chen, B.C.E.; Structural Engineering, Regional Planning. Thesis: Continuity in Rigid Frame Structures.
Tien Tang Kan, C.E.; Structural Engineering, Railway Engineering. Thesis: Analysis of Rigid Frame Concrete Highway Bridges.
Shih-hao Li, B.S. in C.E.; Hydraulic Engineering, Railroad Engineering. Thesis: Economy of Pondage in Water Power.
Carl Frederick Meyer, B.S. in C.E., C.E.; Highway Engineering, Sanitary Engineering. Thesis: The Economics of Highway Traffic Delays.
Edgar Charles Sonderman, B.C.E.; Structural Engineering, Railroad Engineering. Thesis: Economics of Concrete Floor Design.
Yih Tan, B.S. in C.E.; Structural Engineering, Railroad Engineering. Thesis: Strengthening of Existing Metallic Bridges by Arc Welding.
Kwei-feng Tao, B.S. in C.E.; Structural Engineering, Hydraulic Engineering. Thesis: Analyses of a Single Span Rigid Frame Bridge.

MASTER OF ELECTRICAL ENGINEERING

Conferred June 20, 1938

Chang-Pen Hsu, B.S. in E.E.; Electric Circuit Analysis, Hydraulic Engineering. Thesis: Some Generalized Analytical Solutions of Unsymmetrical Faults in a Three-Phase Network.

MASTERS OF MECHANICAL ENGINEERING

CONFERRED SEPTEMBER 29, 1937

Frederick Seward Erdman, B.S., B.S. in M. E.; Hydraulic Engineering, Experimental Engineering. Thesis: Jet or Hydraulic Propulsion.

James Floyd Hirshfeld, A.B., M.E.; Experimental Engineering, Materials of Engineering. Thesis: An Investigation of the Stress-Strain Curve of Vulcanized Rubber at Low Elongations.

Floyd Cleveland Knight, M.E.; Air Conditioning, Wood Utilization. Thesis: Cold Storage for Apples.

CONFERRED JUNE 20, 1938

Leo Charles Pigage, M.E.; Industrial Engineering, Administrative Engineering. Thesis: A Study of Industrial Training.

DOCTORS OF PHILOSOPHY

CONFERRED SEPTEMBER 29, 1937

Elmer Bruce Ashcraft, B.S., M.S.; Optical Chemistry, Analytical Chemistry, Physical Chemistry. Thesis: Tri Sodium Phosphate — Sodium Fluoride: Analytical Methods and Phase Studies.

Frederick Milton Baumgartner, A.B., A.M.; Ornithology, Vertebrate Zoology, Entomology. Thesis: A Study of the American Horned Owls (*Bubo virginianus*).

Damon Boynton, B.S.; Pomology, Plant Physiology, Soils. Thesis: A Study of the Seasonal Fluctuations of Moisture in Several Important New York Orchard Soil Types.

Norman Franklin Childers, B.S. in Agr., A.M.; Pomology, Plant Physiology, Plant Anatomy. Thesis: The Influence of Certain Nutrients on the Photosynthetic Activity of Apple Leaves.

Charles David Cooper, B.S., M.S.; Elementary Education, Educational Psychology, Rural Social Organization. Thesis: The Reactions of Sixth Grade Children to Commercial Motion Pictures as a Medium for Character Education.

Joseph Barr Corns, B.S., M.S.; Vegetable Crops, Pomology, Plant Physiology. Thesis: A Study of the Influence of Certain Factors on the Internal Structure of the Tomato Fruit as Related to Puffing.

Earle Wilcox Crampton, B.S., M.S.; Animal Nutrition, Animal Physiology, Animal Husbandry. Thesis: The Relation Between the Content of Higher Polysaccharides of Forage and Its Feeding Value for Herbivora.

Hugh Gilchrist Dick, A.B., A.M.; Elizabethan Literature, Seventeenth Century Literature, Eighteenth Century Literature. Thesis: The Doctrines of the Ptolemaic Astronomy in the Literature of the English Renaissance.

Paul Joseph Findlen, B.S.; Marketing, Prices and Statistics, Finance. Thesis: An Economic Study of the Marketing of Western New York Potatoes by Motor Truck.

