SPECIAL NOTICE

EFFECTIVE with the fall term of 1946–1947, the Board of Trustees has changed tuition and other fees in the Graduate School as follows:

(1) Tuition for all students with majors in the field of Law, $200 a term.

(2) Tuition for all other students, except those with majors in Engineering, $150 a term.

(3) Health and Infirmary Fee, $15 a term.

(4) Matriculation Fee, $13.

The tuition fee for students with majors in Engineering remains to be determined. Later information may be had by writing to the Treasurer of the University.

CORNELL UNIVERSITY GRADUATE SCHOOL

1946–1947

CONTENTS

ADMINISTRATION

EDMUND EZRA DAY, Ph.D., LL.D., President of the University.

GUSTAVUS WATTS CUNNINGHAM, A.M., Ph.D., Litt.D., LL.D., Dean of the Graduate School.

OTIS FREEMAN CURTIS, A.B., Ph.D., Secretary of the Faculty.

GENERAL COMMITTEE

Professor CARL STEPHENSON, *at large, term expires* 1948.

Professor HAZEL HAUCK, *at large,* 1946.

Professor J. M. SHERMAN, *at large,* 1947.

Professor H. B. ADELMANN, *at large,* 1947.

Professor JAMES HUTTON, Group A *(Languages and Literatures),* 1948.

Professor F. A. HARPER, Group B *(History, Political Science, Philosophy, Psychology, Agricultural Economics, Farm Management, Rural Sociology),* 1947.

Professor T. R. BRIGGS, Group C *(Mathematics, Astronomy, Physics, Chemistry, Geology, Geography, Geodesy),* 1947.

Professor D. S. WELCH, Group D *(Biological Sciences),* 1946.

Professor E. M. STRONG, Group E *(Engineering, Architecture, Applied Physical Sciences, Rural Engineering, Landscape Design),* 1948.

Professor C. V. MORRILL, Group F *(Preclinical Departments of the Cornell University Medical College in New York City),* 1949.

Professor H. C. THOMPSON, Group G *(Agricultural Sciences),* 1946.

Professor H. D. LAUBE, Group H *(Law),* 1947.

Professor P. J. KRUSE, Group I *(Education),* 1948.

Professor PHILLIPS BRADLEY, Group J *(Division of Industrial and Labor Relations),* 1949.

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 4.

GENERAL INFORMATION

THE FACULTY

The Faculty of the Graduate School has exclusive jurisdiction over all graduate work and advanced degrees. It consists of three groups: (1) an *ex-officio* group, including the President of the University, who is the presiding officer, the Deans or Directors of the several Faculties of the University, and the Directors of the Experiment Stations; (2) a variable academic group consisting of those professors, associate 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, associate 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 which supervise the work of graduate students.

The General Committee of the Graduate School is the chief administrative body of the Faculty. It is composed of fourteen 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.

DEGREES OFFERED

It is the purpose of the Graduate School to offer facilities for advanced study and research, to the end that adequately trained students may receive a comprehensive view of a field of knowledge and the training required for independent investigation in that field.

The requirement for receiving an advanced degree is a high grade of scholarly work rather than the fulfillment of routine requirements.

The following degrees are offered:

Master of Arts (A.M.)
Master of Science (M.S.)
Master of Science in Agriculture[1] (M.S. in Agr.)
Master of Fine Arts[2] (M.F.A.)
Master of Architecture[2] (M.Arch.)
Master of Landscape Architecture[2] (M.L.A.)
Master of Regional Planning[2] (M.R.P.)
Master of Science in Engineering[3] (M.S. in Eng.)
Master of Aeronautical Engineering[3] (M.Aero.E.)
Master of Chemical Engineering[3] (M.Chem.E.)
Master of Civil Engineering[3] (M.C.E.)
Master of Electrical Engineering[3] (M.E.E.)
Master of Mechanical Engineering[3] (M.M.E.)
Master of Laws[4] (LL.M.)
Master of Education[5] (M.Ed.)
Master of Science in Education[5] (M.S. in Ed.)
Master of Science in Industrial and Labor Relations[6] (M.S. in I.L.R.)
Doctor of the Science of Law[4] (J.S.D.)
Doctor of Philosophy (Ph.D.)

ADMISSION

An application for admission should be made on the proper form, which will be supplied at the office of the Graduate School. No application will be acted upon until all the credentials enumerated in this form have been filed. In addition to presenting these credentials, the applicant is strongly urged to take the Graduate Record Examination and to submit his scores with his application. This exami-

[1] Open only to students who have had a four-year course in Agriculture or the equivalent.
[2] Under the special jurisdiction of the Division of Architecture and Fine Arts.
[3] Under the special jurisdiction of the Division of Engineering.
[4] Under the special jurisdiction of the Division of Law.
[5] Under the special jurisdiction of the School of Education.
[6] Under the special jurisdiction of the Division of Industrial and Labor Relations.

nation does not require any special preparation, and it is available for a moderate fee. Information about the examination may be obtained and arrangements for taking it made by direct application to the Graduate Record Office, 437 West 59th Street, New York 19, New York.

Inquiries about admission should be addressed to *The Graduate School, Cornell University, Ithaca, New York.* Inquiries about facilities for advanced study and research should be addressed to the Department in which such work is done, or to the Division under whose jurisdiction the degree is granted.

For admission in the fall or spring term, new applications with all supporting documents should be filed in the office of the Graduate School not later than three weeks before the beginning of the term; for admission in the summer session, not later than two weeks. Applications filed later than these dates may fail of consideration in time for registration at the beginning of the term following.

To be admitted to the Graduate School an applicant (1) must hold a baccalaureate degree from a college or university of recognized standing, or have done work equivalent to that required for such a 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 preparation to enter upon graduate study in the field chosen.

A senior in one of the colleges of Cornell University who has completed the academic requirements for a Bachelor's degree, and who qualifies under (2) and (3), may be admitted to the Graduate School, provided his admission is approved by the dean of his college.

An applicant is admitted to the Graduate School in one of the following categories: (1) a candidate for a degree; (2) a non-candidate; (3) a resident doctor.

Candidates. Students admitted to the Graduate School usually pursue a course leading to one of the advanced degrees. The work of a candidate for a degree is directed by a Special Committee, selected by the student.

Candidates for the degrees A.M., M.S., M.Arch., M.L.A., or M.F.A. are expected to have had training in a foreign language equivalent to three college entrance units, or in two foreign languages equivalent to two college entrance units each. If an applicant cannot offer such training, he must pass within the first month of his candidacy

an examination in a foreign language approved by his Special Committee or a longer period of residence is required for the degree.

A candidate for an advanced professional degree given under the jurisdiction of some division of the Graduate School should examine the special requirements for the degree printed at the beginning of the announcement for the division which has jurisdiction over it.

Non-candidates. A properly qualified person who, for valid reasons, does not wish to meet the requirements for a degree may be admitted to the Graduate School as a "non-candidate" and may arrange a program of graduate study suitable to his purposes. A non-candidate is required to select from the members of the Graduate Faculty an adviser to direct his work. He must file with the Dean not later than two weeks after his first registration a statement of the field in which he wishes to work, approved by his adviser. A non-candidate is expected to pursue a coördinated program of graduate work, and his courses must as a rule be chosen from those titled in italic small letters in this Announcement. Each term he must file a statement of the courses which he means to pursue, approved by his adviser.

Resident Doctors. Persons who hold the Doctor's degree or who have equivalent standing may, with 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 preparation. On the recommendation of the Dean, Resident Doctors are exempt from the payment of tuition and all fees except laboratory charges. Ordinarily they are not permitted to attend classes.

MEDICAL REQUIREMENTS...Every student matriculating in the University is required to present a satisfactory certificate of vaccination against smallpox. This must certify either to a successful vaccination within the five years preceding matriculation or to at least three unsuccessful attempts at vaccination within that period.

Within a month preceding or a month following matriculation every student must submit to the University Health Officer for permanent filing, a satisfactory chest radiograph taken within this two-month period. Such radiographs are made at the Infirmary at a special rate charged to students.

REGISTRATION...

The rules of the University provide: "All students taking work in the Graduate School 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." A fee of $5 is required for late registration by matriculated students.

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

A graduate student who has completed the 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 at the office of the Graduate School.

REQUIREMENTS FOR MASTER'S DEGREE

RESIDENCE REQUIREMENTS...

The minimum residence requirement for a master's degree is two full terms.

Before he may be awarded any degree conferred by Cornell University, a student must have spent at least one full academic year, or the equivalent, in residence at the University and in study for that degree. In consequence, graduate work done elsewhere cannot be counted to reduce the residence requirement for a master's degree below one year.

To receive credit for residence a candidate must be regularly enrolled in the Graduate School. The satisfactory completion of his work, term by term, must be attested by the members of his Special Committee.

The amount of residence credit granted to 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 student's Special Committee. In no case shall such credit exceed three-fourths, and in the case of full-time instructors one-half, of full residence credit.

A candidate for an advanced degree is expected to complete his residence with reasonable continuity. 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.

Residence credit in the Summer Session.[1] For A.M., M.S., M.S. in I.L.R., and M.S. in Agr., 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 masters' degrees at the rate of two Summer Sessions for each term of credit.

To obtain residence credit in the Graduate School for work done in the Summer Session 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 as provided for students in the regular session.

Additional requirements of residence for deficiency in foreign language. Candidates for the degree of A.M., M.S., M.S. in I.L.R., M.Arch., M.L.A., or M.F.A., are subject to the following special requirement in foreign language, which may affect the amount of residence required of them.

(a) A candidate must have had training in a foreign language equivalent to three college entrance units, or in two foreign languages equivalent to two college entrance units in each; or

(b) if he lacks such training he must, at the beginning of his candidacy (i.e., within one month after registration), prove 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.

(c) An applicant who, at entrance, cannot 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 and (2) to demonstrat-

[1] This rules applies to the Summer Session of six weeks.

ing, before a member of the Language Examination Board not later than the beginning of his last term of residence, a reading knowledge of a foreign language as provided above. The General Committee of the Graduate School, upon the recommendation of the student's Special Committee, may waive the requirement of an extra term of residence, provided preparation in foreign language is made during a period when the student is not receiving residence credit.

REQUIREMENTS IN COURSE...Two plans of procedure are offered to candidates for masters' degrees, described below as Plan A and Plan B.

PLAN A. Open to candidates for A.M., M.S., M.S. in Agr., M.S. in I.L.R., M.F.A., M.Arch., M.L.A., M.R.P., M.S. in Eng., M.Chem. E., M.C.E., M.E.E., or M.M.E.

Plan A is intended for those candidates who wish to acquire a considerable degree of competence in a restricted field of work, frequently as a basis for further study and research, or for professional purposes.

The candidate works under the direction of a Special Committee, usually of two faculty members, representing a Major and a Minor Subject. He is required to present a thesis or an essay acceptable to his committee and to pass a final examination.

Major and Minor Subjects. A list of approved Major and Minor Subjects 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 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. The requirements may consist of work in formal courses, informal work in seminars, or assigned reading or study and research–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 at least one member of the Faculty to represent each subject and to serve as the members of his Special

Committee. The representative of the Major Subject is the chairman. Not later than two weeks after his 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.

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 student and the members concerned.

Statement of Courses. At the beginning of each term a graduate student shall make out in duplicate a list of all the courses which he plans to take during the term and shall have this list signed by the chairman of his Committee as an indication of approval. The chairman of the Committee shall retain one copy; the duplicate copy shall be filed in the office of the Graduate School within two weeks after registration. Any subsequent change in this list of courses must be certified to the office of the Graduate School by the chairman of the Committee. Courses primarily for undergraduates, printed in italic small letters, are ordinarily not open to graduate students.

Thesis or Essay. A candidate for any of the masters' degrees under Plan A 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. It must be approved, however, by all members of the Committee. For this 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 all members of the Special Committee, must be on file in the office of the Graduate School.

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 should be set up according to the following form:

[TITLE OF THESIS]

A Thesis

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

[————————————]

By

[Author's Name in Full]

[Date on which degree is to be conferred.]

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

Before the degree can be conferred two[1] bound typewritten copies (one of which must be a ribbon copy) of the completed thesis, approved by the Special Committee, must be deposited in the office of the Graduate School. These copies become the property of the University Library.

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

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. No candidate may proceed to the final examination until the other requirements for his degree have been completed, except that the final examination may be given near the end of the candidate's last term of residence. The examination covers the thesis and the Major and Minor Subjects. It may be written or oral, or both, at the option of the Special Committee.

An application for final examination, approved by the Special Committee, must be filed in the office of the Graduate School at least five days in advance of the examination.

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 worked may be invited to participate in the examination. But the Special

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

Committee alone shall decide upon the merits of the candidate's performance.

A report on each final examination, whether passed or failed, shall be filed by the Special Committee in the office of the Dean. By permission of his Special Committee, a candidate who has failed in a final examination may present himself for one re-examination but only within a period of from three to six months after the failure.

PLAN B. Open to candidates for A.M., M.S., M.S. in I.L.R., 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, including such examinations as may be given therein, 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 in that field and in related fields, in the discretion of the candidate's Special Committee, as best meets his needs. Fields of concentration are broader than major and minor subjects specified under Plan A.

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.

Agricultural Economics
Biological Sciences
Education
English
Fine Arts
Foreign Languages
General Science
Home Economics
Mathematics
Industrial and Labor Relations
Physical Sciences
Speech and Drama
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, who is chairman of the Committee, 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 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.

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 student and the members concerned.

Statement of Courses. At the beginning of each term a graduate student shall make out in duplicate a list of all the courses which he plans to take during the term and shall have this list signed by the chairman of his Committee as an indication of approval. The chairman of the Committee shall retain one copy; the duplicate copy shall be filed in the office of the Graduate School within two weeks after registration. Any subsequent change in this list of courses must be certified to the office of the Graduate School by the chairman of the Committee. Courses primarily for undergraduates, printed in italic small letters, are ordinarily not open to graduate students.

Thesis, Research, or Essay. A substantial part of the candidate's work in the field of concentration shall be devoted to studies requiring 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 must follow the procedure for presenting theses outlined under Plan A.

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

Final Examination. After the candidate has substantially satisfied the minimum period of residence and has satisfactorily completed at least thirty semester hours of work approved by his Special Committee, he must present himself for the final comprehensive examination. No candidate may proceed to the final examination until the other requirements for his degree have been completed, except that the final examination may be given near the end of the candidate's last term of residence while he is still taking courses required for the degree. Eligibility for the final examination depends on satisfactory progress in those courses, and their completion is essential to meeting all requirements. The examination 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.

An application for final examination, approved by the Special Committee, must be filed in the office of the Graduate School at least five days in advance of the final examination.

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 worked 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, whether passed or failed, shall be filed by the Special Committee in the office of the Dean. By permission of his Special Committee, a candidate who has failed in a final examination may present himself for one re-examination but only within a period of three to six months after the failure.

SPECIAL REQUIREMENTS FOR PROFESSIONAL DEGREES...

The following special requirements apply in the case of the professional masters' degrees enumerated.

Master of Laws, LL.M. The degree of 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, the candidate must have received the degree of Bachelor of Laws from an approved law school and must have shown a high level 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 or more, 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 see page 232 of this *Announcement* and also the *Announcement of the Cornell Law School.*

Master of Education, M.Ed. This degree is awarded at the end of the fifth year of the five-year program for the preparation of secondary school teachers. Though a brief statement regarding the program for this degree is presented below in this *Announcement,* complete information may be found in the *Announcement of the School of Education.* Prospective candidates should communicate with the Director of the School of Education, 211 Stone Hall, Ithaca, New York.

Master of Science in Education, M.S. in Ed. The degreee is designed for persons of experience who wish to prepare themselves for specialized form of educational work. The candidate, working under the direction of a Special Committee for a minimum of two terms, is required to complete an approved program of study adjusted to his needs. The candidate is required to pass a comprehensive final examination. For further details see below in this *Announcement.*

Master of Fine Arts, M.F.A., with major in the History and Practice of the Fine Arts. This degree is designed for students whose undergraduate major in the history and practice of the fine arts prepares them for advanced work. The graduate work requires two years with a specified curriculum. For details consult the Dean of the College of Architecture.

Masters' Degrees in Engineering. For special requirements, see the announcement of the Engineering Division below.

REQUIREMENTS FOR THE PH.D. DEGREE

Work leading to the Ph.D. degree is designed to give the candidate a thoroughly comprehensive view of a field of knowledge and to train him in methods of research and scholarship in that field. A candidate is expected to maintain a high grade of achievement and to show evidence of ability in independent investigation and study. The requirements for the degree include (1) a minimum of 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) certain requirements in foreign language; (4) the presentation of an acceptable thesis and an abstract of the thesis; and (5) the passing of a qualifying examination and a final examination.

RESIDENCE REQUIREMENTS...For the Ph.D. degree 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.

To receive credit for residence a candidate must be regularly enrolled in the Graduate School. 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 twelve-month period except with the permission of the Dean in special cases. (This rule is suspended to permit accelerated programs of study during the emergency.)

The amount of credit granted to 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 full residence credit.

A candidate for an advanced degree is expected to complete his residence with reasonable continuity. 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.

At least two of the last four terms, and ordinarily the last two, must be spent in consecutive regular terms (other than the six-week Summer Session) at Cornell University.

Residence Credit for a Master's Degree. Residence credit earned as a candidate for a master's degree, either at Cornell or elsewhere, may be credited toward the Ph.D. degree. Normally not more than two terms of credit may be gained in this way, and the transfer requires the recommendation of the Special Committee.

Credit for 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.

Residence in Summer Sessions.[1] To obtain residence credit in the Graduate School for work done in the Summer Session 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, as provided for students in the regular session. For the Ph.D. degree 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.

Credit toward the Ph.D. degree earned in Summer Sessions at Cornell or elsewhere is ordinarily 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 recommendation of his Special Committee and with the approval of the General Committee, earn one more term of credit by work in Summer Sessions at Cornell, with the privilege of credit for an additional term for research under personal direction. In this case, however, the last year of candidacy must be spent in residence at the University and in consecutive, regular terms (other than the six-week Summer Sessions).

Research under 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, receive residence credit for research done during the sum-

[1] These rules apply to the Summer Session of six weeks.

mer 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 terms (other than the six-week Summer Session). 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 the student and the nature of the research to be done. To obtain credit for such work, the student must register *in advance* at the office of the Graduate School, and the professor must certify to its satisfactory completion. A maximum of two terms may be earned in this way.

A candidate registered under Personal Direction during the summer may be admitted to the classes of the six-week Summer Session. Such students must register both in the Summer Session and in the Graduate School and must pay tuition at least equal to that required for the Summer Session.

Work in Absentia. A candidate for the Ph.D. degree may be credited with residence for work done away from the University, provided such an arrangement offers superior advantages for the prosecution of the student's work. Work *in absentia* is subject to the following conditions:

(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) In case a student desires to work *in absentia* during either or both of the last two terms of his residence, he must petition the General Committee for a waiver of the rule requiring him to spend these terms in residence at the University.

MAJOR AND MINOR SUBJECTS...A candidate for the Ph.D. degree 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 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, 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 his 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.

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. No such change in his Special Committee may be made after the fourth term of residence except with the approval of the Dean. 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 student and the members concerned.

Statement of Courses. At the beginning of each term a graduate student shall make out in duplicate a list of all the courses which he plans to take during the term and shall have this list signed by the chairman of his Committee as an indication of approval. The chairman of the Committee shall retain one copy; the duplicate copy shall be filed in the office of the Graduate School within two weeks after

[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.

registration. Any subsequent change in this list of courses must be certified to the office of the Graduate School by the chairman of the Committee. Courses primarily for undergraduates, printed in italic small letters, are ordinarily not open to graduate students.

REQUIREMENTS IN FOREIGN LANGUAGES...A candidate for the Ph.D. degree must demonstrate his ability to read both French and German (or two languages, other than English, approved by his Special Committee), by passing in each of these languages an examination given by a member of the Language Examination Board. The examiner is to be designated by the Dean of the Graduate School. 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 within one month after 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 be waived by the General Committee of the Graduate School upon recommendation of the student's Special Committee, if preparation in foreign language is made during a period when the student is not receiving residence credit.

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.

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

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

THESIS...A candidate for the Ph.D. degree is required to present a thesis. 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 write 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 and must be acceptable in respect both of scholarship and of literary quality. The completed thesis should be in the hands of the Special Committee at least fifteen days before the final examination (Examination B or C; see below). 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 this final examination (B or C) 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 should be set up according to the following form:

[TITLE OF THESIS]
A Thesis
Presented to the Faculty of the Graduate School of Cornell
University for the degree of
[————————————]
By
[Author's Name in Full]
[Date on which degree is to be conferred.]

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

Before the degree can be conferred two[1] 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.

Abstract of thesis. A candidate for the Ph.D. degree must deposit in the office of the Graduate School an abstract of his thesis in two copies, typewritten, double spaced, on bond paper, 8 x 10½ inches.

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

The abstract should be about 1500 words in length and should not exceed 1700 words. It must be approved by the Chairman of the Special Committee and presented in a form acceptable for printing.