John Erwin Foster, B.S., M.S.; Animal Husbandry, Animal Nutrition, Genetics. Thesis: Comparison of Protein Supplements for Fattening Pigs.

Willis DeLancy Gallup, B.S., M.S.; Animal Nutrition, Biochemistry, Veterinary Physiology. Thesis: Biochemical Studies of the Perosis-Preventive Properties of Manganese.

Neil Henry Graham, B.S., A.M.; French, English, Spanish. Thesis: Louis Bouilhet as a Precursor of the Parnassian School.

Raymond William Gregory, B.S.A., M.S.A.; Agricultural Education, Educational Administration, Secondary Education. Thesis: Factors Influencing Establishment in Farming of Former Students of Vocational Agriculture.

Howard Marvin Hodge, B.S.; Bacteriology, Biochemistry, Dairy Industry. Thesis: A Study of Lactobacillus Bulgaricus and Related Organisms.

Macklin Elida John, B.S., M.S.; Rural Social Organization, Agricultural Economics, Educational Psychology. Thesis: Attitudes of Dairy Farmers Toward the Dairymen's League Cooperative Association (Otsego and Livingston Counties, New York, 1935).

Thomas Ogden King, B.S.A., M.S.; Farm Management, Marketing, Statistics. Thesis: Farm Implements in East Central China.

Pincus Philip Levine, B.S., D.V.M., M.S.; Poultry Diseases, Bacteriology, Entomology. Thesis: Observations on the Biology and Control of the Poultry Cestode *Davainea Proglottina* (Dav.).

Otto Karl Liedke, Eng. Agr.; German Literature, German Philology, French Literature. Thesis: Aktivismus und Passivismus in der erzählenden Prosa der modernen deutschen Literatur.

Lloyd Lincoln Lowenstein, A.B.; Mathematical Analysis, Geometry, Physics. Thesis: Linear Equations with an Infinity of Unknowns.

Max Molyneux, A.B.; Elizabethan Literature, English Language, English History. Thesis: *Hero-paideia* or *The Institution of a Young Noble Man by James Cleland.* Edited with Introduction and Notes. (In Two Volumes.)

Emory Aubert Mooney, Jr., A.B., A.M.; Victorian Literature, Elizabethan Literature, American Literature. Thesis: Tennyson and Modern Science.

Catherine Jane Personius, B.S., A.M.; Biological Chemistry, Bacteriology, Physical Chemistry. Thesis: Effect of Heat on Some Physical and Chemical Properties of Potato Tissue.

Lillian Aline Phelps, A.B., A.M.; Zoology, Chemistry, Genetics. Thesis: An Interpretative Study of the Anterior Circulation of *Siren* and *Triturus.*

Jacob Gerhard Rempel, B.S., M.S.; Insect Taxonomy, Ecology and Limnology, Parasitology. Thesis: Intersexuality in Chironomidae Induced by Nematode Parasitism.

Lynn Shelby Robertson, B.S.A., M.S.A.; Farm Management, Marketing, Economics. Thesis: Farming Systems, Trends, and Returns and the Conditions Affecting Them in the Portion of Northwestern Indiana Influenced by Local Industrial Development.

Ralph Wayne Rundles, A.B.; Anatomy, Histology and Embryology, Physiology. Thesis: Fiber and Cellular Degeneration Following Temporal Lobectomy in the Monkey.

John Albert Sanford, A.B.; Nineteenth Century English Literature, Criticism, Elizabethan Literature. Thesis: Dante: Rossetti: Pre-Raphaelitism. A Study in the Early Poetry of Dante Gabriel Rossetti.

James Whaples Sinden, A.B.; Plant Pathology, Physical Chemistry, Plant Physiology. Thesis: Bean Anthracnose — A Study of Infection.

William Arthur Smith, B.S. in Agr., M.S.; Rural Education, Rural Social Organization, Secondary Education. Thesis: The Professional Improvement Status of Teachers of Vocational Agriculture, and Its Relationship to Professional Advancement.

Mary Alice Sowers, B.S., A.M.; Family Life, Education, Social Psychology of the Family. Thesis: Parent-Child Relationships from the Child's Point of View.

Eugene Thorsten Stromberg, A.B., A.M.; Rural Social Organization, Rural Education, Rural Economy. Thesis: The Influence of the Central Rural School on Community Organization.

Joseph Galluchat Tarboux, B.S., E.E., M.E.E.; Electrical Transmissions, Electrical Applications, Mathematics. Thesis: Transient Stability of Power Systems.

William James Lord Wallace, B.S., A.M.; Physical Chemistry, Analytical Chemistry, Inorganic Chemistry. Thesis: The Freezing Points of Aqueous Solutions of Alpha Amino Acids.

Donald Fessenden Weekes, B.S., M.A.; Experimental Physics, Atomic Structure, Theoretical Physics. Thesis: Positions and Widths of Energy Levels of the Silver Nucleus.

Francis White Weitzmann, B.S., A.M.; Poetry, Elizabethan Literature, Middle English. Thesis: Elegy and Tragedy. A Comparative Study in Poetics.
Frederick Ludwig Will, A.B., A.M.; Logic and Epistemology, History of Philosophy, Psychology. Thesis: Formal and Material Truth. A Criticism of Idealistic Logic.

CONFERRED FEBRUARY 9, 1938

Joseph Tsung-Ping Chang, B.S., M.S.; Insect Ecology, Medical Entomology, Economic Entomology. Thesis: The Effect of Temperature upon the Dormancy of Insects.
Thomas Shelby Chapman, A.B., M.S.; Physical Chemistry, Chemical Microscopy, Analytical Chemistry. Thesis: The Anthocyanin Pigments.
John Parker Hertel, B.S.; Farm Management, Marketing, Economics. Thesis: An Economic Study of Farm Equipment in New York State.
Siang-long Hsiong, B.S., M.S. in Agr.; Pomology, Plant Breeding, Plant Physiology. Thesis: Studies on the Crosses of Kieffer Pear with Special Reference to the Inheritance of Dessert and Keeping Qualities, Disease Resistance and Other Plant Characters.
Peter Paul Kellogg, B.S.; Ornithology, Education, Electrical Engineering. Thesis: A Study of Bird Sound Recording.
George Lorant Lam, A.B., A.M.; English Language and Literature, Literary Criticism, Musicology. Thesis: Johnson's *Lives of the Poets:* Their Origin, Text, and History, with Remarks on Sources and Comment on His *Life of Cowley.*
Gabriel A. Lebedeff, B.S., M.S.; Plant Breeding, Cytology, Plant Pathology. Thesis: Study of Intersexuality in Drosophila Virilis.
Yung-Moon Lee, B.S.C.E., M.C.E.; Structural Engineering, Mechanics, Mathematics. Thesis: Mathematical Analysis of Cracks and Some Suggestions to the Experimenters in Photo-Elasticity.
Harry Morgan Love, B.S., M.S.; Farm Management, Marketing, Agricultural Prices and Statistics. Thesis: An Economic Study of Pasture in New York.
Burt Carlton Pratt, B.S. in Ch.E.; Organic Chemistry, Physical Chemistry, Industrial Chemistry. Thesis: Certain Addition Reactions of 1,3-Dienes.
Sterling Jacob Richards, B.S.; Experimental Physics, Theoretical Physics, Mathematics. Thesis: Hysteresis in the Relation Between Capillary Potential and Moisture Content of Porous Media.
Alfred Herman Rishoi, B.S., M.S.; Dairy Industry, Bacteriology, Physical Chemistry. Thesis: The Anomalous Specific Heat, Change in Volume and the Heat of Solidification of Milk Fat Between 0 and 40° C.
William Seward Salisbury, B.S., M.S. in Ed.; Rural Education, Government, Rural Sociology. Thesis: An Analysis of the West Leyden Central School Community and the Educational Implications Growing out of its Peculiar Characteristics, Resources, and Deficiencies.
Anastas Urdanoff Toteff, Agronomist; Statistics, Farm Management, Marketing. Thesis: Prices in Bulgaria, 1881–1935.
Virginia E. Trevorrow, A.B., M.S.; Biochemistry, Physiology, Pathology. Thesis: The Determination of Iodine in Biological Material and the Nature of the Iodine in Blood.
William Emil Utterback, A.B., A.M.; Public Speaking, Government, Psychology. Thesis: English and American Theory of Public Opinion.
Lung Fu Wang, B.S. in C.E., M.C.E.; Structural Engineering, Railroad Engineering, Mechanics. Thesis: Buckling of Rectangular Plates and Its Application to the Plate Girder.
Daniel Otis Wolfenbarger, B.S.; Economic Entomology, Apiculture, Plant Pathology. Thesis: Spraying and Dusting Potatoes on Muck-lands with Special Reference to Biology and Control of the Potato Flea-beetle, *Epitrix cucumeris* Harris.
Ernest Stanley Yawger, Jr., B.S.; Bacteriology, Organic Chemistry, Physical Chemistry. Thesis: *Streptococcus cremoris.*