The candidate must pay to the Treasurer of the University a fee of $12.50 to cover the cost of publishing his abstract in an annual volume, "Abstracts of Theses." This volume will be available in the year following that in which the student receives his degree. A recipient of the degree who wishes to receive a copy of the volume containing the abstract of his thesis should file his name and address in the Office of the Graduate School at the time of submitting his abstract. Off-prints of an abstract may be obtained by agreement with the contracting printer.

EXAMINATIONS...

Qualifying Examination. A candidate for the Ph.D. degree 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 aid in planning 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 examination must be taken within one month after the beginning of a term if it is to be counted as having been taken in that term. 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, shall 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), a candidate must have earned at least two terms of residence credit after the passing or the waiving of the qualifying examination.

Final Examination. A candidate for the Ph.D. degree 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, designated as Final Examination A, may be given at the end of the fourth term of candidacy, or thereafter. Examination A will 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 above. This examination may be oral, or both oral and written, at the discretion of the Special Committee. At the time of taking this examination the student must be registered in the Graduate School, either regularly or as candidate for degree only.

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 22. 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 above.

Applications for final examinations, (A, B, and C), approved by the Special Committee, must be filed in the office of the Graduate School at least five days in advance of the examination.

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 worked 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, whether passed or failed, shall be filed by the Special Committee in the office of the Graduate School. By permission of his Special Committee, a candidate who has failed in any of these final examinations may present himself

for one re-examination but only within a period of from six to twelve months after the failure.

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

REQUIREMENTS FOR THE J.S.D. DEGREE

Work leading to this degree is designed to train legal scholars and to stimulate original investigation in the purpose, administration, history, and progress of the law.

Admission. To be eligible for admission to candidacy for J.S.D. the candidate shall have met the general requirements for admission; 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 shown a high level 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 or more 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 other member or members may be chosen from the Graduate School Faculty in a field or fields appropriate to the 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 page 22.

Final Examination. After the thesis has been completed and filed in the office of the Graduate School, as provided above, the candidate is required to present himself for a final examination. A report on each final examination shall be filed by the Special Committee in the office of the Graduate School. By permission of his Special Committee, a candidate who has failed in a final examination may present himself for re-examination but only within a period of from six to twelve months after the failure.

For further information concerning J.S.D. see below in this *Announcement* and also the *Announcement of the Cornell Law School.*

TUITION AND OTHER FEES

GENERAL REGULATION...Tuition and other fees become due when the student registers. The University allows twenty days of grace in each term, five days in the six-week 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 other fees 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 against 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 Treasurer and the Registrar, when such reasons are set forth in a written statement.

Students registering at any time during the last ten weeks of any 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.

FEES PAYABLE BY GRADUATE STUDENTS...

A Tuition Fee of $100 a term is to be paid by all students registered in the Graduate School except candidates for the LL.M. degree, who must pay a fee of $200 a term. It is payable 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. Graduate students who have satisfactorily completed the requirements of residence for the degree but who remain in residence while working on their theses or while doing other work in contemplation of a degree.

4. 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 subject to the following limitations:

(a) If the salary for the academic year is not greater than $1500, the tuition fee may be waived entirely;

(b) If the salary is greater than $1500 but not greater than $1600, 25% of the tuition will be charged and 75% waived;

(c) If the salary is greater than $1600 but not greater than $1700, 50% of the tuition will be charged and the balance waived;

(d) If the salary is greater than $1700 but not greater than $1800, 75% of the tuition will be charged and the balance waived;

(e) If the salary is greater than $1800, no waiver will be made.

The word salary as used above means total pay — that is, base pay plus any bonus.

Graduate assistants on the nine or twelve months basis who are located here during the summer months, who are registered under personal direction for credit in the Graduate School, and who are required to give service in their department or college during that period, may be recommended for waiver of tuition during the Summer Term also under the above limitations. Those who are engaged only in graduate study and not doing productive work for the department during the

Summer, may not have their tuition waived. The amount of tuition to which the above percentages will be applied is the prorated amount of the full tuition fee based upon the maximum amount of residence credit that can be earned.

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

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 $13 is required of every student upon his first entrance into the University. It must be paid at the time of registration and is not refundable.

A Health and Infirmary Fee of $10 a term is required of all students (except Honorary Fellows, Resident Doctors, students registered in the extramural course, 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* booklet.

A Graduation Fee of $10 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.

An Abstract of Thesis Fee of $12.50 is required, at least ten days before the degree is to be conferred, of each candidate for the degree Doctor of Philosophy. This fee, the cost of publication in the volume "Abstracts of Theses," is in addition to the $10 graduation fee.

A Laboratory and Library Fee of $5 a term is required of all graduate students.

A Willard Straight Hall Membership Fee of $5 a term is required of all graduate students, except those registered in the extramural course.

Refunds of tuition and other fixed fees will be made to students who withdraw from the University prior to the completion of a term for reasons accepted as satisfactory. For students who do not complete a term, tuition and other fees will be charged at the rate of 10 per cent for each week, or fraction of a week, after the sixth day of instruction. The matriculation fee will not be refunded, nor will

refund of the Health and Infirmary fee be made to a student who has been admitted to the Infirmary.

Fees for the Summer Session. Graduate students who attend classes in the Summer Session must register both in the Graduate School and in the Summer Session and must pay a tuition fee of $60 for each Summer Session.

A graduate student who is registered in both the Summer Session and in the Graduate School must also pay a health service and infirmary fee of $4.50. Please note that this paragraph refers only to fees for double registration in the Graduate School and the Summer Session.

Motor Vehicle Registration and Parking Fees. Any student, unless he has the rank of instructor in Cornell University, who owns, maintains, or for his own benefit operates, or has in charge a motor-driven vehicle in Tompkins County, the environment of Ithaca, is required to register his vehicle in person with the Campus Patrol, and, unless it is owned by another member of his immediate family who is a resident of Tompkins County, to pay a registration fee of $1 a term. He must present (a) written consent of his parent or guardian if he is under 21 years of age, (b) evidence that the vehicle may be legally driven in New York State, (c) evidence that the operator may legally drive in New York State, and (d) evidence that the vehicle is effectively insured against public liability for personal injury and property damage for the standard minima of 5–10–1. (Exceptions are: (1) Summer Session students who have not been registered in the University during the past term and (2) special students who are registered for six hours or less a term.) This registration must be completed within the registration days at the beginning of the first term if the student is then subject to the rule. If he becomes subject to the rule after that time, he has one week in which to comply with it. Late registration of a vehicle makes the student liable to a penalty of $1.

Motorcycles must be registered but may not be used on the campus during class hours.

Student parking on the campus during University hours is *prohibited.* Exemption may be granted by the Campus Patrol when the use of the car is essential to the student's attending classes or carrying on his academic or departmental work.

During the Summer Session, the rules are the same.

The student's registration in the University is held to constitute an agreement on his part that he will abide by its rules and regulations with regard to traffic and parking or suffer the penalty prescribed for any violation of them. All privileges under this head may be denied a student who is not in good standing.

Personal Direction. Students carrying on studies during the summer under Personal Direction are required to register with the Registrar as well as in the Graduate School.

Students registered under Personal Direction, if they desire residence credit for their work, must pay a tuition fee proportionate to the ratio which the credit desired bears to one entire term. Such students must pay the administration fee of $12.50, the Willard Straight Hall membership fee of $5, and the Health and Infirmary fee of $10; provided, however, that one half these fees will be remitted if the registration is for a period not exceeding 8 weeks. Such payment admits 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.

FOREIGN STUDENTS

The University maintains on its staff a Counselor to Foreign Students, Mr. Donald C. Kerr, whose duty is to look after the welfare of all students from other countries. He may be consulted on personal problems, social questions, or any other matter in which he may be helpful. His office is in the Cornell Cosmopolitan House, 301 Bryant Avenue, which has living accommodations for a group of foreign and American students. It is suggested that all foreign students write him before coming to Ithaca, or call on him immediately upon arrival. He will be glad to meet them at the train, help them find suitable living quarters, either at the Cosmopolitan House

or elsewhere, and introduce them to other University officials and members of the faculty.

LIVING EXPENSES IN ITHACA

A few men graduate students live in the University Residential Halls. For information about these, address the Manager of Residential Halls, Morrill Hall. The majority of graduate students live in rooms or apartments which are for rent in the vicinity of the University. The lowest possible price is about $3.50 a week. The usual figure is probably about $5 to $6. About the middle of each summer the University publishes a list of inspected rooms in which prices are quoted. For this list write to the Manager of Residential Halls.

The University offers no dining service in connection with its Residential Halls for Men. There are, however, two large cafeterias, the one at Willard Straight Hall and the other at the College of Home Economics. Near the Campus there are many restaurants which cater chiefly to students.

Because of the scarcity of self-supporting labor, new graduate students are advised not to register in the University unless they have sufficient funds for their expenses at least during the first year.

For Women. All women graduate students at Cornell University live in houses approved by the Counselor for Women. Graduate women students who are under twenty-one years of age are required to live in the University Residential Halls. About the first of September the Office of the Counselor of Women issues a list of rooms off the campus available for the fall term. This list may be had by writing to the Counselor of Women who will give assistance in finding suitable rooms. For information regarding any possibilities of 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. Applications should be made to the Dean of Students.

LOAN FUND 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 Counselor of Women.

THE BUREAU OF EDUCATIONAL SERVICE

Established in 1932, the Cornell University Bureau of Educational Service correlates the educational services which the University is prepared to offer with the needs of the institutions which it serves. These services require contact with students and faculty at the University, with alumni, and with other educational institutions and officials.

The chief activities of the Bureau are concerned with the various phases of teacher placement. In the field of education, this is a highly specialized function. Each prospective teacher prepared at Cornell is urged to register with this office well in advance of the completion of his training. By means of this registration, there is on file in appropriate form comprehensive information as to personal, educational, and experiential qualifications of each registrant. With the co-operation of the registrant, this record is kept up to date at all times and is available to any institution or qualified official upon request.

The Bureau's program of rendering discriminating service to interested educational institutions is facilitated by and combined with the follow-up check on registrants previously placed. By this means a realistic evaluation is attained which permits a practical upgrading program to be followed.

Answering frequent requests for information about trends and demands, both long and short term, forms an important part of the Bureau's service. Location of positions, salary range, contract terms, certification requirements, and many other factors are items on which the Bureau is equipped to give up-to-date information.

All graduate students who expect to teach are invited to avail themselves of the services which the Bureau offers. It is located in 102 Stone Hall.

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 the laboratory and library fee. Actual residence at the University and regular registration in the Graduate School are required of incumbents.

AWARD AND TENURE...Appointments to fellowships and scholarships are made on April 1 of each year. Forms for making application may be had from the Office of the Graduate School. These applications, together with supporting documents, must be filed in the Office of the Graduate School on or before the first of March.

The Faculty may combine the stipends of two or more scholarships or fellowships or may divide a fellowship into two or more scholarships. Appointments are made for one academic year.

The holder of a fellowship or a scholarship may not accept another appointment, but must devote his whole time to his studies. He may, however, be called upon to assist in instruction up to a maximum of six clock-hours a week.

The stipends of fellowships and scholarships are payable at the office of the Treasurer of the University in eight equal installments, beginning July 15 or November 15; the other payments being due on the fifteenth of each month following.

FELLOWSHIPS AND SCHOLARSHIPS...The following fellowships and scholarships offered during the year 1946–47 carry exemption from tuition unless otherwise indicated:

ANY FIELD OF STUDY

Two *Allen Seymour Olmstead Scholarships.* Stipends $1,000 each. These scholarships are open to graduate students in any field of study in which major work for the Ph.D. degree is offered.

AGRICULTURE

Three *Henry Strong Denison Fellowships in Agriculture.* Stipends $1,000 each; no exemption from tuition. These fellowships are distributed annually among the

following fields; plant sciences, animal sciences, social sciences, and agricultural engineering. 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. 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 Simon Henry Gage Fellowship in Animal Biology. Stipend $500.

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, Fine Arts, and Regional and City Planning. Stipend $400.

REGIONAL AND CITY PLANNING

See Architecture.

FINE ARTS

See Architecture.

LANDSCAPE ARCHITECTURE

See Architecture.

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.

The Graduate Scholarship in Botany, Geology, or Physical Geography. Stipend $200.

See also under Agriculture.

CHEMISTRY

These fellowships are ordinarily awarded for the last year of residence for the doctorate.

The Sage Fellowship in Chemistry. Stipend $600.

The du Pont Fellowship in Chemistry. Stipend $750.

The Carl G. Schluederberg Fellowship. Stipend $200.

The John E. Teeple Fellowship. Stipend $400.

CLASSICS

Two *Fellowships in Greek and Latin.* Stipends $500 each.

These fellowships may be increased to three or more fellowships or scholarships with correspondingly reduced stipends.

One *Graduate Scholarship in Greek and Latin.* Stipend $200.

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 be in residence at the Brookings Institution. (Temporarily suspended).

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

The Fellowship in Political Economy. Stipend $600.

EDUCATION

See Tuition Scholarships in Education below.

Tuition Scholarships for Prospective Secondary School Teachers

Ten tuition scholarships are available for students in the fifth year of the five-year program, who give promise of becoming outstanding secondary school teachers. Five of these scholarships are available for students who have received their undergraduate training in institutions other than Cornell. Applications should be made to the Director of the School of Education before July 1.

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 Fellowships in Hydraulics, listed below.

THE JOHN McMULLEN GRADUATE SCHOLARSHIPS

The John McMullen Graduate Scholarships are open to candidates for advanced degrees in Chemical, Civil, Electrical, or Mechanical Engineering. These

[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.

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 proceeds of this bequest the Board of Trustees has established fifteen scholarships of an annual value of $900 each. 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. Applications should be addressed to the Graduate School.

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 without free tuition. Applications should be sent to the Graduate School.

ENGLISH

The Martin Sampson Teaching Fellowship. Stipend $900.

This fellowship is offered annually to a graduate student who is preparing to become a teacher of English. The incumbent is required to teach one class during each term of the academic year.

The Cornell Fellowship in English. Stipend $600.

This fellowship is ordinarily awarded only to an applicant who has completed a year of graduate study.

ENTOMOLOGY

See *The Comstock Scholarship in Entomology.* Stipend $150. See also under Agriculture and Animal Biology.

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. These scholarships have, by vote of the Faculty of the Graduate School, been allocated to the fields of Entomology and Nature Study. Applications should be made not later than March 1 to the office of the Graduate School. These Scholarships carry free tuition.

GEOLOGY

The Goldwin Smith Fellowship in Botany, Geology, or Physical Geography. Stipend $400.

The Graduate Scholarship in Botany, Geology, or Physical Geography. Stipend $200.

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 $1,200 a year, and does not carry free tuition.

CHARLES BEAN DeLONG GRADUATE RESEARCH FUND

A fund of $6,000, the income from which is to be used at the discretion of the Department of Geology for the purpose of assisting male graduate students or assistants of the University who are majoring in and carrying out scientific research in economic or structural geology. An award from this fund does not exempt recipient from payment of tuition and fees.

PHYSICAL GEOGRAPHY

See Geology.

GERMAN

The University Fellowship in Germanic Languages. Stipend $400.

GOVERNMENT

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

HISTORY

These fellowships are ordinarily awarded only to applicants who have completed a year of graduate work or are able to submit written work of superior quality.

The President White Fellowship in Modern History.[1] Stipend $500. In the discretion of the Faculty this fellowship may be made a traveling fellowship, with a stipend of $700.

The Fellowship in American History. Stipend $400.

The George C. Boldt Fellowship in History. Stipend $1,000; no exemption from tuition.

The Graduate Scholarship in History. Stipend $200.

HOME ECONOMICS

The Anna Cora Smith Fellowship. Stipend $400.

According to the bequest, this fellowship "is to be awarded annually to a young woman for research in home economics problems."

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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.

MATHEMATICS

The Erastus Brooks Fellowship in Mathematics. Stipend $600.

This fellowship is ordinarily awarded only to an applicant who has had a year or more of graduate study.

NATURE STUDY

The Comstock Scholarship in Nature Study. Stipend $150. Because of accumulation, this scholarship will have a higher cash value during the year 1946–1947.

American Nature Association Research Fellowship. Two or three American Nature Association research fellowships of $400 to $600 are available to graduate students in nature study. Free tuition is not included.

PHILOSOPHY

Three *Susan Linn Sage Fellowships in Philosophy.* Stipends $600 each. One or more of these fellowships may be divided to make two scholarships, stipends $300 each.

PHYSICS

The President White Fellowship in Physics. Stipend $600. The stipend of this Fellowship may, in the discretion of the Faculty, be reduced to $400 and the remaining $200 be assigned to a Graduate Scholarship.

See also Special Temporary Fellowships, below.

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.

This fellowship is ordinarily awarded only to an applicant who has had a year or more of graduate study.

VETERINARY MEDICINE

The Graduate Scholarship in Veterinary Medicine. Stipend $200.

Through accumulations it is sometimes possible to increase the amount available for this scholarship.

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.

The holder of a tuition scholarship may not accept another appointment or be gainfully employed without permission from the General Committee of the Graduate School.

CORNELL SIGMA XI FELLOWSHIP

The Cornell Sigma Xi Fellowship, established by the Cornell Chapter of the Society of Sigma Xi, is open to graduate students in the following fields of study: Mathematics, Physics, Chemistry, Astronomy, Sciences of the Earth, Biology in its various branches including Psychology, Medicine in its various branches, Anthropology, and Engineering in its various branches. This fellowship carries a stipend of $500 and free tuition in the Graduate School. Applications should be made on the regular application forms of the Graduate School and should be filed in the Office of the Graduate School not later than March 1.

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 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 1946–47 the stipend has been fixed at $150. Applications for this scholarship should be made on the regular application forms of the Graduate School and should be filed in the office of the Graduate School not later than March 1.

TEMPORARY FELLOWSHIPS...At the present time the following special fellowships also are awarded by the Faculty of the Graduate School; appointees to these fellowships pay tuition except as noted.

The Allied Chemical and Dye Corporation Fellowship (Chemistry). Carries free tuition.

The American Cyanamid Company Fellowship (Agronomy).

The American Nature Association Fellowship (Nature Study).

The American Potash Institute Potash Fellowship. (Agronomy).

The American Potash Institute Boron Fellowship (Agronomy).

The American Wildlife Institute Fellowship (Rural Education).

The Dow Chemical Company Fellowship (Plant Pathology).

The du Pont Postdoctoral Fellowship (Chemistry).

The du Pont Postgraduate Fellowship (Chemistry).

The du Pont Postgraduate Fellowship (Chemical Engineering).

The du Pont Postgraduate Fellowship (Mechanical Engineering).

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

The International Minerals Fellowship (Poultry).

The Lalor Foundation Fellowship (Entomology).

The Lederle Fellowship (Veterinary Medicine).

The National Lime Association Fellowship (Agronomy).

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

The New York Farmers Pasture Research Fellowship (Agronomy).

The Philco Frozen Food Fellowship (Nutrition).

The Schering Fellowship (Zoology).

The Standard Brands Fellowship (Bacteriology).

The Standard Oil Company Fellowship (Chemical Engineering).

The Tobacco By-Products and Chemical Company Insecticide Fellowship (Entomology).

The Westinghouse Fellowship (Mechanical Engineering).

The William S. Merrell Fellowship (Chemistry).

For information regarding these special fellowships, address the department concerned.

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. The subject of the paper may be either historical or critical or constructive. It may be concerned either with problems of pure philosophy or with the philosophical bearing of the concepts and methods of the 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.

THE UNIVERSITY LIBRARIES

————————, *Librarian;* E. R. B. WILLIS, *Acting Librarian;* HALLDOR HERMANNSSON, *Curator of the Icelandic Collection;* T. G. BERGIN, *Curator of the Dante and Petrarch Collection;* 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;* Miss VIRGINIA WARTERS, *Librarian of the College of Home Economics;* Miss E. C. WILLIAMS, *Librarian of the Veterinary College;* ROBERT P. LANG, *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 Van Cleef Zoology Library, the Barnes Hall Library, the Goldwin Smith Hall 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 over one million. The number of periodicals, transactions, and other serials currently received is over five thousand; and, of many 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 Antislavery 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 2,800 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.

FIELDS OF INSTRUCTION

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

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. Industrial and Labor Relations. 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 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 but open also to advanced undergraduates are listed in *ITALIC CAPITAL LETTERS*. Courses intended primarily for undergraduates but often meeting needs of graduates are listed in *italic small letters,* and are given in skeleton outline only. For details about these courses, 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, Master of Fine Arts, and Master in Regional Planning. 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. 44)

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

AESTHETICS

Associate Professor SMART.

The courses in Aesthetics offered by the Sage School of Philosophy are:

Philosophy 8. Aesthetics: Philosophy of Art. Spring term. Three hours a week. M W F 11. Goldwin Smith 128.

Philosophy 22. Advanced Aesthetics. Fall term. M W 12, or hours to be arranged. Goldwin Smith 220.

An intensive study of selected problems in the field.