CONFERRED JUNE 20, 1938

Raymond Clayton Allen, B.S.; Floriculture, Plant Physiology, Genetics. Thesis: The Influence of Aluminum on the Flower Color of Hydrangea macrophylla DC.

Margaret Altmann, Dr. Agr.; Animal Breeding, Animal Nutrition, Histology. Thesis: The Endocrine Basis for the Elevated Blood Calcium Level Associated with Reproduction in the Female Fowl.

Charles Luther Andrews, A.B.; Experimental Physics, Theoretical Physics, Mathematics. Thesis: The Absorption of Long Wave Length X-Rays.

Fred Cornell Baker, B.S., M.S.; Medical Entomology, Plant Physiology, Veterinary Pathology. Thesis: The Biology of Free-Water-Containing Tree-Hole Fauna in the Ithaca (N.Y.) Region, with Certain Studies on the Important Part Some of the Inhabitants Play in the Transmission of Human and Animal Diseases, and the Taxonomy of New Species.

Henry George Barone, A.B., A.M.; Analysis, Geometry, Prices and Statistics. Thesis: Limit Points of Sequences and Their Transforms by Methods of Summability.

Robert Hood Barth, A.B., M.S.; Organic Chemistry, Industrial Chemistry, Physical Chemistry. Thesis: The Relation of Molecular Structure and Chemical Reactivity: Cleavage of Benzils.

Sheridan Alba Berthiaume, B.S.; Paleontology, Sedimentation, Economic Geology. Thesis: Stratigraphy and Foraminiferal Fauna of the Meganos and Vacaville Formations (Eocene) of California.

Charles Henry Bridges, B.Chem., M.Chem.; Industrial Chemistry, Organic Chemistry, Administrative Engineering. Thesis: Heat Transfer to Boiling Liquids.

Minnie Susan Buckingham, A.B., B.D., A.M.; Victorian Literature, English Prose Fiction, Romantic Period. Thesis: The Use of Religious Elements in the Fiction of Margaret Wilson Oliphant.

Milton Tomlinson Bush, B.Chem.; Organic Chemistry, Physical Chemistry, Biological Chemistry. Thesis: Arsenated Derivatives of Phenobarbital.

Cleo Chrisof, A.B.; Psychology, Neuroanatomy, Social Psychology. Thesis: The Formulation and Elaboration of Thought-Problems: An Experimental Study of Thinking.

Chris Jay Christensen, A.B., A.M.; Rural Education, Rural Social Organization, Economics. Thesis: The Significance of the School Garage as a Factor in Pupil Transportation.

Charles Erwin Clark, A.B., M.S.; Geometry, Applied Mathematics, Mathematical Analysis. Thesis: Simultaneous Invariants of a Complex and Subcomplex.

Victor Coles, B. S., A.M.; Ornithology, Rural Education. Botany. Thesis: Studies in the Life History of the Turkey Vulture (*Cathartes aura septentrionalis Wied*).

Charles Wilson Colman, A.B.; French Literature, French Philology, Spanish Literature. Thesis: Jean Richepin.

Joseph Fanning Drake, A.B., A.M.; Rural Education, Secondary Education, Rural Social Organization. Thesis: Occupational Interests and Opportunities as Determinants in the Construction of Curricula for a Negro Land-Grant College in Alabama.

Helen Louisa Drew, A.B., A.M.; Literary Criticism, Rhetoric, Milton. Dissertation: The Diction of Milton's Prose.

Reid Bingham Duncan, A.B., A.M.; American History, Modern European History, Government. Thesis: Papers Relating to American Agricultural Exports: 1830–1850.

James Lindsay Dyson, B.S., M.S.; Economic Geology, Structural Geology, Physical Geography. Thesis: Ruby Gulch Gold Mining District, Little Rocky Mountains, Montana.

John Norman Efferson, B.S., M.S. in Agr.; Farm Management, Marketing, Prices and Statistics. Thesis: An Economic Study of the Cost of Production and Marketing of Cauliflower, Lettuce, and Celery in New York, 1936.

Henry Martyn Estall, A.B., A.M.; History of Philosophy, Epistemology, Education. Thesis: Studies in the Philosophy and Psychology of Franz Brentano.

Cedric Evans, A.B., A.M.; Ethics, Modern Philosophy, Economic Theory and Its History. Thesis: The Ethical Philosophy of G. E. Moore and W. D. Ross.

Barbara Catharine Fretz, A.B., A.M.; American History, Modern European History, Education. Thesis: The Changing View in History with Special Reference to the History of Stephen A. Douglas.

Malcolm Bruce Galbreath, B.S., M.S.; Agricultural Education, Secondary Education, Farm Management. Thesis: The Discovery of Administrative Policies in Vocational Education in Agriculture According to Statements of Practice Expressed in the 1937–1942 Five-Year State Plans.

Ermanno Francis Gizzarelli, A.B., A.M.; Musicology, Italian Literature, History. Dissertation: An Historical Survey of Italian Folk Song and A Critical Estimate of Modern Research.

Arthur Leonard Goodrich, Jr., B.S., M.S.; Invertebrate Zoology, Insect Morphology, Vertebrate Zoology. Thesis: The Origin and Fate of the Entoderm Elements in the Embryology of *Porcellio laevis* Latr. and *Armadillidium nasatum* B. L. (Isopoda).

Leonard Joyce Goss, D.V.M.; Veterinary Pathology, Veterinary Bacteriology, Biochemistry. Thesis: A Survey of the Mortality in Farm Poultry Flocks with Special Reference to the Incidence of Tumors.

Edward Kidder Graham, A.B., A.M.; Medieval History, Ancient History, Modern European History. Thesis: Anglo-Saxon Vassalage.

Mildred Jean Headings, A.B., A.M.; Modern European History, American History, Reformation History. Thesis: The Development of the Newspaper from the Pamphlet.

Alida Shangle Hotchkiss, B.S., M.S.; Economics of the Household, Statistics, Marketing. Thesis: Consumer Practices in Buying Potatoes in Relation to Store Offerings: A Study of Consumer Demand. Cleveland, Ohio, March 1936 and October-December, 1936. Rochester, New York, January-February, 1937.

Russell A. Hyre, B.S.; Plant Pathology, Plant Physiology, Physical Chemistry. Thesis: The Effect of Sulfur Fungicides on the Photosynthesis and Respiration of Apple Leaves.

Orme Julius Nies Kahlenberg, B.S., M.S.; Dairy Industry, Animal Nutrition, Biochemistry. Thesis: A Method for the Determination of Glucose, Galactose, and Lactose in Admixture and Its Application in the Study of Lactose Hydrolysis in the Alimentary Tract of the Rat.

Sister Margaret Teresa Kelley, A.B., M.A.; Literary Criticism, English Language, Seventeenth Century Literature. Dissertation: The Influence of Dante's Paradiso upon Milton.

Rodney Kenneth Ketcham, A.B., A.M.; French Literature, French Philology, Musicology. Thesis: A Critical Analysis of the Novels of Rene Bazin.

Tseh Liang Kwan, B.S.; Plant Breeding, Marketing, Agronomy. Thesis: A Genetic Study of Certain Spike and Kernel Characters in a Cross between Chinese and American Wheat.

Eleazer Lecky, A.B., A.M., LL.B.; The Romantic Period, Eighteenth Century Literature, Elizabethan Literature. Thesis: Meaning and Metaphor.