ARCHITECTURE

Professors H. E. BAXTER, L. D. BROWN, L. P. BURNHAM, G. D. CLARKE, A. H. DETWEILER, T. W. MACKESEY, E. D. MONTILLON, A. D. SEYMOUR, J. N. TILTON, JR., F. M. WELLS, GEORGE YOUNG, JR., 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 BURNHAM, MONTILLON, SEYMOUR, HARTELL, MACKESEY, and WELLS.

HISTORY OF ARCHITECTURE. Professor DETWEILER.

ARCHITECTURAL CONSTRUCTION. Professors BAXTER, BROWN, TILTON, and YOUNG.

REGIONAL AND CITY PLANNING

Professors G. D. CLARKE and T. W. MACKESEY, and other members of the University Faculty.

Graduate work is offered in regional and city planning leading to the degree, Master in Regional Planning. The purpose of graduate work in regional and city planning is to offer to adequately trained students facilities for advanced study and research, with the twofold purpose of providing each student with a comprehensive view of the field of planning and of training him for independent investigation in that field. Students may approach advanced work in planning from a background of study in any one of a number of related fields including architecture, landscape architecture, engineering, government, geography, sociology, economics, or agriculture. Each graduate student follows a plan of study drawn up in consultation with a Faculty Committee. That plan of study is based on the individual student's background and interests.

710. *PRINCIPLES OF REGIONAL AND CITY PLANNING.* Fall term. Credit three hours.

711. *CITY PLANNING PRACTICE.* Spring term. Credit three hours. Prerequisite, Course 710. Professors CLARKE and MACKESEY.

The procedures and techniques of gathering and analyzing data for municipal planning studies; the selection and integration of data for use in planning; practical application of the theories of city planning; office practice. Lectures, assigned reading, reports.

712. *REGIONAL PLANNING PRACTICE.* Spring term. Credit three hours. Prerequisite, Course 710. Open to graduates and upperclassmen in all colleges of the University. Professors CLARKE and MACKESEY.

A study of the principles involved in county, regional, state, and national planning. Includes discussion of following factors involved: land use, water resources, recreation, transportation, public services, and public works. Lectures, assigned reading, reports, and examinations. Occasional lectures may be given by members of other faculties and outside lecturers.

713. *HOUSING.* Fall term. Credit two hours. Registration limited. Prerequisite, Course 710. Professors CLARKE and MACKESEY.

An introduction to the theory and standards of housing practice through analysis and comparison of various existing examples, considering the social, economic, and technical sides of the work. Lectures, assigned reading, and reports.

715. *SEMINARY IN PARK PLANNING.* Fall term. Credit two hours. Registration limited. Professor CLARKE.

Specific problems relating to the design of city, state, and national parks, with a study of examples.

716. *SEMINARY IN PARKWAY, EXPRESSWAY, AND HIGHWAY PLANNING.* Spring term. Credit two hours. Professor CLARKE.

717. *ZONING PRINCIPLES AND PRACTICE.* Spring term. Credit two hours. Prerequisite, Course 710. Professor MACKESEY.

Technical and legal aspects of drafting and administering zoning regulations.

718. *CITY PLANNING DESIGN.* Either term. Credit arranged. Professors CLARKE and MACKESEY.

719. *CITY AND REGIONAL PLANNING RESEARCH.* Either term. Credit arranged. Professors CLARKE and MACKESEY.

THE HISTORY AND PRACTICE OF THE FINE ARTS

Professors D. L. FINLAYSON, A. H. DETWEILER, J. A. HARTELL, CHRISTIAN MIDJO, F. O. WAAGÉ, K. L. WASHBURN, N. D. DALY, and J. O. MAHONEY.

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. A special six-year course leads to the two degrees A.B. and M.F.A.

DRAWING AND PAINTING. Professors MIDJO, WASHBURN, DALY, and J. O. MAHONEY.

COMPOSITION. Professors MIDJO, WASHBURN, DALY, and J. O. MAHONEY.

SCULPTURE. Professor WASHBURN.

HISTORY OF ART. Professors FINLAYSON and WAAGÉ.

HISTORY OF ARCHITECTURE. Professor DETWEILER.

Other members of the staff will cooperate as necessary.

LANDSCAPE ARCHITECTURE

Professors G. D. CLARKE, E. D. MONTILLON, 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 and MONTILLON.

HISTORY OF LANDSCAPE ARCHITECTURE. Professor MONTILLON.

PLANTING DESIGN.

PARK AND PARKWAY DESIGN. Professor CLARKE.

MUSIC

Professors JOHN M. KUYPERS, DONALD J. GROUT, ROBERT PALMER, and PAUL J. WEAVER.

MUSIC THEORY

1. *Theory I. The Elements of Music.* Two terms. Credit three hours a term. M W F 8 and 9. Laboratory sections, T Th 8 and 9.

101. *Theory II. Elementary Harmony.* Two terms. Credit three hours a term. M W F 10. Prerequisite, Music 1 or its equivalent.

201. *THEORY III. ADVANCED HARMONY AND THE PRINCIPLES OF COUNTERPOINT.* Two terms. Credit three hours a term. Prerequisite, Music 101 or its equivalent. M W F 11. Assistant Professor PALMER.

This course is a continuation of Theory II. This course includes the study of modulation, altered and mixed chords, and the harmonization of more elaborate chorale melodies leading to contrapuntal harmony. Basic contrapuntal principles are studied, including the devices of imitation and canon as well as the invention and simpler fugal forms. A thorough analysis of the polyphonic forms is undertaken and original work in these forms constitutes the basis of the course.

301. *THEORY IV. ANALYTIC TECHNIQUE AND THE PRINCIPLES OF COMPOSITION.* Two terms. Credit two hours a term. T Th 10. Prerequisite Music 201 or its equivalent. Assistant Professor PALMER.

This course is a survey of musical literature from the 10th to the 20th centuries with the purpose of developing a general technique of analysis applicable to the music of any period. It covers the structural, textural, and aesthetic factors of each period and in this way gives insight into the general principles of musical composition. Original work will be undertaken according to the desire and need of the individual student.

MUSIC APPRECIATION AND ENSEMBLE

11. *The Art of Music.* Two terms. Credit three hours a term. M W F 11. Goldwin Smith A. Open to all students.

15. *Choral and Instrumental Ensemble, First Year.* Two terms. Credit one hour a term. Either term may be taken without the other. Hours to be arranged. Open to all students who are active members of the Sage Chapel Choir, the Cornell Chorus, the University Orchestra, or the Men's or Women's Glee Club.

115. *Choral and Instrumental Ensemble, Second Year.* Two terms. Credit one hour a term. Hours to be arranged. Prerequisite, Music 15 or its equivalent. Open only to members of one of the musical organizations.

This course is a continuation of Music 15.

MUSIC HISTORY

21. *History of Music.* Two terms. Credit three hours a term. M W F 12. Goldwin Smith A. Open to sophomores and upperclassmen, and to freshmen by permission.

121. *The Opera.* Fall term. Credit three hours. M W F 11. Prerequisite, Music 21 or its equivalent.

123. *Orchestral Music.* Spring term. Credit three hours. M W F 11. Prerequisite, Music 21 or its equivalent.

223. *BEETHOVEN.* Spring term. Credit two hours, T 2 to 4. Prerequisites, at least one course from the group Music 121–127 and at least two terms of Music Theory. Professor WEAVER.

A study of the life and works of Beethoven. Special topics will be assigned to each student, related to the field covered by his prerequisite courses.

224. *BRAHMS.* Fall term. Credit two hours. T 2 to 4. Prerequisites, at least one course from the group Music 121–127 and at least two terms of Music Theory. Professor WEAVER.

A study of the life and works of Brahms. Special topics will be assigned to each student, related to the field covered by his prerequisite courses.

321. *MUSIC OF THE BAROQUE PERIOD.* Two terms. Credit three hours a term. M W F 10. Prerequisites, Music 11, Music 21, and Music 101 or their equivalents. Professor GROUT.

A study of the forms, styles, principal composers and representative compositions of the period 1600–1750.

APPLIED MUSIC

401. *First Year, Individual Instruction in Voice, Piano, String, Woodwind, and Brass Instruments.* Credit two hours a term in the case of qualified students who are majoring in music; for other students, no credit.

402. *Second Year, Individual Instruction.* A continuation of Music 401, open to students who have completed that course.

451. *Piano Master Class.* Two terms. Credit two hours a term in the case of qualified students who are majoring in music.

A limited number of advanced piano students will be accepted for this course. Those interested should consult the chairman of the department.

421. *INTRODUCTION TO RESEARCH.* Two terms. Credit two hours a term. M 2 to 4. Prerequisites, a reading knowledge of French and German and a fair knowledge of music theory and general music history. Professor GROUT.

The basic materials and techniques of musicological research.
This course is open to graduate students (and, by permission, seniors).

501. *SEMINARY IN COMPOSITION.* Two terms. Credit two hours a term. Hours to be arranged. Assistant Professor PALMER.

A limited number of graduate students (and, by permisison, seniors) will be admitted to this course who have (1) facility in the hearing, reading, and writing of melody, harmony, and counterpoint, (2) a working knowledge of soprano, alto, tenor, and bass clefs, and (3) facility in score reading.

The work is intended to make the student acquainted with compositional practices in various styles, and to develop the student's creative abilities.

521. *SEMINARY IN MUSICOLOGY.* Two terms. Credit two hours a term. Hours to be arranged. Professor GROUT.

This course is primarily for graduates (and, by permission, seniors) who have (1) the requisite knowledge of one or more of the important foreign languages, (2) a fair knowledge of music theory, and (3) some skill in practical music.

The work is intended to make the student acquainted with the accomplishments of the past and with modern methods 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, H. A. MYERS, and H. D. ALBRIGHT.

The degree of Master of Fine Arts in Drama and Dramatic Production will be granted to candidates of special aptitude in the practical phases of Dramatic Production or Playwriting. Their program must include suitable studies in related Fine Arts; two years of residence will normally be required, with approximately one-half the program of study in applied projects in stage presentation; 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.

Modern Drama. (English 48).

Shakespeare. (English 61.)

DRAMATIC STRUCTURE. Associate Professor MYERS. *(English* 150 and 250.)

DRAMATIC PRODUCTION. Associate Professor STAINTON. *(Speech and Drama* 41. Fall term, M W F 11.)

ADVANCED DRAMATIC INTERPRETATION AND ACTING. Professor DRUMMOND. *(Speech and Drama* 42. Spring term. W 2–4.)

ADVANCED DRAMATIC PRODUCTION. Professor DRUMMOND. *(Speech and Drama* 44.) Throughout the year. T 2–4, and an hour to be arranged.

STAGECRAFT AND DESIGN. Associate Professor STAINTON. *(Speech and Drama* 45. Spring term. M W 11, T 1:40–4.)

STAGE LIGHTING. Associate Professor STAINTON. *(Speech and Drama* 45a.) Spring term. Hours to be arranged.

HISTORY OF THE THEATRE. Professor DRUMMOND. *(Speech and Drama* 48.)

[*PLAYWRITING.* Professor DRUMMOND. *(Speech and Drama* 49b. A two-term course.) Not given in 1946–47.]

DRAMATIC PRODUCTION in relation to aesthetic principles. Professor DRUMMOND. *(Speech and Drama* 66.) Fall term, T Th 12.

[*DRAMATIC ART.* Professor DRUMMOND. *(Speech and Drama* 67. A two-term course.) Not given in 1946–47.]

MODERN THEORIES OF STAGE PRESENTATION. Associate Professor STAINTON. *(Speech and Drama* 68.) Fall and spring terms. Hours to be arranged.

THEATRE PRACTICE. Associate Professor STAINTON. *(Speech and Drama* 91. Throughout the year; may be entered either term. Hours to be arranged.)

POETRY

Professors M. H. ABRAMS, R. C. BALD, W. H. FRENCH, C. W. JONES, EDWIN NUNGEZER, W. M. SALE, JR., H. W. THOMPSON, and C. I. WEIR, JR.

See also courses described under English Language and Literature, pp. 55ff.

31. *Medieval Literature.* Throughout the year. Three hours a week.

32. *The English Renaissance.* One term. Three hours a week.

34. *Eighteenth Century Literature.* Throughout the year. Three hours a week.

35. *The Romantic Revival.* Throughout the year. Three hours a week.

36b. *The Victorian Age.* One term. Three hours a week.

39. *American Literature.* Throughout the year. Three hours a week.

53. *Recent English Poetry.* One term. Three hours a week.

54. *Recent American Poetry.* One 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.* One term. Three hours a week.

108. *ELIZABETHAN LITERATURE.* Fall and spring terms. Associate Professor NUNGEZER.

110. *SEVENTEENTH CENTURY LITERATURE.* Fall and spring terms. Professor BALD.

112. *SCOTTISH LITERATURE.* Fall and spring terms. Professor THOMPSON.

135. *STUDIES IN VICTORIAN LITERATURE.* Fall and spring terms. Associate Professor JONES.

140. *AMERICAN LITERATURE.* Fall and spring terms. Professor THOMPSON.

LANGUAGES AND LITERATURES

THE CLASSICS

Professors HARRY CAPLAN, JAMES HUTTON, H. L. JONES, FRIEDRICH SOLMSEN, and F. O. WAAGÉ.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

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 additional to those investigated in the seminary courses are ordinarily treated in 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 archaeological journals and the standard works of reference in these rooms, the general University Library is at the disposal of 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 $200 and tuition will be awarded this year.

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. Not given in 1946–47.]

[8. *Illustrated Lectures on Ancient Greece and Greek Life.* Not given in 1946–47.]

10. *English Translations of Greek and Latin Classics.* Throughout the year. Three hours a week.

15. *Lectures:* Foundations of Western Thought. First term. Three hours a week. Associate Professor SOLMSEN.

17. *ARISTOPHANES, CLOUDS; SOPHOCLES, OEDIPUS REX, ANTIGONE; HERODOTUS.* Throughout the year. Three hours a week. Prerequisite, Greek 2b. Professor JONES.

20. *LYRIC POETRY; AESCHYLUS, PROMETHEUS VINCTUS; THEOCRITUS; DEMOSTHENES, PHILIPPICS.* Throughout the year. Three hours a week. Prerequisite, Greek 17. Professor CAPLAN.

22. *PLATO, THE REPUBLIC; PINDAR, SELECTED ODES; THUCYDIDES.* Throughout the year. Three hours a week. Prerequisite, Greek 20. Associate Professor SOLMSEN.

25. *ADVANCED GREEK COMPOSITION.* Throughout the year. One hour a week. Prerequisite, Greek 5. Professor JONES.

[33. *SEMINARY.* Studies in Greek and Roman Rhetoric and Oratory. Not given in 1946–47.]

39. *SEMINARY. AESCHYLUS.* Throughout the year. Professor HUTTON. Library, Classical Seminary Room.

[42. *SEMINARY. PLATO.* Not given in 1946–47.]

[52. *GREEK DIALECTS.* Not given in in 1946–47.]

See also readings in GREEK PHILOSOPHY (under PHILOSOPHY), INDO-EUROPEAN PHILOLOGY (under LATIN), and ANCIENT HISTORY (under HISTORY).

ARCHAEOLOGY AND ANCIENT ART

Professor WAAGÉ.

1. *History of Painting and Sculpture: Ancient and Mediaeval.* Fall 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.

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

101. *PAUSANIAS AND THE TOPOGRAPHY OF GREECE WITH SPECIAL REFERENCE TO ATHENS.* First term. Hours to be arranged. Goldwin Smith 35.

102. *PROBLEMS IN CLASSICAL ARCHAEOLOGY.* Second term. Hours to be arranged. Goldwin Smith 35.

LATIN

1a. *Freshman Course: For Students Offering Three Units of Entrance Latin.* 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.

4. *Latin Language Review.* Throughout the year. One hour a week.

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

11. *Sallust.* First term. Two hours a week.

12. *Ovid.* Second term. Two hours a week.

16. *THE GREATER REPUBLICAN WRITERS. PLAUTUS; CICERO; LUCRETIUS.* Throughout the year. Three hours a week. Professor HUTTON.

[17. *LITERATURE AND HISTORY OF THE EARLY EMPIRE. TACITUS, ANNALS; JUVENAL; PLINY'S LETTERS; SENECA'S LETTERS.* Not given in 1946–47.]

21. *LATIN WRITING.* Throughout the year. One hour a week.

26. *COURSE FOR TEACHERS.* Second term. Two hours a week.

41. *SEMINARY. HORACE.* Throughout the year. Professor CAPLAN. Library, Classical Seminary Room.

[42. *SEMINARY. CICERO, DE NATURA DEORUM.* Not given in 1946–47.]

[43. *SEMINARY. STUDIES IN THE HISTORY OF LATIN LITERATURE.* Not given in 1946–47.]

45. *LATIN WRITING, ADVANCED COURSE.* Throughout the year. One hour a week.

[47. *HISTORY OF THE LATIN LANGUAGE.* Not given in 1946–47.]

48. *VULGAR LATIN: PETRONIUS, CENA TRIMALCHIONIS; VULGAR LATIN INSCRIPTIONS INCLUDING CHRISTIAN INSCRIPTIONS.* First term. Two hours a week.

[49. *COMPARATIVE GRAMMAR OF GREEK AND LATIN;* Introduction to Indo-European Linguistics. Not given in 1946–47.]

[51. *ITALIC DIALECTS: OSCAN AND UMBRIAN.* Not given in 1946–47.]

ENGLISH LANGUAGE AND LITERATURE

Professors M. H. ABRAMS, R. C. BALD, W. H. FRENCH, C. W. JONES, H. A. MYERS, EDWIN NUNGEZER, W. M. SALE, JR., H. W. THOMPSON, and C. I. WEIR, JR.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

English Literature to 1700 1, 2, 3, 4	The English Renaissance 2, 3†
English Literature since 1700 1, 2, 3, 4	The Classical Period 2, 3†
American Literature 1, 2, 3, 4	Nineteenth Century Literature 2, 3†
The English Language 1, 2, 3, 4	English Poetry 2, 3, 4
Medieval Literature 1*, 2, 3, 4	Dramatic Literature 1*, 2, 3, 4
Old and Middle English 2, 3†	Prose Fiction 2, 3, 4

* May be accepted as a major subject for the Doctorate if the minors are in two fields other than English.

† May be accepted as a minor for the Doctorate, provided that it does not fall within the major subject.

The type of work within each subject will vary, according as it is chosen for a major or a minor, and for the Master's or the Doctor's degree. Candidates are expected to choose their major and minor subjects within two weeks after registration.

In the Cornell University Library are 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* is a series of monographs in which the work of graduates and members of the staff may be published. Thirty-four numbers have appeared. The more recently established series of *Cornell Studies in American History, Literature, and Folklore* provides for the publication of editions, monographs, and essays by students registered in any college or session of the University.

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. All candidates for the degree of Doctor of Philosophy must have at least a full-year course in Old English; must show, in a qualifying examination given not later than the beginning of the second year of graduate study, that they have a general knowledge of English and American literature; must pass a final examination, to be taken approximately a year before the dissertation is submitted, on their major and minor subjects and the field in which the dissertation is to be written; 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. 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, Plan A, must have sufficient knowledge of French or German to make use of scholarly works in one of these languages.

The Martin Wright Sampson Teaching Fellowship, of the value of $900, with exemption from tuition fees, and one fellowship of $600, also carrying exemption from tuition fees, are awarded annually to graduate students in English. To secure consideration applicants must ordinarily have completed a year of graduate study. The Department also nominates deserving applicants for tuition scholarships. Furthermore, a number of part-time teaching appointments are often available to men working for advanced degrees; these carry exemption from tuition fees in the Graduate School in addition to the regular remuneration.

Information for candidates for the Master's degree under Plan B has been drawn up and may be obtained from the secretary of the Department. All graduate students in English are advised, on their arrival at Cornell, to consult at the earliest moment a member of the Committee of Graduate Studies in English, who will advise them about their work and help them to select a special committee.

Instruction in English available to candidates for advanced degrees is listed below in three groups: I. Courses open to undergraduates as well as graduate students; II. Courses at a more advanced level open only to graduate students; and III. Intensive and specialized study available to candidates for the doctorate.

The candidate for the Master's degree under Plan A is ordinarily expected to have completed successfully at least three two-term courses from Groups I and II, or to have completed 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 six two-term courses, including four from Groups II and III, or to have completed six courses which his Special Committee deems equivalent in scope and quality.

GROUP I. Courses for undergraduates and graduate students: graduate students taking these 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* and the supplementary announcements.

31. *MEDIEVAL LITERATURE.* Two terms. Three hours a week.

32. *THE ENGLISH RENAISSANCE.* One term. Three hours a week.

34. *EIGHTEENTH CENTURY LITERATURE.* Two terms. Three hours a week.

35. *THE ROMANTIC REVIVAL.* Two terms. Three hours a week.

36. *THE VICTORIAN AGE.* Two terms. Three hours a week.

37. *TWENTIETH CENTURY ENGLISH LITERATURE.* One term. Three hours a week.

39. *AMERICAN LITERATURE.* Two terms. Three hours a week.

40a. *MODERN ENGLISH FICTION.* One term. Three hours a week.

40b. *MODERN AMERICAN FICTION.* One term. Three hours a week.

44. *EUROPEAN FICTION.* Two terms. Three hours a week.