Charles Gatewood Lincoln, B.S.A.; Economic Entomology, Morphology of Insects, Pomology. Thesis: Ecological Studies on the Alfalfa Snout Beetle, *Brachyrhinus ligustici* (L.).

Karla Longree, Dr. Agr.; Plant Pathology, Mycology, Bacteriology. Thesis: Studies on the Effect of Temperature and Relative Humidity on the Powdery Mildew of Roses.

Reuben Roosvelt McDaniel, B.S., M.S.; Algebra, Analysis, Physics. Thesis: Approximation to Algebraic Numbers by Means of Periodic Sequences of Transformations on Quadratic Forms.

Arlie Estus McGuire, B.S.A., M.S.; Rural Secondary Education, Rural Social Organization, Elementary Education. Thesis: Knowledge, Ability and Attitude Alignments of Secondary School Pupils as Related to Certain Current Social Problems.

Bassett Maguire, B.S.; Taxonomy, Paleobotany, Comparative Morphology. Thesis: A Monograph of the Genus Arnica. Part I. The Subgenera Arctica and Austromontana.

Cecilia Charlotte Mettler, A.B., A.M.; American History, European History, Constitutional Law. Thesis: A Biographical Sketch of Christopher Gadsden.

Albert Miller, B.S., M.S.; Entomological Embryology, Insect Taxonomy, Vertebrate Embryology. Thesis: Embryological Studies on the Stonefly, *Pteronarcys proteus* Newman (Plecoptera, Pteronarcidae).

George Edward Moreland, B.S., M.S.; Invertebrate Zoology, Medical Entomology, Ornithology. Thesis: *Telorchis Ambystomae* sp. nov. (*Telorchiinae, Plagiorchiidae, Trematoda*) : its structure, life cycle and classification, with a review of the genus *Telorchis* and its status.

Walter Julius Mueller, A.B., A.M.; German Literature, German Philology, French Literature. Thesis: Germanischer Mythos und Germanische Sage in Den Dramen Gerhart Hauptmanns.

Merritt Joseph Murray, B.S., A.M.; Genetics, Cytology, Zoology. Thesis: Interspecific and Intergeneric Crosses in the Family Amaranthaceae in Relation to Sex Determination.

Kaspar Osvald Myrvaagnes, B.S., A.M.; German Literature, German Philology, Old Norse. Thesis: A Study of the Development of Goethe's Attitude toward the Social Classes of His Time.

Channing Clarke Nelson, B.Chem.; Industrial Chemistry, Organic Chemistry, Physical Chemistry. Thesis: The Rate of Absorption of Carbon Dioxide by Solutions of Monoethanolamine in a Hurdle Tower.

George David Oberle, B.S. in Agr., M.S.; Plant Breeding, Pomology, Cytology. Thesis: A Genetic Study of Floral Morphology and Function in Cultivated Forms of Vitis.

Carroll Hepburn Owen, A.B., A.M.; German, German Philology, Latin. Thesis: The Treatment of History in Gerhart Hauptmann's Dramas.

Henry E. Paul, B.S.; Animal Nutrition, Biochemistry, Physiology. Thesis: Fat Utilization by Herbivora. I. The Influence of the Melting Points of Fats on Their Utilization by Herbivora. II. The Effect of Feeding to Guinea Pigs Butter Fat from Cows Receiving Cod Liver Oil.

Henry Jewett Pettit, Jr., A.B., A.M.; Literary Theory, 18th Century English Literature, 17th Century Literature. Thesis: A History of Young's *Night Thoughts* (exclusive of translations).

Venia Tarris Phillips, B.S., M.S.; Insect Morphology, Botany, Zoology. Thesis: The Biology and Identification of Trypetid Larvae.

William Winfield Ray, B.S., M.S.; Mycology, Bacteriology, Botany. Thesis: Contributions to Knowledge of the Genus Taphrina in North America.

Ruth Elizabeth Remsberg, B.S., M.S.; Plant Pathology, Cytology, Genetics. Thesis: Studies in the Genus *Typhula* Fries.

Mathias Cowley Richards, B.S.; Plant Pathology, Entomology, Plant Physiology. Thesis: Studies on the Downy Mildew of Spinach and the Causal Organism *Peronospora spinaciae* Laubert.

Richards Atwell Rowland, Geol. Engineer; Structural Geology, Economic Geology, Optical Mineralogy. Thesis: A Petrotectonic Analysis of Cleavage in Otherwise Unmetamorphosed Sediments.

Richard Leigh Sawyer, B.S., A.M.; Organic Chemistry, Biochemistry, Physical Chemistry. Thesis: A Study of Certain Cyclic Vinyl Ethers. Investigation of a Natural Fungicidal Principle.

Fisk William Stocking Scudder, B.A.; Cytology, Histology and Embryology, Biochemistry. Thesis: Spermatogenesis in Desmognathus Fuscus.

Dwight Ellsworth Sollberger, B.S. in Ed.; Vertebrate Zoology, Economic Botany, Nature Study. Thesis: Notes on the Life History of the Small Eastern Flying Squirrel *Glaucomys volans volans* (Linnaeus).

Harold Foster Spencer, A.B., M.S.; Cytology, Genetics, Bacteriology. Thesis: The Nuclear Cycle in Certain Centric Diatoms.

Bernard Stambler, A.B., A.M.; The English Language and Literature, Musicology, English History. Thesis: Terence in Europe to the Rise of Vernacular Drama.

Chester G. Starr, jr., A.B., A.M.; Ancient History, Mediaeval History, Latin. Thesis: The Roman Imperial Navy to the Age of Diocletian.

Clyde Sherman Stine, A.B., A.M.; Education, Rhetoric, and Public Speaking, Speech and Phonetics. Thesis: Problems of Education among the Pennsylvania Germans.

Daniel Cramer Swanson, B.S., S.B.; Experimental Physics, Thermodynamics, Theoretical Physics. Thesis: Energy Losses of Fast Neutrons in Scattering by Lead and Iron.

Siang Yu Tang, B.S., M.S.; Plant Breeding, Plant Physiology, Agronomy. Thesis: Inheritance of Spikelet Characters in Oat Crosses Involving Early Ripe and Two Strains of Avena Sterilis Macrocarpa.

Richard Martin Tisinger, B.S., M.S.; Rural School Administration, Rural Social Organization, Rural School Supervision. Thesis: A Uniform System of Cost Accounting of School Transportation.

John Schrader Tremper, A.B., A.M.; German Literature, Germanic Philology, Philosophy. Thesis: A Study of the Technique in August von Kotzebue's Serious Dramas.

Eugene Tu, B.S.C.E., M.C.E.; Structural Engineering, Mechanics, Sanitary Engineering. Thesis: A Method of Analysis for the Study of the Integral Arch Action of Open-Spandrel Concrete Arches.

Elizabeth Grace Van Buskirk, A.B., A.M.; Latin, Ancient History, Greek. Thesis: Seneca's Use of the Historical *Exemplum*.

Ahmes Pinto Viegas, Agr. Eng.; Plant Pathology, Mycology, Plant Anatomy. Thesis: The White Smut of Water Lilies.

Ellis Flower Wallihan, B.S., M.S.; Forest Soils, Plant Physiology, Silviculture. Thesis: Light, Soil Moisture, and Nutrients as Factors Affecting the Response of Forest Vegetation to Trenching.

Hubert Judson Webb, B.S.; Soils, Analytical Chemistry, Plant Physiology. Thesis: Some Characters of Rhizobium as Influenced by Previous Symbiotudes.

Edith Webb Williams, A.B., A.M.; Rural Social Organization, Labor and Industrial Relations, Social Psychology of Rural Life. Thesis: Factors Associated with Adjustment in Rural Marriages.

Paul Eshelman Williams, A.B., A.M.; History of Philosophy, Philosophy of Religion, Epistemology and Logic. Thesis: A Study in Hegel's Method.

Sih Chang Yu, B.S., M.S. in Agr.; Plant Breeding, Agronomy, Pomology. Thesis: A Genetic Study of Certain Spike, Kernel and Other Characters in a Cross Between Two Wheat Varieties.

MEMBERS OF THE STAFF OFFERING COURSES FOR GRADUATE STUDENTS 1939–40

INDEX