45. *THE ENGLISH DRAMA TO 1642.* One term. Three hours a week.

48. *MODERN DRAMA.* One term. Three hours a week.

53. *RECENT ENGLISH POETRY.* One term. Three hours a week.

54. *RECENT AMERICAN POETRY.* One term. Three hours a week.

56. *MIDDLE ENGLISH METRICAL ROMANCES.* One term. Three hours a week.

58. *AMERICAN FOLK LITERATURE.* One term. Three hours a week.

60. *CHAUCER AND HIS AGE.* Two terms. Three hours a week.

61. *SHAKESPEARE.* Two terms. Three hours a week.

63. *MILTON.* One term. Three hours a week.

78a. *EMERSON, THOREAU, AND WHITMAN.* One term. Three hours a week.

78b. *POE, HAWTHORNE, AND MELVILLE.* One term. Three hours a week.

81. *OLD ENGLISH PROSE AND POETRY.* Two terms. Three hours a week.

89. *MODERN LITERARY CRITICISM.* One term. Three hours a week.

GROUP II. Courses open only to graduate students. Not all of these can be offered, but persons interested in particular courses should address inquiries to the Department of English. If enough students apply, rooms and hours for a course will be arranged.

100. *BIBLIOGRAPHY AND METHOD.* An introduction to Graduate Research in English. Fall and spring terms. Professor BALD.

A survey of the principal sources of information and of the various techniques used in literary research. Recommended for all students entering upon graduate study.

102. *MIDDLE ENGLISH LITERATURE.* Fall and spring terms. Associate Professor FRENCH.

A survey of English literature from 1150 to 1500, with special attention to literary and textual problems; the Arthurian traditions in England; the metrical romances; and dialects.

108. *ELIZABETHAN LITERATURE.* Fall and spring terms. Associate Professor NUNGEZER.

A study of representative prose and poetry from Erasmus to Bacon.

110. *SEVENTEENTH CENTURY LITERATURE.* Fall and spring terms. Professor BALD.

112. *SCOTTISH LITERATURE.* Fall and spring terms. Professor THOMPSON.

From Allan Ramsay to the present, with emphasis upon balladry and other contributions of Scottish letters to the romantic tradition in England and America.

135. *STUDIES IN VICTORIAN LITERATURE.* Fall and spring terms. Associate Professor JONES.

140. *AMERICAN LITERATURE.* Fall and spring terms. Professor THOMPSON.

145. *THE TECHNIQUE OF THE NOVEL.* Fall and spring terms. Associate Professor SALE.

150. *DRAMATIC STRUCTURE.* Fall and spring terms. Associate Professor MYERS.

A study of dramatic history and theory, with reading of representative plays. This course is supplementary to English 23 and 48, which should precede or accompany it.

GROUP III. Specialized study for candidates for the doctorate. The professors designated will endeavor to supervise the work of advanced students in the undermentioned topics.

201. *OLD AND MIDDLE ENGLISH LITERATURE.* Associate Professor FRENCH.

203. *MEDIEVAL LITERATURE.* Associate Professor JONES.

208. *ELIZABETHAN LITERATURE.* Associate Professor NUNGEZER.

209. *THE ENGLISH DRAMA TO 1700.* Professor BALD and Associate Professor NUNGEZER.

210. *SEVENTEENTH CENTURY LITERATURE.* Professor BALD and Assistant Professor WEIR.

214. *EIGHTEENTH CENTURY LITERATURE.* Professor THOMPSON and Associate Professor SALE.

215. *THE ENGLISH NOVEL.* Associate Professor SALE.

216. *THE ROMANTIC PERIOD.* Professor BALD.

235. *VICTORIAN LITERATURE.* Associate Professor JONES.

240. *AMERICAN LITERATURE.* Professor THOMPSON and Associate Professor MYERS.

250. *DRAMATIC STRUCTURE.* Associate Professor MYERS.

254. *CONTEMPORARY LITERATURE.* Assistant Professor WEIR.

258. *FOLK LITERATURE.* Professor THOMPSON.

GERMANIC LANGUAGES AND LITERATURES

Professors V. LANGE and H. SCHNEIDER.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

German Literature 1, 2, 3, 4

Germanic 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 treated in 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 Baroque period, the age of Goethe, 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. *Elementary Intensive Course.* A one-term course, given every term. Six hours a week.

1a. *Course for Beginners.* First term of a two-term course, given every term. Three hours a week.

1b. *Course for Beginners.* Second term of a two-term course, given every term; follows 1a. Three hours a week.

1g. *Course for Graduate Students.* Both terms. Three hours a week.

3a. *Intermediate Course.* First term of a two-term course, given every term. Three hours a week.

3b. *Intermediate Course.* Second term of a two-term course, given every term; follows 3a. Three hours a week.

4. *Composition and Conversation.* Given every term. Three hours a week.

5. *Modern German Texts.* A one-term course, given every term. Three hours a week.

7. *German Literature from Goethe to the Present.* A two-term course, fall and spring terms. Two hours a week.

8. *Scientific German.* A one-term course, given every term. Three hours a week.

10. *Advanced German Composition and Conversation.* A two-term course, fall and spring terms. Three hours a week.

11. *Schiller's Life and Works.* A one-term course, spring term. Three hours a week.

13. *Goethe's Life and Works, including Faust.* A two-term course, fall and spring terms. Three hours a week.

15. *Survey of German Literature.* A two-term course, fall and spring terms. Three hours a week.

16. *Contemporary German Literature.* A one-term course, spring term. Three hours a week.

17. *Nineteenth Century Drama.* A one-term course, fall term. Three hours a week.

18. *Lessing's Life and Works.* A one-term course, fall term. Three hours a week.

19. *German Lyric Poetry from Goethe to George.* A one-term course, fall term. Three hours a week.

20. *The German Novel from 1800 to the Present.* A one-term course, spring term. Three hours a week.

21. *Bibliographical Introduction to the History of German Literature.* A one-term course, spring term. Two hours a week.

35. *GERMAN ROMANTICISM.* A one-term course, fall term. Two hours a week. Professor LANGE. By appointment.

36. *GERMAN BAROQUE LITERATURE.* A one-term course, spring term. Two hours a week. Professor LANGE.

37. *MIDDLE HIGH GERMAN.* A one-term course, spring term. Three hours a week. By appointment.

42. *GOTHIC.* A one-term course, fall term. Three hours a week. By appointment.

This course will serve as a general introduction to Germanic philology.

43. *OLD HIGH GERMAN.* A one-term course, spring term. Three hours a week. Prerequisite, German 37. By appointment.

49. *SEMINARY IN GERMAN LITERATURE.* A one-term course, fall term. Two hours a week. Professor LANGE. By appointment.

52. *SEMINARY IN GERMANIC PHILOLOGY.* A one-term course, fall term. Two hours a week. Professor ———. By appointment.

SPEECH AND DRAMA

Professors A. M. DRUMMOND, H. A. WICHELNS, HARRY CAPLAN, W. H. STAINTON, R. H. WAGNER, C. K. THOMAS, and H. D. ALBRIGHT.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

Division of Rhetoric and Public Speaking

Rhetoric and Public Speaking 1, 2, 4
Principles of Public Address 3, 4
History of Public Address 3, 4
Classical Rhetoric 3, 4
Medieval Rhetoric 3, 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. In many cases, the work will require more than the minimum periods of residence. Ordinarily, residence in this University during two academic years will be necessary for the attainment of the doctorate.

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 usually chose one minor subject from the field of literary history and criticism or from that of the social sciences.

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 will be advised to take additional courses in Public Speaking and Speech Training.

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 presentation 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.

1. *Public Speaking.* Repeated in spring term. Three meetings a week.

2. *Public Speaking.* Repeated in spring term. Three meetings a week. A continuation of course 1.

7. *Discussion.* Repeated in spring term. Associate Professor WAGNER. Fall term: M W F 11; spring term: T Th S 9, T 11, Th 11–1.

Principles and practice of group thinking: an introduction to systematic investigation and reflective thinking, with application to current questions; practice in various types of group discussion.

10. *Oral Interpretation of Literature.* Repeated in spring term. Three meetings a week.

11. *Oral Interpretation of Literature.* Spring term. Three meetings a week. A continuation of course 10.

12. *Argument and Debate.* Repeated in spring term. Three meetings a week.

13. *ADVANCED ARGUMENTATION.* Spring term. Associate Professor WAGNER. M W F 9.

Advanced study of principles, methods, and noted examples.

[16. *FORMS OF PUBLIC ADDRESS.* Professor WICHELNS. Not given in 1946–47.]

21. *HISTORY OF PUBLIC ADDRESS.* Throughout the year. Professor WICHELNS. M Th 2–3:15.

23. *THEORIES OF PUBLIC ADDRESS.* Throughout the year. Associate Professor WAGNER. T 2–4:30.

[24. *PUBLIC OPINION AND THE METHOD OF ARGUMENT.* Professor WICHELNS. Not given in 1946–47.]

[25. *BRITISH RHETORIC AND ORATORY.* Associate Professor WAGNER. Not given in 1946–47.]

30. *VOICE TRAINING.* Repeated in spring term. Associate Professor THOMAS. Two meetings a week; conferences.

32. *PHONETICS AND SPEECH TRAINING.* Fall term. Associate Professor THOMAS. T Th S 11.

33. *REGIONAL AND HISTORICAL PHONETICS.* Spring term. Associate Professor THOMAS. T Th S 11.

[34. *PRINCIPLES OF LINGUISTICS.* Associate Professor THOMAS. Not given in 1946–47.]

36. *PRINCIPLES AND METHODS OF SPEECH CORRECTION.* Associate Professor THOMAS. Hours to be arranged.

40. *DRAMATIC INTERPRETATION.* Spring term. Assistant Professor ALBRIGHT. M W F 10.

41. *DRAMATIC PRODUCTION: DIRECTION.* Fall term. Associate Professor STAINTON. M W F 11.

Dramatic interpretation and the related principles of stage direction and production.

42. *ADVANCED DRAMATIC INTERPRETATION AND ACTING.* Spring term. Professor DRUMMOND. W 2–4.

A practical course in direction, rehearsal, and acting, leading to public presentations in the Laboratory Theatre; special attention to oral interpretation.

44. *ADVANCED DRAMATIC PRODUCTION.* Throughout the year. Professor DRUMMOND. T 2–4 and an hour to be arranged.

Laboratory practice in the presentation and production of plays.

45. *DRAMATIC PRODUCTION: STAGECRAFT.* Spring term. Associate Professor STAINTON. M W 11. Laboratory T 1:40–4 or as arranged.

Stage production; problems and practice in construction and design.

45a. *DRAMATIC PRODUCTION: STAGE LIGHTING.* Fall term. Associate Professor STAINTON. Hours to be arranged.

[46. *Stage Design and Theatre Crafts.* Not given in 1946–47.]

[47. *History of Costume.* Not given in 1946–47.]

48. *HISTORY OF THE THEATRE.* Fall term. Professor DRUMMOND. M W F 11.

The development of the theatre, with special attention to the period theatres and theatrical styles which influence modern stage presentation.

48b. *AMERICAN DRAMA AND THEATRE.* Spring term. Professor DRUMMOND. M W F 11.

A study of the American theatre and of the principal American plays, with special emphasis on the drama as an expression of the national life and culture.

[49b. *Playwriting.* Throughout the year. Professor DRUMMOND. Not given in 1946–47.]

91. *THEATRE PRACTICE.* Throughout the year; may be entered in either term. Associate Professor STAINTON. Hours as arranged.

Projects correlated with the work of the University Theatre.

STUDIES IN GREEK AND ROMAN RHETORIC AND ORATORY. Professor CAPLAN. (See Greek 33.)

DRAMATIC LITERATURE. See English 48 and 61.

Fine Arts. See especially Fine Arts 1a, 1b (History of Painting and Sculpture); Philosophy 8; Music 5, 10.

SEMINARY COURSES

[60. *RHETORICAL CRITICISM.* Associate Professor WAGNER. Not given in 1946–47.]

62. *PHILOSOPHY OF RHETORIC.* Throughout the year. Professor WICHELNS. Hours to be arranged.

[63. *SPEECH TRAINING.* Associate Professor THOMAS. Not given in 1946–47.]

66. *THEORIES OF DRAMATIC PRODUCTION.* Fall term. Professor DRUMMOND. T Th 12.

The chief theories of dramatic production in relation to aesthetic principles.

[67. *DRAMATIC ART.* Professor DRUMMOND. Not given in 1946–47.]

68. *MODERN THEORIES OF STAGE PRESENTATION.* Throughout the year. Associate Professor STAINTON. Hours to be arranged.

DRAMATIC STRUCTURE. See especially English 150, 250. Associate Professor MYERS.

ROMANCE LITERATURES AND PHILOLOGY

Professors T. G. BERGIN, MORRIS BISHOP, G. I. DALE, B. L. RIDEOUT, and P. J. THOMAS.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

French Language 1, 2, 3, 4

French Literature 1, 2

French Philology 1, 2, 3, 4

Medieval French Literature 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

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 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

Spanish-American Literature 3, 4

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

The courses of study in this department are divided into three categories: those intended primarily for undergraduates, those intended alike for undergraduates and graduates, and those intended primarily for graduates. 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. 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.

ROMANCE PHILOLOGY

Professor BERGIN.

1. *INTRODUCTION TO ROMANCE PHILOLOGY.* Throughout the year. Credit three hours a term. Prerequisite, a major in one of the Romance Languages, with a reading knowledge of another. Professor BERGIN.

Lectures, outside reading, and classroom exercises on the structure and development of the Romance Languages, with the reading of exemplary texts.

FRENCH

Professors BERGIN and BISHOP; *Associate Professors* RIDEOUT and THOMAS.

16. *History of French Literature.* Throughout the year. Credit three hours a term. Professor BISHOP. M W F 11. Goldwin Smith 290.

Lectures in French and classroom discussions. Primarily for undergraduates.

17. *Literature of the Seventeenth Century.* Throughout the year. Credit three hours a term. Prerequisite, French 16. Professor BISHOP. T Th S 12. Goldwin Smith 281.

Lectures in French and classroom discussions on the development of French Classicism and the leading authors of the seventeenth century.

[18. *Literature of the Eighteenth Century.* Not given in 1946–47.]

19. *Literature of the Early Nineteenth Century.* Throughout the year. Credit three hours a term. Prerequisite, French 16. Associate Professor RIDEOUT.

Lectures in French and classroom discussions on the French authors of the period, with particular concern for the theory and practice of Romanticism.

[20. *Literature of the Late Nineteenth Century.* Not given in 1946–47.]

[21. *Literature of the Twentieth Century.* Not given in 1946–47.]

[23. *French Historical Grammar.* Not given in 1946–47.]

24. *FRENCH PHILOLOGY.* See Romance Philology 1.

[31. *Literature of the Sixteenth Century.* Not given in 1946–47.]

[32. *French Poetry.* Not given in 1946-47.]

[41. *OLD FRENCH.* Not given in 1946–47.]

[42. *OLD PROVENCAL PHILOLOGY AND LITERATURE.* Not given in 1946–47.]

47. *MODERN FRENCH SEMINARY.* Throughout the year. Credit two hours. Professor BISHOP. T 2:30. Library, French Seminary.

An introduction to the methods and materials of research in French Literature, by means of a collective study of a problem of literary history.

ITALIAN

Professor BERGIN.

15. *Dante.* Throughout the year. Credit three hours a term. Hours to be arranged.

Reading of the *Divina Commedia,* with a study of the background of the poem and its significance.

20. *SEMINARY IN ITALIAN LITERATURE.* Credit two hours a term. Professor BERGIN. Hours to be arranged.

Critical examination of a problem in Italian literary history.

SPANISH

Professors DALE and ————.

10. *History of Spanish Literature.* Throughout the year. Credit three hours a term. Professor DALE. M W F 11. Goldwin Smith 281.

Lectures in Spanish and classroom discussion. Primarily for undergraduates.

11. *Survey of Spanish-American Literature.* Throughout the year. Credit three hours a term. Professor ————. Hours to be arranged.

Lectures in Spanish and classroom discussion. Primarily for undergraduates.

[17. *Cervantes.* Not given in 1946–47.]

[18. *The Spanish-American Novel.* Not given in 1946–47.]

19. *The Nineteenth Century Spanish Novel.* Throughout the year. Credit three hours a term. Professor DALE. T Th S 11. Goldwin Smith 281.

Extensive reading, with critical study of the major works.

[20. *Latin-American Culture.* Not given in 1946–47.]

21. *Mexican Literature.* Throughout the year. Credit three hours a term. Professor ————. Hours to be arranged.

41. *OLD SPANISH.* Throughout the year. Credit two hours a term. Professor DALE. W 2:15. Library, Spanish Seminary.

A philological and morphological study of Old Spanish texts, with special emphasis on the *Poema del Cid.*

[42. *CALDERÓN AND ALARCÓN.* Not given in 1946–47.]

[43. *THE PICARESQUE NOVEL.* Not given in 1946–47.]

50. *SEMINARY IN SPANISH-AMERICAN LITERATURE.* Throughout the year. Credit two hours a term. Professor ————. Hours to be arranged.

Critical study of a problem or aspect of Spanish-American literature.

SUSAN LINN SAGE

SCHOOL OF PHILOSOPHY

Professors G. WATTS CUNNINGHAM, GEORGE H. SABINE, E. A. BURTT, HAROLD R. SMART, MAX BLACK, and ARTHUR E. MURPHY.

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, metaphysics and epistemology, and philosophy of religion. Candidates for the doctorate are required, and other graduate 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 41 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.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

Aesthetics 1, 2, 3, 4

Ethics 1, 2, 3, 4

History of Philosophy 1, 2, 3, 4

Logic 1, 2, 3, 4

Metaphysics and Epistemology 1, 2, 3, 4

Philosophy 4

Philosophy of Religion 1, 2, 3, 4

The courses titled in italic small letters are primarily for undergraduates, though some of them may be taken by graduate students on permission of the instructors. For detailed information concerning them consult the *Announcement of the College of Arts and Sciences.*

1a. *Philosophical Classics.* Given each term. Three hours a week.

1b. *Philosophical Classics* (Second course). Given alternate terms. Three hours a week.

2. *Logic.* Given each term. Three hours a week.

3. *Problems of Philosophy.* Fall term. Three hours a week.

4. *Ethics.* Throughout the year. Three hours a week.

5. *History of Philosophical Ideas.* A two-term course, fall and spring terms. Three hours a week.

8. *Aesthetics: Philosophy of Art.* Spring term. Three hours a week.

10. *Modern Political Theory.* Spring term. Three hours a week.

12. *American Philosophy.* Fall term. Three hours a week.

13. *Philosophy of Religion.* Spring term. Three hours a week.

14. *History of Religions.* Fall term. Three hours a week.

15. *Philosophy of Science.* Throughout the year. Three hours a week.

Informal Study. For qualified majors in philosophy.

18. *HISTORY OF PHILOSOPHICAL SYSTEMS.* A two-term course, fall and spring terms. Three hours a week. Professor CUNNINGHAM. For graduates, philosophy majors, and other juniors and seniors with the consent of the instructor. T Th S 10. Goldwin Smith.

A systematic study of the main systems in Western philosophy.

22. *AESTHETICS.* (Advanced Course). Fall term. M W 12, or hours to be arranged. Goldwin Smith 220.

An intensive study of selected problems in the field.

[23. *PHILOSOPHY OF RELIGION* (Advanced course.) Fall term. Professor BURTT. Not given in 1946–47.]

An intensive study of selected problems in the field.

SYMBOLIC LOGIC. (See Mathematics.)

[25. *PLATO AND ARISTOTLE.* Throughout the year. Given alternate years, not in 1946–47.]

A philosophical study of the two ancient thinkers, with substantial readings from their works in translation.

26. *MODERN PHILOSOPHERS.* Throughout the year. Associate Professor SMART. M W F 2. Goldwin Smith 220.

A study of selected thinkers of the period, with special attention to Hume and Kant.

27. *SEMANTICS AND LOGIC.* Throughout the year. Professor BLACK. Hours to be arranged. Goldwin Smith 220.

An intensive study of the main tendencies and problems in the field.

[28. *THEORY OF VALUE.* Throughout the year. Not given in 1946–47.]

An intensive study of the main problems in ethics and social philosophy.

29. *METAPHYSICS AND EPISTEMOLOGY.* Throughout the year. Professor Murphy. Hours to be arranged. Goldwin Smith 220.

An intensive study of the main theories and problems regarding reality and knowledge.

30. *SEMINARY IN ANCIENT AND MEDIAEVAL PHILOSOPHY.* Spring term. M W 12, or hours to be arranged. Goldwin Smith 220.

Topic for 1946–47: Stoic Ethics.

[31. *SEMINARY IN MODERN PHILOSOPHY.* Spring term. Not given in 1946–47.]

[32. *SEMINARY IN SEMANTICS AND LOGIC.* Fall term. Given in alternate years, not in 1946–47.]

[33. *SEMINARY IN THEORY OF VALUE.* Spring term. Given in alternate years, not in 1946–47.]

[34. *SEMINARY IN METAPHYSICS AND EPISTEMOLOGY.* Fall term. Given in alternate years, not in 1946–47.]

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 and journalism.

ECONOMICS

Professors DONALD ENGLISH, P. T. HOMAN, M. S. KENDRICK, R. E. MONTGOMERY, P. M. O'LEARY, H. L. REED, and F. A. SOUTHARD, JR.; *Associate Professors* G. P. ADAMS, JR., and J. G. B. HUTCHINS.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

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 Economics 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 ECONOMICS.—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.]

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.

11. *Money, Currency, and Banking.* Three hours a week.

12. *Commercial Banking and the Federal Reserve System.* Three hours a week.

[13. *Financial History of the United States.* Three hours a week. Not given in 1946–47.]

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

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

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

31. *Corporation Finance.* Three hours a week.

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

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

34. *Economics of Transportation.* Three hours a week throughout the year.

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

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

44. *Public Policy and Industrial Relations.* Three hours a week.

45. *The Economics of Dissent.* Two hours a week.

46. *Legal and Constitutional Aspects of Labor Problems and Social Insurance.* Three hours a week.

52. *Federal Finance.* Three hours a week.

61a. *Economic and Business History.* First term. Three hours a week.

61b. *Economic and Business History.* Second term. Three hours a week.

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

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

74. *International Economic Organization.* Three hours a week.

81. *Economics of Enterprise.* Three hours a week. May not be given in 1946–47.

82. *Economic Analysis.* Three hours a week.

83. *History of Modern Economic Thought.* Three hours a week throughout the year.

The following seminary courses usually meet for two hours a week throughout the year. The subject matter dealt with changes from year to year and registration for them may be repeated.

110. *MONEY AND CREDIT.* Professor REED.

130. *CONTROL OF INDUSTRY.* Associate Professor ADAMS.

140. *LABOR ECONOMICS.* Professor MONTGOMERY.

150. *PUBLIC FINANCE.* Professor KENDRICK.

160. *ECONOMIC HISTORY.* Associate Professor HUTCHINS.

170. *INTERNATIONAL ECONOMICS.* Professor SOUTHARD.

180. *ECONOMIC THEORY.* Professor HOMAN.

GOVERNMENT

Professors R. E. CUSHMAN, H. W. BRIGGS, M. EINAUDI, and ELIAS HUZAR.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

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

Comparative European Government 1, 2, 3, 4

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 1946–47 research in Government will be directed primarily in the fields of American Constitutional Law, Political Theory, and International Law and Relations, and Comparative European Governments, 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 National Government.* Fall term. Three hours a week.

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

3. *State and Local Government.* Spring term. Three hours a week.

[6. *Municipal Government.* Credit three hours. Not given in 1946–47.]

7. *PUBLIC ADMINISTRATION.* Throughout the year. Credit three hours a term. Professor HUZAR. M W F 11. Boardman 121.

Efficiency and responsibility in public administration; principles and problems of administrative organization, the civil service, fiscal management, and methods of administrative action.

9. *INTRODUCTION TO INTERNATIONAL RELATIONS.* Fall term. Credit three hours. Professor BRIGGS. M W F 9. Boardman 110.

A survey of nationalism, internationalism, imperialism, and the racial, political, economic, and geographical factors in modern international relations.

10a. *DEVELOPMENT OF MODERN POLITICAL THOUGHT.* Fall term. Credit three hours. Professor EINAUDI. T Th S 10. Boardman 121.

Political thought from the sixteenth century to the French Revolution: from Bodin's "limited sovereignty" to Rousseau's "general will."

10b. *CONTEMPORARY POLITICAL THOUGHT.* Spring term. Credit three hours. Professor EINAUDI. T Th S 10. Boardman 320.

A study of the major developments in political thought in the nineteenth and twentieth centuries.

[11a. *CONSTITUTIONAL GOVERNMENT IN EUROPE.* Credit three hours. Not given in 1946–47.]

11b. *COMPARATIVE STUDY OF PUBLIC REGULATION OF ECONOMIC LIFE.* Fall term. Credit three hours. Professor EINAUDI. T Th S 9. Boardman 321.

An analysis, from the political and administrative point of view, of the most significant developments in the field of government regulation of economic life. Both American and European experience will be taken into account.

14a and b. *INTERNATIONAL LAW.* Throughout the year. Credit three hours a term. Professor BRIGGS. M W F 11. Boardman 320.

A systematic study of the nature, development, and judicial application of the principles of international law. Cases, readings, discussions.

15. *INTERNATIONAL ORGANIZATION.* Spring term. Credit three hours. Professor BRIGGS. M W F 9. Boardman 122.

An analysis of international governmental procedures and institutions: international administration; international legislation; power politics and collective efforts to maintain international peace and security; the League of Nations; the United Nations Organization, and specialized agencies; the judicial function and the International Court of Justice.

[16a. *CONTEMPORARY AMERICAN FOREIGN POLICY: THE LATIN AMERICAN POLICY OF THE UNITED STATES.* Credit three hours. Not given in 1946–47.]

[16b. *CONTEMPORARY AMERICAN FOREIGN POLICY: THE FAR EASTERN POLICY OF THE UNITED STATES.* Credit three hours. Not given in 1946–47.]

19. *CONGRESS: ORGANIZATION AND METHODS OF WORK.* Fall term. Credit three hours. Professor HUZAR. M W F 10. Boardman 320.

Problems and practices of membership, organization, and operation of the national legislature.

20. *CONSTITUTIONAL LAW: THE AMERICAN FEDERAL SYSTEM.* Fall term. Credit three hours. Professor CUSHMAN. T Th S 11. Boardman 122.

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

21. *CONSTITUTIONAL LAW: FUNDAMENTAL RIGHTS AND IMMUNITIES.* Spring term. Credit three hours. Professor CUSHMAN. T Th S 11. Boardman 122.

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 laws.

22. *SEMINARY IN CONSTITUTIONAL PROBLEMS.* Spring term. Credit two hours. Professor CUSHMAN. T 2–4. Boardman 317. Students will be admitted upon consultation with the instructor.

23. *SEMINARY IN POLITICAL THEORY.* Throughout the year. Credit two hours. Professor EINAUDI. Students will be admitted upon consultation with the instructor.

24. *SEMINARY IN INTERNATIONAL LAW AND INTERNATIONAL RELATIONS.* Throughout the year. Credit two hours a term. Professor BRIGGS. Students will be admitted upon consultation with the instructor.

HISTORY

Professors M. L. W. LAISTNER, CARL STEPHENSON, F. G. MARCHAM, C. W. DE KIEWIET, P. W. GATES, and C. P. NETTELS; *Associate Professor* KNIGHT BIGGERSTAFF; *Assistant Professor* MARC SZEFTEL.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

American History 1, 2, 3, 4	Far Eastern History 1, 2, 3, 4
Ancient History 1, 2, 3, 4	Medieval History 1, 2, 3, 4
English 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.

The COLLECTION OF REGIONAL HISTORY at Cornell has rich manuscript materials for the study of the history of up-state New York and surrounding areas. It has also assembled extensive newspaper files for the study of American 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 are offered in ancient, medieval, and modern European history, English history, Far Eastern 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. The attention of graduate students in History is also drawn to courses 16a–b (Contemporary American Foreign Policy) and 21 (Constitutional Laws) given in the Department of Government.

AMERICAN HISTORY

Professors P. W. GATES and C. P. NETTELS.

82. *American History*, 1607–1865. Fall term.

83. *American History, 1865 to the Present.* Spring term.

89. *AMERICAN HISTORY: HISTORY OF THE WEST.* Fall and spring terms. Three hours a week. Prerequisites, History 82, 83. Professor GATES. M W F 12.

[91. *RECENT AMERICAN HISTORY.* Fall and spring terms. Prerequisites, History 82, 83, or the equivalent. Professor GATES. M W F 12. Not given in 1946–47.]

92a. *AMERICAN COLONIAL HISTORY TO 1763.* First term. M W F 11. Professor NETTELS.

92b. *THE AGE OF WASHINGTON, 1763–1800.* Second term. M W F 11. Professor NETTELS.

[93. *ECONOMIC HISTORY OF THE UNITED STATES.* Second term. Professor GATES. M W F 12. Not given in 1946–47.]

99. *SEMINARY IN AMERICAN HISTORY.* One or more terms during the year. Two hours a week. Professor NETTELS. Hours to be arranged.

100. *SEMINARY IN AMERICAN HISTORY.* One or more terms during the year. Two hours a week. Professor GATES. Hours to be arranged.

ANCIENT HISTORY

Professor M. L. W. LAISTNER.

2a. *Greek Civilization.* Fall term. Three hours a week.

2b. *Roman Civilization.* Spring term. Three hours a week.

[3. *GREEK HISTORY,* 500–323 B.C. First term. M W F 11. Not given in 1946–47.]

[4. *THE HELLENISTIC AGE.* Spring term. M W F 9. Not given in 1946–47.]

5. *THE ROMAN REPUBLIC,* 133–30 B.C. Boardman 321.

6. *THE ROMAN EMPIRE,* 30 B.C.–180 A.D.

8. *SEMINARY IN GREEK AND ROMAN HISTORIOGRAPHY.* Throughout the year.

[14. *SEMINARY IN ROMAN HISTORICAL INSCRIPTIONS.* Two terms. Fall and spring terms. M 2–4 University Library, Classical Seminary. A reading knowledge of Latin is essential. Not given in 1946–47.]

ENGLISH HISTORY

Professor F. G. MARCHAM.

61a and b. *English History.* A two-term course, fall and spring terms.

[65. *ENGLISH CONSTITUTIONAL HISTORY SINCE 1485.* Throughout the year. Not given in 1946–47.]

66a. *HISTORY OF ENGLAND UNDER THE TUDORS AND STUARTS.* Throughout the year. Three hours a week.

[67 and 68. *HISTORY OF ENGLAND FROM THE EIGHTEENTH CENTURY TO PRESENT.* Throughout the year. Three hours a week. Not given in 1946–47.]

69. *SEMINARY IN TUDOR AND STUART HISTORY.* One or two terms during the year.

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

FAR EASTERN HISTORY

Associate Professor KNIGHT BIGGERSTAFF.

15. *CHINESE HISTORY.* Throughout the year. Associate Professor BIGGERSTAFF.

18a and b. *MODERN HISTORY OF THE FAR EAST, 19TH AND 20TH CENTURIES.* A two-term course, fall and spring terms. Associate Professor BIGGERSTAFF. M W F 8.

A study of the political, social, and economic background of international relations in Eastern Asia.

20. *SEMINARY IN MODERN CHINESE HISTORY.* One or two terms during the year. Associate Professor BIGGERSTAFF.

MEDIEVAL HISTORY

Professor CARL STEPHENSON.

22. *Medieval History.* Fall term.

23. *THE RISE OF THE UNIVERSITIES.* First term. T Th 10.

24. *SOCIAL AND ECONOMIC HISTORY OF THE MIDDLE AGES.* Second term. T Th 10.

[24. *ENGLISH CONSTITUTIONAL HISTORY TO 1485.* First term. T Th 10. Not given in 1946–47.]

26. *SEMINARY IN MEDIEVAL HISTORY.* One or two terms during the year. Prerequisite, reading knowledge of Latin; German and French desirable. Hours to be arranged.

MODERN EUROPEAN HISTORY

Professor C. W. DE KIEWIET, *Professor* CARL STEPHENSON, and *Assistant Professor* MARC SZEFTEL.

42a. *Modern History,* 1600–1850.

[42b. *Recent European History,* 1870–1944. Not given in 1946–47.]

[43. *FRANCE IN THE 17TH AND 18TH CENTURIES.* Throughout the year. Professor DE KIEWIET. Not given in 1946–47.]

46. *EUROPE AND THE FRENCH REVOLUTION.* First term. T Th S 11. *Assistant Professor* SZEFTEL.

47. *THE NAPOLEONIC ERA.* Spring term. T T S 11. Assistant Professor SZEFTEL.

51a–b. *RUSSIA FROM PETER THE GREAT TO THE PRESENT.* Throughout the year. T Th S 9. Assistant Professor SZEFTEL.

SEMINARY IN MODERN EUROPEAN HISTORY. Professor DE KIEWIET. Hours to be arranged.

SEMINARY IN MODERN EUROPEAN HISTORY. Assistant Professor SZEFTEL. Hours to be arranged.

SOCIOLOGY

SOCIOLOGY AND ANTHROPOLOGY; RURAL SOCIOLOGY

Professors W. A. ANDERSON, H. R. COTTAM, L. S. COTTRELL, JR., LOUIS GUTTMAN, R. L. SHARP, R. M. WILLIAMS. [On leave: *Professor* F. F. STEPHAN.]

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

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

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.

REQUIREMENTS FOR THE DEGREE OF PH.D.

GENERAL SOCIOLOGY. When offered as a major for the Ph.D. degree: (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, statistics.

When offered as a minor for the Ph.D. degree: a general knowledge of part (1) 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. degree: (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.

STATISTICS. When offered as a minor for the Ph.D. degree: (1) the completion of an approved sequence of courses including a full year in Sociology 172; (2) completion of a research project which demonstrates that the candidate is able to select methods appropriate to the problem and to employ advanced statistical methods.

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.

STATISTICS. When offered as a major, the requirements are the same as for the minor of the Ph.D. degree. When offered as a minor, either part (1) or part (2) of the requirements for the Ph.D. degree.

The following courses are offered in the department of Sociology and Anthropology (SA) and Rural Sociology (RS) as indicated.

GENERAL SOCIOLOGY

SA2. *Introduction to Sociology.* Fall term. Credit three hours.

SA3. *Man and Culture.* Spring term. Credit three hours.

SA 10. *THE FAMILY.* Spring term. Credit three hours. Prerequisite, Social Science B, Sociology 2, or equivalent. Professor COTTRELL. T Th S 11. McGraw 200.

The development of the family as a social institution; the relation between social change and changes in the family pattern; the social psychology of intra-family relationships.

SA20. *SOCIAL PATHOLOGY.* Fall term. Credit three hours. Prerequisite, Social Science B, Sociology 2, or equivalent. Professor ————. T Th S 11. McGraw 200.

Social and personal disorganization in modern society; programs and agencies that aim at reorganization.

[SA21. Criminology. Fall term. Credit three hours. Not given in 1946–47.]

SA28. *PROBLEMS IN RACE RELATIONS.* Spring term. Credit three hours. Prerequisite, one course in sociology, anthropology, or psychology. Associate Professor GUTTMAN. M W F 10. McGraw 200.

A study of the distribution of minority groups in the United States and the sociology of racial or ethnic group relations in this country. Special attention will be given to selected groups.

SOCIAL PSYCHOLOGY. Throughout the year. Credit three hours a term. Prerequisite, one of the following: Psychology 1, Sociology and Anthropology 2, Social Science B, or permission of the instructor. Professors COTTRELL and BITTERMAN. M W F 11. McGraw 200. (Interdepartmental course offered jointly by the Department of Psychology and the Department of Sociology and Anthropology.)

The study of the human personality and its development, functioning, and social adjustment; the social psychological processes in the behavior of groups.

SA31. *ATTITUDE AND PUBLIC OPINION ANALYSIS.* Fall term. Credit three hours. Not open to freshmen. No prerequisites. Associate Professor GUTTMAN. M W F 10. McGraw 200.

A study of the methodology and techniques of public opinion polling and attitude surveys.

SA40. *POPULATION PROBLEMS.* Fall term. Credit three hours. Professor ————. T Th S 10. McGraw 200.

Population growth, distribution, and migration; the problem of population quality; special population problems resulting from the war.

[SA41. *THE CITY.* Fall term. Credit three hours. Not given in 1946–47.]

[SA42. *SOCIAL PLANNING.* Spring term. Credit three hours. Not given in 1946–47.]

SA43. *THE STRUCTURE AND FUNCTIONING OF AMERICAN SOCIETY.* Throughout the year. Credit three hours a term. Prerequisite, consent of the instructor. Associate Professor WILLIAMS. T Th S 9. McGraw 200.

Social stratification and social institutional structures of American society and their functional inter-relations.

SA70. *Introduction to Statistics.* Fall term. Credit three hours. Not open to freshmen. Associate Professor GUTTMAN. M W F 2. McGraw 200.

A descriptive course on elementary principles and methods for the systematic collection, presentation, and interpretation of statistics. For students who desire only one course in statistics, this course will provide an acquaintance with the principal sources of statistics, a knowledge of the major uses of statistics, and a critical understanding of elementary methods of analysis and statistical reasoning.

SA71. *METHODS OF STATISTICAL ANALYSIS.* Throughout the year. Credit four hours a term. Prerequisites, for the first term: Mathematics 65a, 30, or equivalent, or enrollment therein; for the second term: Mathematics 65b, or equivalent or enrollment therein. Associate Professor GUTTMAN. M W F 9 and laboratory to be arranged. McGraw 300.

The analysis of frequency distributions of qualitative and quantitative variables, graphic representation, averages, dispersion, sampling and tests of significance, analysis of variance, regression, correlation, elementary multivariate analysis.

SA100. *INFORMAL STUDY.* Throughout the year. Hours and credit to be arranged. Open to upperclass majors and graduate students in sociology and anthropology. Departmental staff members.

SA130. *SEMINARY: RESEARCH IN SOCIAL PSYCHOLOGY.* Fall term. Credit two hours. Prerequisite, consent of instructor. Professor COTTRELL. Th 2–4. Warren 304.

SA142. *SEMINARY.* Fall term. Credit two hours. Prerequisite, consent of the instructor. Associate Professor WILLIAMS. T 2–4. McGraw 220. Topic to be announced.

SA172. *SEMINARY: ADVANCED STATISTICAL METHODS.* Throughout the year. Credit two hours a term. Prerequisite, Sociology 71 or equivalent. Associate Professor GUTTMAN. Hours and place to be arranged.

The topic or topics for the seminar will be decided by a consensus of the students. The theory of statistical inference (fundamental sampling problems), multiple factor analysis; reliability and validity of scales, the theory of statistical prediction, and other topics are among those that might be chosen.

RS 207. *SOCIOLOGICAL THEORY.* Throughout the year. Credit three hours a term. Open to seniors and graduate students. Given in alternate years. Prerequisite, permission of instructor. Professor ANDERSON. T Th S 9. Warren 302.

A critical analysis of sociological theories from the time of August Comte to contemporary sociologists.

[RS208. *SYSTEMATIC SOCIOLOGY.* Throughout the year. Credit three hours a term. Given in alternate years. Not given in 1946–47.]

[RS209. *SEMINARY.* Spring term. Credit two hours. Not given in 1946–47.]

ANTHROPOLOGY

SA60. *SOCIAL ANTHROPOLOGY.* Throughout the year. Credit three hours a term. Associate Professor SHARP. M W F 12. McGraw 200.

Problems in the comparative and historical study of cultures, both primitive and complex: environments and technologies; social structures, familial, political, economic, religious, and associational; ritual and symbolic behavior; culture and personality; cultural interests and the problems of divergent interests within and between cultures.

SA64. *CULTURES OF ASIA.* Fall term. Credit three hours. Prerequisite, consent of the instructor. Associate Professor SHARP. M W F 9. McGraw 200.

A study of the cultures or representative ethnic groups in eastern Asia, including India and Indonesia, their origins, relationships with each other, and reactions to Western Civilization.

[SA65. *THE AMERICAN INDIAN.* Spring term. Credit three hours. Not given in 1946–47.]

SA68. *PHYSICAL ANTHROPOLOGY AND HUMAN EVOLUTION.* Fall term. Credit three hours. Professor PAPEZ and instructors. M W F 11. (See Zoology 223.)

SA160. *SEMINARY IN ANTHROPOLOGY.* Throughout the year. Hours and credit to be arranged. Prerequisite, consent of the instructor. Associate Professor SHARP.

RURAL SOCIOLOGY

RSI. *Sociology for Students of Rural Life.* Repeated each term. Credit three hours.

RS12. *Rural Sociology.* Fall term. Credit three hours.

RS111. *Rural Community Organization.* Spring term. Credit three hours. Prerequisite, Course 12 or permission of the instructor. Professor ———. T Th S 10. Warren 302.

The application of Sociology to the practical problems of community organization.

[RS112. *Rural Recreation.* Spring term. Credit three hours. Not given in 1946–47.]

RS123. *Practice in Social Work Agencies.* Throughout the year. Hours and credit arranged. Professor ————.

Supervised practice field work in various types of social work activities.

RS124. *Social Case Work.* Throughout the year. Credit three hours a term. Prerequisite, permission of instructor. Professor ————. M W F 9. Warren 340.

RS125. *Social Welfare Organization.* Spring term. Credit three hours. Prerequisite, permission of instructor. Professor ————. M W F 10. Warren 340.

[RS126. *Skills in Case Work.* Fall term. Credit three hours. Not given in 1946–47.]

RS132. *RURAL LEADERSHIP.* Spring term. Credit two hours. Prerequisite, permission of instructor. Professor ————. Th 2. Warren 302.

A seminar course in the theory and practices of leadership and the problems of selection and training of leaders.

[RS133. *Group Leadership.* Spring term. Credit three hours. Not given in 1946–47.]

RS211. *The Rural Community.* Fall term. Credit three hours. Prerequisite, Course 12 or permission of instructor. Professor WILLIAMS. T Th S 10. Warren 302.

An analysis of the structure and functioning of the rural community.

RS212. *RURAL SOCIOLOGY.* Fall term. Credit four hours. For graduate students only. Prerequisite, permission of instructor. Professor COTTAM. T Th S 11 and one hour to be arranged. Warren 325.

A general study of the problems of rural society.

[RS213. *RESEARCH IN RURAL SOCIAL ORGANIZATION.* Throughout the year. Hours and credit to be arranged. Not given in 1946–47.]

RS217. *SEMINARY IN THE HISTORY OF RESEARCH IN RURAL SOCIOLOGY.* Spring term. Credit three hours. Primarily for graduate students. Prerequisite, permission of instructor. Professor ANDERSON. T Th S 11. Warren 302.

A study of the development of research in Rural Sociology. Analysis of research methods, objectives, and results.

ANIMAL SCIENCES

NOTE—*Laboratory space is limited and is often overtaxed, especially in courses which admit both graduate students and undergraduates. Graduate students who desire to enroll in such courses are warned to make application for space well in advance of the beginning of instruction. This holds particularly of the second term, since the College of Agriculture holds its preregistration for undergraduates in January. Failure to arrange for laboratory space in advance will probably result in exclusion from courses.*

Graduate work in Animal Sciences at Cornell University is distributed through many Departments in the Colleges of Agriculture, Arts and Sciences, 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 44.

ANIMAL BREEDING

Rice Hall; *Professors* F. B. Hutt, S. A. Asdell, G. O. Hall, A. L. Romanoff, G. W. Salisbury, J. H. Bruckner, R. K. Cole.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

Animal Breeding 1, 2, 3, 4

Before entering upon graduate work the student should have had courses in general biology or zoology, comparative anatomy, 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, biochemistry, 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 Breeding.* Second term. Credit two hours.

P.H. 125. *Heredity and Eugenics.* Fall term. Credit two hours.

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

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

P.B. 201. *ADVANCED GENETICS.* Spring term. Credit three hours. Prerequisites, Plant Breeding 101 and Botany 124. Associate Professor CUSHING. M W F 8. Plant Science 146. Laboratory work to be arranged.

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 and some plants, with as complete a genetic analysis of these as time permits.

P.B. 211. *STATISTICAL METHODS OF ANALYSIS.* Fall term. Credit two hours. Associate Professor LIVERMORE. Th 1:40–4. Plant Science 233.

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 BREEDING.* Fall term. Prerequisite, Animal Husbandry 20 or Plant Breeding 101. Professor SALISBURY. T Th 11. Wing E. Given in alternate years.

A consideration of the problems involved in the improvement of the larger farm animals and the application of genetics in their solution.

A.H. 125. *ENDOCRINOLOGY, REPRODUCTION, AND LACTATION.* Spring term. Prerequisite, a course in human or veterinary physiology. Credit two hours. Professor ASDELL. M W 10. Wing A.

A general course in endocrinology, with more detailed consideration of the endocrine processes involved in reproduction and lactation.

A.H. 126. *PROBLEMS IN ANIMAL PHYSIOLOGY.* Fall term. Registration by permission. Professor ASDELL. Times to be arranged. Given in alternate years.

Assigned reading and conferences on growth, reproduction, and lactation in mammals.

[P.H. 120. *POULTRY GENETICS.* Spring term. Credit three hours. Prerequisites, Zoology 1, Plant Breeding 101, and permission of the instructor. Professor HUTT. M W F 9. Given in alternate years. Not given in 1946–47.]

A survey of inherited characters in domestic birds, cytology, linkage, inbreeding, hybrid vigor, resistance to disease, genetic principles in poultry breeding, physiology of avian reproduction, infertility, embryonic mortality, and avian endocrinology.

P.H. 229. *SEMINARY IN ANIMAL BREEDING.* Professors HUTT, ASDELL, and staff.

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

ANIMAL NUTRITION

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

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

Animal Nutrition 1, 2, 3, 4

(See also Food and Nutrition 1, 2, 3, 4; Martha Van Rensselaer Hall, *Professors* HELEN MONSCH, CATHERINE PERSONIUS, MARION PFUND, HAZEL HAUCK, FAITH FENTON, MILLICENT HATHAWAY, GRACE STEININGER, CHARLOTTE YOUNG, L. A. MAYNARD, and J. K. LOOSLI, under Home Economics, page 220.)

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, analytical 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. *PRINCIPLES OF NUTRITION.* Fall term. Credit 3 hours. Prerequisites, 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. *LABORATORY WORK IN NUTRITION.* Fall term. Credit 3 hours. Must be preceded by or accompanied by course 110. Registration by permission. Professor MCCAY. M W F 1:40–4. Dairy Industry Building 160.

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

P.H. 210. *EXPERIMENTAL METHODS IN POULTRY NUTRITION.* Fall term. Credit one hour. Registration by permission. Professor NORRIS. Discussion

and laboratory period, W 1:40–5. Rice. Given if desired by a sufficient number of students. Not given every year.

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. 210. *SPECIAL TOPICS IN ANIMAL NUTRITION.* Registration by permission. Professor MAYNARD and Associate Professor LOOSLI. Spring term. Credit one hour. One meeting a week at an hour to be arranged.

A presentation and discussion of the knowledge and techniques of special fields of animal nutrition.

A.H. 215. *HISTORY OF NUTRITION.* Fall term. Credit one hour. Prerequisites, 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. *SEMINARY IN ANIMAL NUTRITION.* Fall and spring terms. Credit one hour each term. 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.

BIOCHEMISTRY

Fernow Hall; *Professors* SUMNER, WILLIAMS, and MAYNARD; *Associate Professor* GORTNER; *Assistant Professors* SOMERS and NELSON; and *Doctor* LAWRENCE.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

Biochemistry 1, 2, 4

10. *Elements of Biochemistry.* Lecture. Fall term. Four lectures a week.

11. *Elements of Biochemistry.* Laboratory. Fall term. Two laboratories a week.

101. *GENERAL BIOCHEMISTRY.* Lecture. Fall term. Credit four hours. Prerequisites, Chemistry 102A and 102B, 210, 225, 305A and 305B, and 310A or the equivalent. Lectures, M W F S 11. Dairy Industry Building 218. Professor WILLIAMS.

For graduate and advanced undergraduate students, dealing with the chemistry of plant and animal substances and the reactions occurring in biological systems.

102. *GENERAL BIOCHEMISTRY.* Laboratory. Fall term. Credit two hours. Prerequisite or parallel, Biochemistry 101. Laboratory, M F 1:40–4. Dairy Industry Building 175. Professor WILLIAMS, Dr. LAWRENCE, and assistants.

Laboratory practice with plant and animal materials and the experimental study of their chemical properties.

130. *PRINCIPLES OF FOOD PRESERVATION.* (Same as Chemical Engineering 720B.) Spring term. Credit two hours. Registration by permission. Lectures, T Th 10. Olin Hall. Associate Professor GORTNER.

A discussion of the basic physical, chemical, and biological principles of food preservation and their application in refining, dehydration, cold storage, freezing,

canning, fermentation, chemical preservation, and packaging. The effects of food processing upon the maintenance of nutritive value and on other food qualities.

201. *BIOCHEMISTRY OF LIPIDS AND CARBOHYDRATES.* Spring term. Credit two hours. Prerequisite, Biochemistry 101 and 102. Lectures, M W 9. Dairy Industry Building 218. Professor SUMNER.

For graduate students only. Discussion of the biological and physical chemistry of the lipids and carbohydrates.

202. *BIOCHEMISTRY OF PROTEINS AND ENZYMES.* Spring term. Credit two hours. Prerequisite, Biochemistry 101 and 102. Lectures, T Th 9. Dairy Industry Building 218. Professor SUMNER.

For graduate students only. Discussion of the biological and physical chemistry of proteins and enzymes.

203. *ADVANCED BIOCHEMISTRY.* Laboratory. Spring term. Credit two hours. Prerequisite, to accompany or follow Biochemistry 201 and 202. M W 1:40–4. Dairy Industry Building 175. Professor SUMNER and Assistant Professor NELSON.

For graduate students only. Practice in the use of special techniques and instruments employed in biochemical research and in the isolation of biochemical compounds.

[210. *PLANT BIOCHEMISTRY.* Spring term. Credit two hours. Prerequisite, Biochemistry 101 and 102. Given in alternate years. Not given in 1946–47.]

Lectures and discussion of biochemical topics of particular interest to students in plant sciences.

215. *BIOCHEMISTRY SEMINARY.* Fall and spring terms. Credit one hour each term. Registration by permission. T 4:15. Dairy Industry Building 119. Department Staff.

Assignments and discussion of recent advances in biochemistry.

220. *BIOCHEMISTRY, RESEARCH WORK.* Fall and spring terms. Credit and hours to be arranged. Registration by permission. Professors SUMNER, WILLIAMS, GORTNER, SOMERS, and NELSON.

ENTOMOLOGY AND LIMNOLOGY

Comstock Hall; *Professors* W. E. BLAUVELT, J. C. BRADLEY, F. H. BUTT, J. E. DEWEY, E. J. DYCE, W. T. M. FORBES, J. D. HOOD, R. W. LEIBY, ROBERT MATHESON, L. B. NORTON, C. E. PALM, R. L. PATTON, W. A. RAWLINS, P. A. READIO, H. H. SCHWARDT, H. H. SHEPARD, T. C. WATKINS; and *Dr.* D. A. WEBSTER.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

Apiculture 1, 2, 3,
Insect Ecology 1, 2, 3
Economic Entomology 1, 2, 3
Insect Embryology 1, 2, 3
Entomology 4
Limnology and Fisheries 1, 2, 3
Medical Entomology 1, 2, 3
Insect Morphology and Histology 1, 2, 3
Parasitology 1, 2, 3
Insect Physiology 1, 2, 3
Insect Taxonomy 1, 2, 3
Insect Toxicology 1, 2, 3
Insecticide Chemistry 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 of graduate students in connection with the Summer Session of Cornell University.

Undergraduate courses 12, 15, 30, 41, 122, 131 and either 185 or 16, are accounted a part of a preparation for graduate study in entomology:

12. *General Entomology.* Fall term. Credit three hours.

30. *Taxonomy of Insects.* Fall and spring terms. Credit two hours a term.

122. *Insect Morphology, Anatomy, and Histology.* Fall and spring terms. Credit three hours a term.

131. *The Phylogeny and Classification of Insects.* Fall term. Credit four hours.

185. *Insect Physiology.* Fall term. Credit three hours.

16. *Insect Ecology.* Fall term. Credit three hours.

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

Course 61 is also recommended for certain phases of the work.

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

Descriptions of the above courses will be found in the Announcement of the College of Agriculture.

16. *INSECT ECOLOGY.* Fall term. Credit three hours. Prerequisites, Biology 1 or Zoology I, and Entomology 12. Professor PALM. Lecture, T Th 9. Comstock 145. Laboratory, Th 1:40–4. Comstock 110.

A general study of insects in relation to their environment. Attention is given to life-history studies in the field and insectary; the role that insects play in different natural associations; the relations between structure, instinct, habitat, and ways of living. Photographing insects in the field and laboratory is included as a part of the course.

122. *INSECT MORPHOLOGY, ANATOMY, AND HISTOLOGY.* Fall and spring term. Credit three hours a term. Prerequisite, course 12. Assistant Professor BUTT. Lecture, M 10. Comstock 145. Laboratory, M W 1:40–4. Comstock 270.

A thorough study of external and internal anatomy of insects. Laboratories will include gross dissection and histological studies of internal organs of representative insects.

123. *INSECT EMBRYOLOGY AND POST EMBRYONIC DEVELOPMENT.* Spring term. Credit two hours. Prerequisites, courses 12 and 122. Assistant Professor BUTT. Lecture and laboratory, hours by appointment. Comstock 270.

Lectures with assigned reading and reports by students.

124. *INSECT HISTOLOGY.* Technique. Fall term to be repeated in the spring term. Credit two hours. Prerequisites, courses 12 and 122. Assistant Professor BUTT. Two laboratories a week by appointment. Comstock 265.

The technique of preparing, sectioning, and mounting insect tissues for study.

241. *ADVANCED ECONOMIC ENTOMOLOGY.* Spring term. Credit three hours. Prerequisite, course 41. Professor READIO. Lecture, T 10. Comstock 145. Laboratories, F 1:40–4 and S 8–10:30.

A course for the student intending to work in the field of economic entomology. The lectures consist of discussions of the principles and methods of insect control; the laboratories consist of practical exercises in the use of materials and methods of insect control in the orchard, vegetable garden, and greenhouse.

51. *PARASITES AND PARASITISM.* Spring term. Credit two hours. Prerequisite, Biology 1 or Zoology 1. Professor MATHESON. Lecture, Th 9. Comstock 245. Practical exercises, Th or F 1:40–4. Comstock 200.

A consideration of the origin and biological significance of parasitism, and of the structure, life, and economic relations of representative parasites.

52. *MEDICAL ENTOMOLOGY.* Spring term. Credit two or three hours. Prerequisite, Zoology 1 or Biology 1. Lecture, W 10. Comstock 245. Laboratory, W or Th 1:40–4. One extra laboratory period a week for three hours credit. Comstock 200. Professor MATHESON.

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.

261. *ADVANCED BEEKEEPING.* Fall term, to be repeated in the spring term. Credit four hours a term. Associate Professor DYCE. M F 11–12:50. Comstock 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.* Fall term. Credit two or three hours. Professor BRADLEY. Lectures, W F 11. Comstock 300. Library work by assignment.

A critical study of the biologist's works of reference. Practice in the use of generic and specific indices and bibliographies, and in the preparation of the latter; methods of preparing technical papers for publication; zoological nomenclature. This course, of a technical nature, is intended to aid students, specializing in zoology or entomology in their contact with literature.

131. *THE PHYLOGENY AND CLASSIFICATION OF INSECTS.* Fall term. Credit four hours. Prerequisites, Entomology 30 and must be preceded or accompanied by Entomology 15 and 122. Professor BRADLEY and Mr. PATE. Lecture, W F 10. Laboratory, T Th 1:40–4. Comstock 300.

Lectures on the evolution and classification of the orders and families of insects, living and extinct, and on their comparative morphology and bionomics; a laboratory study of the taxonomic literature on insects (exclusive of the larger orders of Holometabola) and of the classification and characters of representative genera and species. For continuation see courses 133 and 134.

[133. *TAXONOMY OF THE HOLOMETABOLA; COLEOPTERA AND DIPTERA.* Spring term. Credit three hours. Given in alternate years. Not given in 1946–47.]

134. *TAXONOMY OF THE HOLOMETABOLA; LEPIDOPTERA, AND HYMENOPTERA.* Spring term. Credit three hours. Prerequisites, Entomology 30 and 122; should be preceded by Entomology 15, 122, and 131. Professor BRADLEY, Assistant Professor FORBES, and Mr. PATE. Lecture, W 10. Laboratory, T Th 1:40–4. Comstock 300. Given in alternate years.

Lectures on the classification, comparative morphology, and the bionomics of the Lepidoptera and Hymenoptera; a laboratory study of the taxonomic literature and of the classification and characters of representative genera and species of these orders. This course, together with course 133 is a continuation of course 131.

185. *INSECT PHYSIOLOGY.* Fall term. Credit five hours. Prerequisites, Chemistry 102 or 104, Physics 3 and 4, Insect Morphology 122. Professor PATTON. Lectures, M W F 9. Comstock 145. Laboratory, M W 1:40–4. Comstock 265.

An introductory course for upperclassmen and graduate students. The physiology of insect systems is discussed and demonstrated by a series of laboratory exercises.

RESEARCH

300. *RESEARCH.* Throughout the year. Prerequisite, permission to register from the professor under whom the work is to be taken. Comstock Hall. Fee to be determined by the nature of the work.

300a. *INSECT ECOLOGY.* Professor PALM.

300b. *INSECT MORPHOLOGY, HISTOLOGY, AND EMBRYOLOGY.* Assistant Professor BUTT.

300c. *TAXONOMY.* Professors BRADLEY (all orders), MATHESON (Diptera), Associate Professor HOOD (Thysanoptera), and Assistant Professor FORBES (Lepidoptera).

300d. *ECONOMIC ENTOMOLOGY.* Professors MATHESON, READIO, PALM, and SCHWARDT; Associate Professors LEIBY and BLAUVELT; and Assistant Professors RAWLINS and WATKINS; at Geneva, Professors GLASGOW, CHAPMAN, and HARTZELL.

300e. *MEDICAL ENTOMOLOGY AND PARASITOLOGY.* Professor MATHESON.

300f. *APICULTURE.* Associate Professor DYCE.

300h. *INSECT PHYSIOLOGY.* Assistant Professor PATTON.

300i. *INSECT TOXICOLOGY.* Assistant Professors SHEPARD and NORTON.

300j. *INSECTICIDAL CHEMISTRY.* Assistant Professor NORTON.

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 245.

SEMINARIES

JUGATAE. Fall and spring terms. M 4:15–5:15. Comstock 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.

ECONOMIC ENTOMOLOGY. Fall and spring terms. Required of graduate students in economic entomology. Professors READIO and WATKINS. W 4:15. Comstock 145.

GENERAL BIOLOGY

Roberts Hall; *Associate Professor* HOOD.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

General Biology 4.

1. *General Biology.* Throughout the year. Credit three hours a term. Laboratory fee, $3.50 a term.

7. *GENERAL BIOLOGY.* Throughout the year. Prerequisite, at least twelve hours in animal or plant sciences. Associate Professor HOOD. 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.

FISH CULTURE

Comstock Hall; *Doctor* WEBSTER.

Fish Culture 1, 2, 3, 4 (see under Limnology and Fisheries, below)

LIMNOLOGY AND FISHERIES

Comstock Hall; *Doctor* WEBSTER.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

Fisheries 1, 2, 4

Limnology 1, 2, 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 32 and 171; fourth year, Entomology 173 and 174, Zoology 22 and Botany 115. Students are urged to obtain a grounding in Statistics.

171. *Limnology.* Spring term. Credit three hours.

173. *Fishery Biology.* Fall term. Credit three or four hours.

174. *Fish Culture.* Spring term. Credit three hours.

Descriptions of the courses mentioned above will be found in the *Announcement of the College of Agriculture.*

[172. *ADVANCED LIMNOLOGY.* Fall term. Credit three hours. Prerequisite, permission to register. Lectures, Th 11. Comstock 145. Laboratory, F 1:40–4, S one period by appointment. Comstock 110. Not given in 1946-47.]

A qualitative and quantitative treatment of the problem of the productivity of inland waters.

300g. *RESEARCH IN LIMNOLOGY AND FISHERIES.* Fall and spring terms. Should be preceded or accompanied by courses 173, 174, and 171. Dr. WEBSTER. Hours and credit to be arranged.

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

[*SEMINARY IN FISHERIES.* Fall and spring terms. Time and place to be arranged. Not given in 1946–47.]

For the discussion by qualified students of the principles of fishery management.

195. *CHEMISTRY AND TOXICOLOGY OF INSECTICIDES.* Fall term. Credit four hours. Prerequisite, a course in college chemistry. Primarily for graduate students. Lectures, M W 10. Comstock 145. Laboratory, M W 1:40–4. Comstock 50. Assistant Professors SHEPARD and NORTON.

The fundamental principles of chemical control of insects, including recently developed insecticides. Methods of insecticide research are stressed in laboratory exercises.

PSYCHOLOGY

Morrill Hall; *Professors* K. M. DALLENBACH, H. S. LIDDELL, A. L. WINSOR, F. S. FREEMAN, and T. A. RYAN; *Doctors* F. L. MARCUSE, M. E. BITTERMAN, and J. B. COHEN.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

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

The research department possesses a laboratory in Morrill Hall with rooms for general and individual research, for small animal 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.* Credit three hours.

2. *The Special Psychologies.* Credit three hours.

3. *Introductory Laboratory.* Credit three hours.

4. *Intermediate Course in Psychology.* Credit three hours.

5. *Perception.* Credit three hours.

6. *Memory and Thinking.* Credit three hours.

7. *Animal Psychology.* Credit three hours.

Social Psychology. Credit three hours.

11. *Physiological Psychology of the Senses.* Credit three hours.

12. *Legal Psychology.* Credit three hours.

13. *History of Experimental Psychology.* Credit three hours.

14. *Contemporary Psychology.* Credit three hours.

15. *Psychology of the Abnormal.* Credit three hours.

16. *Statistical Methods for Psychologists.* Credit three hours.

Genetic Psychology. Credit three hours.

The Psychology of Literature. Credit three hours.

18. *Psychosomatic Interrelationships.* Credit three hours.

19. MINOR RESEARCH PROBLEMS. Either for a single term or throughout the year. Credit three hours a term. Professors DALLENBACH, LIDDELL, and RYAN. Instructors BITTERMAN, COHEN, and MARCUSE. Hours to be arranged. Morrill, Psychological Laboratory.

Experimental research or informal study in general, abnormal, animal, applied, physiological, and social psychology. The course is designed for students majoring in psychology who are prepared to undertake original investigation.

20. *THE CORRELATIONAL AND PSYCHOPHYSICAL METHODS.* Second term. Credit three hours. Professor DALLENBACH. M W F 2–4. Morrill, Psychological Laboratory.

30. *GENERAL PHYSIOLOGICAL PSYCHOLOGY.* Credit three hours.

[116. *READING OF GERMAN PSYCHOLOGY.* Not given in in 1946–47.]

[121. *TECHNIQUE OF EXPERIMENTATION.* Not given in 1946–47.]

122. *RESEARCH METHODS IN SOCIAL PSYCHOLOGY.* Second term. Credit three hours. Dr. BITTERMAN. T 2–4. Morrill, Seminary Room.

129. *SEMINARY IN PSYCHOLOGY.* Second term. Credit three hours. Hours to be arranged. Morrill, Seminary Room.

132. *ADVANCED ABNORMAL PSYCHOLOGY.* Second term. Credit three hours. Dr. MARCUSE. M W F 12. Morrill 340.

Intensive study of selected topics.

133. *CONDITIONING AND EXPERIMENTAL NEUROSES.* Fall term. Credit three hours. Professor LIDDELL. M W F or T Th F 1:40–4. Cornell Behavior Farm.

Laboratory exercises and demonstrations of phenomena of conditioned reflex action and neurotic patterns in animals. Group discussions on Fridays.

EDUCATIONAL PSYCHOLOGY

MENTAL MEASUREMENTS. (Education 7) Fall term. Credit three hours. Prerequisite, a course in general or educational psychology, or human growth and development. Professor FREEMAN. T Th S 9. Goldwin Smith 234.

Development of the individual and group tests of intelligence and personality; principles underlying their construction and use; their use in schools, psychological clinics, and in other fields. The nature of mental abilities. The use of educational tests. Demonstrations in administering and interpreting tests.

EXPERIMENTAL EDUCATIONAL PSYCHOLOGY. (Education 8) Fall and spring terms. Credit and hours to be arranged. Consent of the instructor is required. Education 7 or its equivalent should normally precede this course. Professor FREEMAN.

The application of psychological and statistical methods to problems in education.

INDIVIDUAL DIFFERENCES. (Education 18) Spring term. Credit three hours. Prerequisite, a course in general or educational psychology, or human growth and development. Professor FREEMAN. T Th 2–3:15 and a third hour to be arranged. Goldwin Smith 248.

The nature, causes, and implications of individual differences in abilities and behavior. Study and observations of atypical groups.

Human Growth and Development. (An Interdepartmental Course). Course A. Summer and fall terms. Credit three hours. Prerequisite, a laboratory science preferably general biology or introductory zoology. Professor PAPEZ. Course B. Fall and spring terms. Credit three hours. Prerequisite, Course A. Professor FREEMAN.

APPLIED PSYCHOLOGY

50. *WORK, FATIGUE, AND EFFICIENCY.* Second term. Credit three hours. Prerequisite, Psychology 1. Assistant Professor RYAN. M W F 9.

A survey of the external and internal factors which affect the efficiency, speed, and accuracy of human work. Consideration will be given to sedentary or "mental" work as well as to physical work, in relation to fatigue, monotony, rest, sleep, and the effects of noise, light, temperature, narcotics, incentives, and social factors.

51. *PSYCHOLOGY IN BUSINESS AND INDUSTRY.* First term. Credit three hours. Prerequisite, Psychology 1. Assistant Professor RYAN. M W F 9.

A study of experimental and statistical analyses of psychological problems in vocational selection, industrial production, personnel, advertising, selling, and market research.

PERSONNEL ADMINISTRATION. (Hotel Administration 119) Second term. Credit three hours. Prerequisite, Psychology 1. Professor WINSOR. M W F 8. Plant Science 233.

SEMINARY IN PERSONNEL ADMINISTRATION. (Hotel Administration 219). Second term. Credit two hours. Prerequisite, course 18. Open to qualified seniors and graduate students. Professor WINSOR. Th 4:15–6. Warren 340.

ZOOLOGY

Professors H. B. ADELMANN, A. A. ALLEN, P. W. GILBERT, D. R. GRIFFIN, W. J. HAMILTON, JR., PAUL KELLOGG, S. L. LEONARD, J. W. PAPEZ, G. M. SUTTON, W. A. WIMSATT, A. H. WRIGHT, and B. P. YOUNG; and *Doctors* AMY G. MEKEEL and E. C. RANEY.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

Comparative Anatomy 1, 2, 3, 4	Invertebrate Zoology 1, 2, 3, 4
Comparative Physiology 1, 2, 3, 4	Neurology 1, 2, 3, 4
Ecology 1, 2, 3, 4	Ornithology 1, 2, 3, 4
Endocrinology 1, 2, 3, 4	Vertebrate Zoology 1, 2, 3, 4
Histology and Embryology 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.

Attention is also directed to the fields of study and courses offered in the Department of Entomology.

1. *Introductory Zoology.* Throughout the year. Three hours a week.

11. *Comparative Anatomy.* Through the year. Three hours a week.

3. *The Conservation of Wild Life.* Fall term. Credit two hours.

8. *Elementary Taxonomy and Natural History of Vertebrates.* Fall and spring term. Credit three hours each term.

2. *Game Management.* Credit three hours.

9. *General Ornithology.* Credit three hours. One lecture and two laboratory periods a week.

110. *Economic Zoology.* Credit one hour. One lecture.

131. *Techniques in Ornithology.* Credit three hours.

6. *Histology (Veterinary).* Throughout the year. Four hours a week.

9. *Embryology (Veterinary).* Two hours a week.

101. *The Tissues: Histology and Histogenesis.* Fall term. Four hours a week.

221. *Structure of the Human Body.* Spring term. Credit three hours.

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

HISTOLOGY AND EMBRYOLOGY

Stimson Hall; *Professors* H. B. ADELMANN and W. A. WIMSATT.

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.

102. *THE ORGANS: HISTOLOGY AND DEVELOPMENT.* Spring term. Credit four hours. Prerequisite, course 101 or its equivalent. Professor WIMSATT and assistants. Lectures, W F 10. Stimson G–1. Laboratory, W F 1:40–4. Stimson 206.

A continuation of course 101. Courses 101 and 102 together give the fundamental facts of the microscopic structure and development of the body. There is also offered opportunity to gain knowledge of technique in the fixing, embedding, and sectioning of selected organs.

104. *VERTEBRATE EMBRYOLOGY.* Spring term. Credit five hours. Prerequisite, Biology 1 or Zoology 1. Professor ADELMANN and assistants. Lectures, T Th S 11. Stimson G–1. Laboratory, Section I, T Th 8–11; Section II, T Th 1:40–4. Stimson 206.

An introduction to general vertebrate embryology designed to provide a basis for the appreciation of biological problems. The material is treated comparatively with particular emphasis on the development of the amphibian, the bird, and the mammal. A few invertebrate forms are used where desirable for illustration.

[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. Professor ADELMANN and instructor. Day and hours to be arranged. Stimson 206. Not given in 1946–47.]

108. *SEMINARY.* First and second terms. One hour each week. 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.

[115. *EXPERIMENTAL EMBRYOLOGY.* 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 1946–47.]

Undergraduate course 101 may often be attended with advantage by graduate students.

ENDOCRINOLOGY

Stimson Hall; *Professor* S. L. LEONARD.

140. *EXPERIMENTAL ENDOCRINOLOGY.* Spring term. Credit two or three hours. Prerequisite, Zoology 1 or equivalent and Chemistry. Associate Professor LEONARD. Open to graduate students only. Lectures, M F 11. Stimson 308. Laboratory, 1:40–4 for a limited number of students. Hours to be arranged.

Lectures on anatomy, physiology of the vertebrate endocrine glands, glandular inter-relationships; chemical and physiological properties of hormones, assay methods. Laboratory, small animal surgery and micro-technique for the endocrines, illustrative experiments on hormonal effects.

VERTEBRATE TAXONOMY AND ECOLOGY

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

[22. *ICHTHYOLOGY.* Credit three hours. Doctor RANEY. Lectures, T Th 8. Stimson G–25. Laboratory, F 1:40–4 or S 8–10:30. Stimson 225.

In the lectures, special emphasis is laid on the principal phases of fish 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 identifications and field trips. Not given in 1946–47.]

23. *HERPETOLOGY.* Spring term. Credit three hours. Professor WRIGHT and ————. Lectures, T Th 8. Stimson G–25. Laboratory, F 1:40–4 or S 8–10:30. Stimson 225.

Lectures on amphibians and reptiles, their life histories, distribution, and taxonomy. Laboratory periods deal with identification and field trips.

25. *MAMMALOGY.* Fall term. Credit three hours. Associate Professor HAMILTON. Lectures, T Th 8. Stimson G–1. Laboratory, F 1:40–4 or S 8–10:30. Stimson 225.

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.* Spring term. Credit one hour. Professor WRIGHT, Associate Professor HAMILTON, and Doctor RANEY. T 7:30 p.m. Stimson 225. Limited to upperclass students and graduates.

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.* Fall term. Professor WRIGHT. T 7:30 p.m. Stimson 225.

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.

COMPARATIVE ANATOMY

Stimson Hall; *Professor* P. W. GILBERT.

The department is well equipped with suitable collections and apparatus to offer graduate work in comparative vertebrate anatomy. Particular emphasis is placed on the functional interpretation of structure, the aim being to correlate the activities and structural adaptations of the living animal. Students majoring

in this field will find it advantageous to have taken courses in comparative anatomy, histology, embryology, physiology, and vertebrate ecology.

INVERTEBRATE ZOOLOGY

Stimson Hall; *Associate Professor* B. P. YOUNG.

[16. *INVERTEBRATE ZOOLOGY.* Throughout the year. Credit three hours a term. Prerequisite, course 1 or equivalent. Associate Professor YOUNG. Lecture, F 9. Stimson G–1. Laboratory, F 1:40–4, and S 9–11:20. Stimson 116.]

[Course deals with the comparative anatomy, development, taxonomy, and physiology of the major groups of animals lacking backbones. Life histories of animals affecting the welfare of man are stressed. Not given in 1946–47.]

NEUROLOGY

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

225. *COMPARATIVE NEUROLOGY.* Spring term. Credit three hours. Prerequisite, nine hours of Animal Biology. Professor PAPEZ. Hours to be arranged. Stimson 316.

A comparative study of the vertebrate nervous system based on dissections of brains of lower mammals and dog, and sections of cat brain stem; study of chief nerve mechanisms that determine the form and structure of the nervous systems, their evolutionary and functional significance. Two lectures, M W 12, and one laboratory period, W 1:40–4.

226. *CEREBRAL MECHANISMS.* Spring term. Credit three hours. Prerequisite, course 225. Professor PAPEZ. Given if desired by a sufficient number of students. Hours to be arranged. Stimson Hall 316.

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.

ORNITHOLOGY

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

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.

126. *ADVANCED ORNITHOLOGY.* Fall term. Credit three hours. Prerequisite, course 9 or Vertebrate Taxonomy 8. Professor ALLEN. Lecture, W 11. Fernow 122. Laboratory and field work. T Th 1:40–4. Fernow 210.

The structure and classification of birds; geographical distribution; the literature and institutions of ornithology; identification of representative birds of the world. The first part of the term is devoted to field work on the fall migration

and the identification of birds in winter plumage. Designed primarily for students specializing in ornithology or animal biology.

136. *ORNITHOLOGY SEMINARY.* Throughout the year. M 7:30–9 p.m. Fernow Seminar Room. Required of all graduate students in Ornithology.

ZOOLOGY, ALL BRANCHES

400. *RESEARCH PROBLEMS.* Credit and hours to be arranged. Problems may be undertaken in any phase of zoology but the consent of the instructor concerned is a prerequisite.

PLANT SCIENCES

NOTE—*Laboratory space is limited and is often overtaxed, especially in courses which admit both graduate students and undergraduates. Graduate students who desire to enroll in such courses are warned to make application for space well in advance of the beginning of instruction. This holds particularly of the second term, since the College of Agriculture holds its preregistration for undergraduates in January. Failure to arrange for laboratory space in advance will probably result in exclusion from courses.*

BACTERIOLOGY

Dairy Building; *Professors* J. M. SHERMAN, OTTO RAHN, C. N. STARK, GEORGES KNAYSI, I. C. GUNSALUS, W. W. UMBREIT, and C. F. NIVEN, JR.; 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. 44)

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.)

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.* Fall term. Credit six hours. Prerequisite, Chemistry 101. Associate Professor UMBREIT and assistants. Lectures, M W F 11. Laboratory practice, M W F 1:40–4. Dairy Industry Building 218 and 301.

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

103. *APPLIED BACTERIOLOGY.* Spring term. Credit six hours. Prerequisite, course 1, quantitative analysis, and organic chemistry. Professor SHERMAN, Associate Professor GUNSALUS and assistants. Lectures, recitations, and laboratory practice, M W F 1:40–5. Dairy Industry Building 119 and 301.

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

105. *HIGHER BACTERIA AND RELATED MICROORGANISMS.* Fall term. Credit four hours. Prerequisite, course 1. Professor KNAYSI and Miss DYAR. Lectures, recitations, and laboratory practice, T Th 1:40–5. Dairy Industry Building 119 and 323.

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

106. *SOIL MICROBIOLOGY.* (Same as Agronomy 106.) Spring term. Credit three hours. Prerequisite, course 1, Agronomy 1, and Chemistry 201 or its equivalent. Lectures, M W 8. Caldwell 143. Laboratory, W or F 1:40–4. Caldwell 201. Professor J. K. WILSON.

A course in biological soil processes designed primarily for students specializing in soil technology or bacteriology. The laboratory work is supplemented by reports and by abstracts of important papers on the subject.

210. *PHYSIOLOGY OF BACTERIA.* Fall term. Credit two hours. Prerequisites, 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.* Spring term. Credit three hours. Must be preceded or accompanied by course 210. Professor RAHN and assistant. 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.* Spring term. Credit two hours. Prerequisites, 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. *SELECTED TOPICS IN BACTERIOLOGY.* A two-term course, fall and spring terms. Credit one hour a term. Professor RAHN. F 8. Dairy Industry Building 120.

213. *MORPHOLOGY AND CYTOLOGY OF BACTERIA.* Fall term. Credit three hours. Professor KNAYSI. Lectures, T Th S 9. Dairy Building 119.

The morphology, cytology, and microchemistry of microorganisms.

215. *CHEMISTRY OF BACTERIAL PROCESSES.* Spring term. Credit two hours. Lectures, T Th 8. Dairy Industry Building 119. Associate Professors GUNSALUS and UMBREIT.

The chemistry of metabolism, fermentation, and nutrition 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 244.

BOTANY

Professors LEWIS KNUDSON, A. J. EAMES, L. W. SHARP, O. F. CURTIS, W. C. MUENSCHER, L. C. PETRY, L. F. RANDOLPH, D. G. CLARK, K. C. HAMNER, and R. T. CLAUSEN; at Geneva, *Professors* M. T. MUNN and W. F. CROSIER.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

Botany 2, 4

Cytology 1, 2, 3, 4

Economic Botany 1, 2, 3, 4

Paleobotany 1, 2, 3, 4

Plant Physiology 1, 2, 3, 4

Plant Taxonomy 1, 2, 3, 4

Plant Morphology (including Anatomy) 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 both local and foreign material for taxonomic study.

The rich flora about Ithaca and its accessibility make the location especially advantageous for many phases of botany, as materials may be easily obtained. 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.

Seminars are conducted in several of the fields listed above. The purpose of these various seminars 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 seminars 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. A prospective student contemplating summer work in botany and plant physiology should correspond with the appropriate member 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 exemptions from the payment of tuition. In 1947–48 the scholarship will be awarded. One of the Henry Strong Denison Fellowships in Agriculture 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

31. *Introductory Plant Physiology.* Fall or spring term. Credit four hours. Lectures, T Th 10. Plant Science 141. Laboratory, T Th 1:40–4; W F 1:40–4. Assignment to laboratory section must be made at the time of registration.

231. *PLANT PHYSIOLOGY, ADVANCED LECTURE COURSE.* A two-term course, fall and spring. Credit three hours a term. Prerequisite, training in botany and chemistry, to be determined in each case by the department. Professors KNUDSON and CURTIS. Lectures, M W F 10. Plant Science 141.

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.* A two-term course, fall and spring. Credit three hours a term. Prerequisite or parallel, course 231. Professors KNUDSON and CURTIS and Associate Professor CLARK. Laboratory, M 1:40–4, S 8–12:30. Plant Science 241.

Principally a quantitative study of various phases of plant physiology. The student will apply chemical, physical, and biological methods in the study of plant physiological processes.

233. *SEMINARY IN PLANT PHYSIOLOGY.* Fall and spring terms. Required of graduate students in Plant Physiology. Professors KNUDSON and CURTIS and Associate Professors CLARK and HAMNER. 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 and CURTIS, Associate Professors CLARK and HAMNER.

ANATOMY

123. *PLANT ANATOMY.* Fall term. Credit four hours. Prerequisite, course 1 or the equivalent. Dr. BLASER. T 9–12:30; Th S 9–11:30. Lecture to be arranged within these periods. Plant Science 228.

A detailed study of the internal structure of vascular plants with emphasis on determination and interpretation.

RESEARCH IN ANATOMY. Professor EAMES.

CYTOLOGY

124. *GENERAL CYTOLOGY.* Fall term. Credit four hours. Prerequisite, Botany 1 or Zoology 1 or equivalent. Lectures, M W 9. Plant Science 143. Laboratory, M W or T Th 10–12:30. Plant Science 219. Assignment to laboratory section must be made at the time of registration.

The principal topics considered are cells and their components, nuclear and cell division, meiosis and fertilization, and the relation of these to problems of development, reproduction, and heredity. Both plant and animal materials are used. Microtechnic is not included.

224. *ADVANCED CYTOLOGY.* Spring term. Credit two hours. Prerequisites, Botany 124, Plant Breeding 101, and permission to register. Professor L. W. SHARP. Lecture, W 9. Plant Science 143. Laboratory and seminar, to be arranged.

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 244.

MORPHOLOGY

(COMPARATIVE MORPHOLOGY OF FUNGI. Given in the Department of Plant Pathology.)

126. *MORPHOLOGY OF VASCULAR PLANTS.* Fall and spring terms. Credit three hours a term. Prerequisites, course 1 or its equivalent, and permission to register; first term prerequisite to second. Professor EAMES. Lecture, F 9. Plant Science 143. Laboratory, W 9–12:30; F 10–12:30. Plant Science 228.

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

RESEARCH IN MORPHOLOGY. Professors EAMES and PETRY.

TAXONOMY

13. *TREES AND SHRUBS.* Fall term. Credit four hours. Prerequisite, course 1 or its equivalent. Associate Professor CLAUSEN. Lectures, T Th 9. Plant Science 143. Laboratory or field work, T Th 1:40–4. Plant Science 211.

The identification, classification, distribution, and economics of woody plants. Attention is given to identification both in summer and in winter conditions. Part of the laboratory work is conducted outdoors.

117. *TAXONOMY OF VASCULAR PLANTS.* Spring term. Credit four hours. Prerequisite, course 1 or its equivalent. Associate Professor CLAUSEN. Lectures, T Th 9. Plant Science 143. Laboratory, T Th 1:40–4. Plant Science 211.

A study of the kinds of seed plants and ferns, their classification into genera, families, and orders, and field work on the local flora. Emphasis is placed on wild plants, but the more commonly cultivated varieties receive some attention. Those desiring advanced work on special groups or problems may follow this with course 171.

219. *ADVANCED TAXONOMY OF VASCULAR PLANTS.* Fall term. Credit two hours. Prerequisite, course 117 or its equivalent and training in cytology and genetics. Associate Professor CLAUSEN. Lecture, T 11. Practice, Th 11. Plant Science 211.

A study of variation, isolation, and hybridity in relation to taxonomy, together with a survey of the vegetation of North America. The practice period affords experience in floristic and revisionary methods and in identification.

RESEARCH IN TAXONOMY. Professors EAMES and MUENSCHER and Associate Professor CLAUSEN.

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 244.

PALEOBOTANY

RESEARCH IN PALEOBOTANY. Professors EAMES and PETRY.

ECONOMIC BOTANY

55. *WEEDS AND POISONOUS PLANTS.* Fall term. Credit three hours. Prerequisite course 1 or its equivalent. Lecture, F 8. Laboratory, W F 1:40–4. Plant Science 353. Professor MUENSCHER and assistant.

Special emphasis is given to the habits, characteristics, and properties which make weeds and poisonous plants harmful or undesirable, the losses and injury produced by them, and the methods for their prevention, eradication, and control. Field and laboratory practice in the identification of common weeds and poisonous plants is included.

[56. *SEED ANALYSIS.* Spring term. Credit one hour. Prerequisite Course 1 or its equivalent. Lectures and laboratory, F 1:40–4. Plant Science 353. Professor MUENSCHER and assistant. Not given in 1946–47.]

A course designed for students in the applied plant science departments and those interested in preparing to be seed analysts. Practice will be given in making purity analyses and germination tests according to standard and official methods and recommendations. Opportunity will be provided for practice in the identification of weed seed impurities and the application of special treatments required for germinating dormant seeds.

[51. *ECONOMIC BOTANY.* Fall term. Credit three hours. Lectures, T Th 8. Laboratory, M 1:40–4. Plant Science 353. Professor MUENSCHER and assistant. Not given in 1946–47.]

A treatment of the source, distribution, cultivation, and utilization of the principal economic plants of the world. Special emphasis is given to morphological and ecological characteristics of the crop plants that supply the chief sources of products utilized for foods, beverages, drugs, fibers, and shelter.

[115. *AQUATIC PLANTS.* Spring term. Credit three hours. Prerequisite, course 1 or its equivalent. Lecture, M 9. Laboratory, M W 1:40–4. Plant Science 353. Professor MUENSCHER. Not given in 1946–47.]

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

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

OTHER COURSES

161. *HISTORY OF BOTANY.* Fall and spring terms. No credit. Hours to be arranged. Plant Science 404.

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.

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 KNUDSON, EAMES, SHARP, CURTIS, PETRY, MUENSCHER, and RANDOLPH, Associate Professors CLARK and CLAUSEN, and Assistant Professor HAMNER. 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 244.

PLANT BREEDING

Professors H. H. LOVE, F. P. BUSSELL, R. G. WIGGANS, S. S. ATWOOD, R. L. CUSHING, J. R. LIVERMORE, H. M. MUNGER, R. P. MURPHY, H. H. SMITH; *Doctor* ERNEST DORSEY; at Geneva, *Professor* R. WELLINGTON.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

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, and disease and insect resistance. 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 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 usually find it impossible to complete his graduate work in the minimum time.

Students majoring in plant breeding or genetics will 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.* Fall term. Credit four hours. Prerequisite, a beginning course in a biological science. Courses in cytology and in taxonomic botany and zoology will be found helpful. Lectures, M W F 8. Plant Science 233. One conference period, to be arranged. Laboratory, M T or F 1:40–4. Plant Science 146. Associate Professor CUSHING.

A course designed to acquaint the student with the fundamental principles of heredity and variation in plants and animals.

Laboratory studies of hybrid material in plants and breeding experiments with the vinegar fly, Drosophila.

102. *PLANT BREEDING.* Fall term. Credit three hours. Given in alternate years.

103. *PLANT BREEDING.* Fall term. Credit three hours. Given in alternate years. Prerequisite, Botany 1, a course in at least one of the following: field crops, vegetable crops, floriculture, or pomology, and course 101 or permission to register. Lectures, T Th 8. Plant Science 141. Lecture and practice, S 8–10. Plant Science 146. Associate Professor MUNGER.

A study of the principles and practices of plant breeding. Lectures supplemented by periods in the greenhouse and experimental fields.

201. *RECENT ADVANCES IN GENETICS.* Spring term. Credit three hours. Prerequisites, Plant Breeding 101 and Botany 124. Associate Professor CUSHING. M W F 8. Plant Science 146. Laboratory work to be arranged.

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 and some plants, with as complete a genetic analysis of these as time permits.

211. *STATISTICAL METHODS OF ANALYSIS.* Fall term. Credit two hours. Associate Professor LIVERMORE. Th 1:40–4. Plant Science 233.

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.

212. *SPECIAL PROBLEMS IN STATISTICAL METHODS.* Spring term. Noncredit course. Limited to graduate students who have had course 211 or similar work. Professor LOVE. Hours to be arranged.

A conference course dealing with the problems of plot technique and related topics, such as the design of experiments and interpretation of results.

222. *SEMINARY.* Fall and spring terms. Credit one hour. Required of all graduate students taking either a major or minor in this department. Members of departmental staff. Th 4:15. Plant Science 404.

PLANT PATHOLOGY

Professors L. M. Massey, Donald Reddick, M. F. Barrus, H. M. Fitzpatrick, W. H. Burkholder, C. Chupp, C. E. F. Guterman, F. M. Blodgett, A. B. Burrell, D. S. Welch, A. G. Newhall, G. C. Kent, A. W. Dimock, L. J. Tyler, W. D. Mills, A. F. Ross, K. H. Fernow, K. G. Parker, J. S. Niederhauser, and H. S. Cunningham; at Geneva, *Professors* O. A. Reinking, W. O. Gloyer, J. H. Hamilton, D. H. Palmiter, W. T. Schroeder, and A. J. Braun.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

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 the 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. *Elementary Plant Pathology.* Fall and spring terms. Credit three hours. Professors Kent and Welch and Associate Professor L. J. Tyler. One lecture and two laboratories each week.

200. *GENERAL PLANT PATHOLOGY.* Fall term. Credit four hours. For graduate students with their major or minor in Plant Pathology. Open also to

qualified graduate students in other fields. Prerequisite, permission to register. Professors KENT and WELCH. Lecture, T 11. Plant Science 336. Practice, three 3-hour periods weekly at the students' convenience.

A course designed to give the entering graduate student an introduction to the basic features and techniques of the science of phytopathology and to provide an adequate foundation for successful prosecution of research in this field.

2. *PRINCIPLES OF PLANT DISEASE CONTROL.* Fall or spring term; for graduates and undergraduates. Credit three hours. Prerequisite, Course 1 or 200 or the equivalent. Associate Professor L. J. TYLER. Lecture, Th 8. Plant Science 336. Laboratory, T Th 1:40–4. Plant Science 342.

A consideration of the principles and methods of plant disease control. Required of graduate students with major or minor in plant pathology.

201. *ADVANCED PLANT PATHOLOGY.* A two-term course, fall and spring terms. Professor MASSEY. Lecture, T 9. Plant Science 336. Practice, T Th 10–12:30. Plant Science 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. *DISEASES OF TREES AND SHRUBS.* Spring term. Credit three hours. Prerequisite, course 1 or 200. Professor WELCH. Lecture, F 10. Plant Science 336. Practice, T Th 1:40–4. Plant Science 362.

A course dealing with the diseases peculiar to woody plants, their recognition and treatments.

[121. *COMPARATIVE MORPHOLOGY OF FUNGI.* Fall term. Credit four hours. Prerequisite, Botany 1 or the equivalent, and permission to register. Professor FITZPATRICK. Lecture, M W 11. Plant Science 336. Practice, M W 1:40–4. Plant Science 329. Given in alternate years. Not given in 1946–47.]

An introductory course designed to acquaint the beginning student with the general field of mycology. Emphasis placed on morphology rather than on taxonomy.

221. *MYCOLOGY.* A two-term course, fall and spring terms. Credit five hours. Prerequisite, Botany 1 or the equivalent, and permission to register. Professor FITZPATRICK. Lecture, M W 11. Plant Science 336. Practice, M W 1:40–4 and one equivalent additional period to be arranged. Plant Science 329. Given in alternate years.

A more intensive course than the preceding, and designed especially for students specializing in mycology or plant pathology. Emphasis is placed on morphology and taxonomy, but other aspects of mycology are embraced. Practice in identification of specimens is afforded in various groups, and field work is encouraged.

[222. *ADVANCED MYCOLOGY.* Fall term. Credit five hours. Prerequisite, course 221. Professor FITZPATRICK. Given in alternate years. Not given in 1946–47.]

This course is designed chiefly for students majoring in mycology or in mycological phases of plant pathology. It supplements course 221, gives additional training in taxonomy and widens the students' horizon in the field as a whole. Emphasis is placed on field work, identification of specimens, herbarium practice, and library studies as a preliminary to research. Lectures deal with special topics.

231. *HISTORY OF PLANT PATHOLOGY.* A two-term course, fall and spring terms. Requires a reading knowledge of French and German. Professor ———. Designed especially for graduate students specializing in Plant Pathology.

241. *RESEARCH.* Professors MASSEY, REDDICK, BARRUS, FITZPATRICK, CHUPP, BURKHOLDER, BLODGETT, WELCH, FERNOW, NEWHALL, MILLS, GUTERMAN, BURRELL, KENT, PARKER, DIMOCK, TYLER, NIEDERHAUSER, H. S. CUNNINGHAM, and A. F. ROSS.

242. *SEMINARY.* Members of the staff. Weekly.

243. *LITERATURE REVIEW.* Members of the staff. Bi-weekly.

PHYSICAL SCIENCES

ASTRONOMY

Professor R. W. SHAW and *Doctors* D. A. MACRAE and R. E. WILLIAMSON.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

Astronomy 1, 2, 4

Astrophysics 1, 2, 4

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. 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.

Candidates for the degree of Doctor of Philosophy, Master of Arts, or Master of Science with a major in Astronomy or in Astrophysics will be required to offer for admission the equivalent of Introductory Astronomy, six hours of Interpretational Astronomy, and six hours of electives in the field of Astronomy.

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

Students with advanced standing in the sciences or in mathematics, but who do not desire to major or minor in Astronomy, may be admitted after consultation with the professor in charge to such courses in Astronomy as may seem desirable.

The Fuertes Observatory equipment includes a 12-inch equatorial by Brashear, an astronomical theodolite with circles reading to seconds of arc 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.

A substation of the Fuertes Observatory is located on the grounds of the Arizona State College at Flagstaff, Arizona. The equipment consists of an 8-inch Schmidt telescope of focal ratio 1.5. The department has under construction a 24-inch reflecting telescope which is to be erected at the Arizona station.

In addition to the Observatory the Astronomy Department has a laboratory for elementary instruction, an astrophysics laboratory, an optical laboratory, a photographic dark room, a department library, and several offices in Rockefeller Hall.

101, 102. *Introduction to Astronomy*. Three hours a week.

A–10. *Air Navigation*. Three hours a week.

M–8, M–9. *Navigation and Nautical Astronomy*. Three hours a week.

121. *Origin of the Solar System*. Three hours a week.

131. *Stellar Interiors*. Three hours a week.

138. *Astrochemistry*. Three hours a week.

141. *The Galaxy*. Three hours a week.

144. *External Galaxies*. Three hours a week.

154. *Theory of Orbits.* Three hours a week.

162. *Astronomical Spectroscopy.* Three hours a week.

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

186. *Geodetic Astronomy.* Three hours a week.

[230. *ASTROPHYSICS.* Fall and spring terms. Credit three hours a term. Prerequisites, Differential Equations and Astronomy 131 or 138. Associate Professor SHAW. Not given in 1946–47.]

Radiative transfer in stellar envelopes. Quantum theory of absorption and emission processes. The continuous spectrum. Line contours. Special topics, including novae, shell-stars, planetary nebulae, and interstellar material.

232. *ADVANCED STELLAR INTERIORS.* Either term. Credit three hours. Prerequisites, Differential Equations and Astronomy 131. Dr. WILLIAMSON.

Physical processes in the interiors of stars. Theory of polytropes. Degeneracy and white dwarfs, stellar envelopes, pulsating and rotating stars. Stellar evolution.

245. *ADVANCED GALACTIC STRUCTURE.* Either term. Credit three hours. Prerequisites, Differential Equations and Astronomy 141 and 144. Dr. MACRAE.

Standard star sequences. Absorption in space. Elements of stellar dynamics. Distribution functions and their application to methods of analysis for stellar distributions and velocity distributions. Application of probability theory. Observational techniques.

255. *CELESTIAL MECHANICS.* Either term. Credit three hours. Prerequisites, Differential Equations and Astronomy 154. Dr. WILLIAMSON.

Hamilton-Jacobi theory of dynamics. Tidal theory. The restricted three-body problem. General and special perturbations.

256. *ROCKET THEORY.* Either term. Credit three hours. Prerequisites, Differential Equations and an upper-class course in Analytical Mechanics. Dr. WILLIAMSON.

Survey of dynamical principles involved. The two-body problem as applied to rockets. Calculation of rocket orbits in free space and in the earth's atmosphere. Special physical and astronomical problems associated with rocket motion.

257. *STELLAR DYNAMICS.* Either term. Credit three hours. Prerequisites, Differential Equations and Astronomy 141. Dr. WILLIAMSON.

Distribution of matter and motions in galaxies and star clusters. Definition and evaluation of relaxation times for various stellar systems. Application of Liouville's theorem. Statistical theory of stellar encounters with reference to the evolution of clusters and multiple star systems.

265. *ASTROPHYSICS LABORATORY.* Either term. Credit one to three hours. Prerequisites, Astronomy 162, 164, or 166, and the consent of the instructor. Staff.

The student will be given opportunity to familiarize himself with techniques involved in obtaining, reducing, and evaluating data of astrophysical interest. Laboratory work may be accompanied by lectures on method and technique.

295. *ADVANCED STUDY AND RESEARCH.* Either term. Credit variable. Staff.

Extended study or research on special topics selected with the advice and consent of the staff. Upon sufficient demand the work may be given formally.

CHEMISTRY

Professors PETER DEBYE, S. H. BAUER, T. R. BRIGGS, A. T. BLOMQUIST, C. K. CAIN, J. L. HOARD, J. R. JOHNSON, J. G. KIRKWOOD, A. W. LAUBENGAYER, F. A. LONG, W. T. MILLER, M. L. NICHOLS, J. PAPISH; *Doctors* R. B. EATON and A. L. JONES.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

Inorganic Chemistry 1, 2, 3, 4	Organic Chemistry 1, 2, 3, 4
Analytical Chemistry 1, 2, 3, 4	Physical 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 or 104; Qualitative Analysis 203, or 210; Quantitative Analysis 220 and 221, or 225; Introductory Organic Chemistry 305a and b and 310a; Introductory Physical Chemistry 405a and b, and 410a; they must also present the equivalent of two units of German.

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 310b, and Introductory Physical Chemistry Laboratory 410b. 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 periods of residence may be necessary.

Every candidate is required to pass a departmental Qualifying Examination. 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 the fall, on days set by the Committee on Qualifying Examinations. All students entering candidacy for the doctorate in chemistry are expected to take them at the time announced.

Successful completion of these examinations will show that the candidate is qualified to proceed in his graduate training at once. Failure in one or more of the examinations will necessitate thorough review of the work in elementary courses and satisfaction of the staff members of the Division concerned before the end of the first semester. The special committee of any candidate who has not thus given satisfactory evidence that he is qualified to proceed may refuse to allow him to continue for a second term as a candidate for the Ph.D. degree in Chemistry.

After the candidate 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. Teaching assistantships are open to entering graduate students.

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

INORGANIC CHEMISTRY

102a and b. *General Chemistry*. Throughout the year. Two lectures and one recitation-laboratory period a week.

104a and b. *General Chemistry*. Throughout the year. Two lectures and one recitation-laboratory period a week.

110a and b. *Introductory Inorganic Chemistry*. Throughout the year. Fall term, three lectures a week. Spring term, two lectures a week.

115. *Introductory Inorganic Chemistry*. Fall term. One recitation and two laboratory periods a week.

130a and b. *ADVANCED INORGANIC CHEMISTRY*. A two-term course: Fall and spring terms. 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 groups. The less familiar elements are treated in detail and the stereochemistry of inorganic substance is considered.

135. *ADVANCED INORGANIC CHEMISTRY.* Both terms. Credit two to six hours. Prerequisite, Chemistry 305 and 310. Professor LAUBENGAYER. 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.* Spring term. Credit two hours. Not to be given in 1946–47.]

165. *CHEMISTRY OF THE RARE ELEMENTS.* Fall and spring terms. Credit two or more hours. Prerequisite, Chemistry 130. 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.* Both terms. Credit two or more hours a term.

ANALYTICAL CHEMISTRY

203. *Introductory Qualitative Analysis.* Spring term. One lecture, one recitation, and three laboratory periods a week.

205. *Introductory Qualitative Analysis.* Fall term. Three lectures a week.

206. *Introductory Qualitative Analysis.* Fall term. Three laboratory periods a week.

210. *Introductory Qualitative Analysis.* Both terms. One lecture and two laboratory periods a week.

220. *Introductory Quantitative Analysis.* Both terms. Two lectures and one recitation a week.

221. *Introductory Quantitative Analysis.* Both terms. Three laboratory periods a week.

225. *Introductory Quantitative Analysis.* Both terms. Two lectures and two laboratory periods a week.

230. *ADVANCED QUANTITATIVE ANALYSIS.* Spring term. Credit three hours. Prerequisite, Chemistry 225 or 220 and 221. Professor NICHOLS, Dr. JONES, and assistant. Recitation: one hour a week, to be arranged. Laboratory periods: T Th 1:40–4; T Th 8–12:30; S 8–1. Baker 294.

Students will be assigned to a combination of laboratory periods that will total seven and one-half hours a week.

The calibration of weights and volumetric apparatus; the analysis of ferrous and non-ferrous alloys, silicates, and organic substances by various gravimetric, volumetric, and combustion methods.

235. *ADVANCED QUANTITATIVE ANALYSIS.* Spring term. Credit two hours. Prerequisite, Chemistry 405a or 406a. Professor NICHOLS. W F 9. Baker 207.

A discussion of selected topics in quantitative analysis, and the development and present status of various analytical methods. Given in alternate years.

[250. *Gas and Fuel Analysis.* One lecture and two laboratory periods a week. Not given in 1946–47.]

270. *SPECIAL METHODS OF QUANTITATIVE ANALYSIS.* Both terms. Credit three hours. Prerequisite Chemistry 220 and 221 or special permission. Professor NICHOLS and assistants. Lecture, T 11. Baker 207. Laboratory, S 8–1. Baker 282 and 294.

The complete analysis of coal gas, the analysis of coal, the determination of the heating value of gaseous and solid fuels, and gas evolution methods. The application of instrumental methods to quantitative analysis including nephelometric, refractometric, colorimetric, electrolytic, polariscopic, combustion, conductometric and potentiometric methods.

275. *QUANTITATIVE MICROANALYSIS.* Fall term. Credit three or more hours. Prerequisite, Chemistry 230 and special permission. Professor NICHOLS. Hours to be arranged. Baker 358.

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

280. *EMISSION SPECTROSCOPY IN CHEMICAL ANALYSIS.* Fall and spring terms. Credit variable. Prerequisite, special permission. Professor PAPISH and assistant. Laboratory hours to be arranged. Baker 396. Conference, to be arranged.

The construction and use of spectroscopic equipment; spectrum excitation; qualitative and quantitative spectrochemical analysis.

295. *Research for Seniors.* Both terms. Credit two or more hours a term.

ORGANIC CHEMISTRY

305a and b. *Introductory Organic Chemistry.* Throughout the year. Three lectures a week.

310a and b. *Introductory Organic Chemistry.* Throughout the year. Three laboratory periods a week.

315a and b. *ADVANCED ORGANIC CHEMISTRY.* A two-term course. Fall and spring terms. Credit two hours a term. Prerequisites, Chemistry 305, 310, and 340. Professor JOHNSON. T Th 9. Baker 177.

Fall term, survey of the more important classes of organic compounds and their reactions. Spring term, discussion of general topics (tautomerism, molecular rearrangements, stereochemistry, mechanisms of reactions). Students may register for either term separately.

320. *ADVANCED ORGANIC CHEMISTRY.* Both terms. Credit two to six hours a term. Prerequisites, Chemistry 305 and 310. (340 is desirable). Assistant Professor BLOMQUIST and assistants. F 1:40–4, S 8–12. Baker 352.

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.

[325a and b. *SELECTED TOPICS IN ORGANIC CHEMISTRY.* A two-term course. Fall and spring terms. Credit two hours a term. Prerequisite, Chemistry 315 or 340, or the consent of the instructor. Either part of the course may be taken separately. Assistant Professor BLOMQUIST. M W 12. Baker 377.

Fall term, discussion of alicyclic compounds (including terpenes, large rings, sterols), special reagents, and methods. Spring term, organic nitrogen and sulfur compounds. Given in alternate years. Not given in 1946–47.]

330. *CHEMISTRY OF HIGH POLYMERS.* Fall term. Credit two hours. Prerequisite, Chemistry 315 or 340, or the consent of the instructor. Associate Professor MILLER. M W 11. Baker 177. Given in alternate years.

335. *PHYSICAL ASPECTS OF ORGANIC CHEMISTRY.* Spring term. Credit two hours. Prerequisite, Chemistry 315 or 340 and Chemistry 405 or 406. Associate Professor MILLER. M W 10. Baker 377. Given in alternate years.

340. *IDENTIFICATION OF ORGANIC COMPOUNDS.* Both terms. Credit three hours. Prerequisites, Chemistry 305 and 310 at grades of 75 or better, or the consent of the instructor. Associate Professor MILLER, Assistant Professor CAIN, and assistants. Lectures and conferences, T Th 10. Baker 207. Two laboratory periods, M T W or Th 1:40–4. Baker 350.

The classification reactions of organic compounds and the preparation of solid derivatives are applied to the identification of unknown organic substances.

345. *BIOCHEMICAL ASPECTS OF ORGANIC CHEMISTRY.* Fall term. Credit two hours. Prerequisite, Chemistry 315 or 340. Assistant Professor CAIN. T Th 11. Baker 377.

A discussion of the organic chemistry of natural products, including plant and animal pigments, vitamins, hormones, etc.

375. *Elementary Organic Chemistry.* Fall and spring terms. Four lectures and two laboratory periods a week.

395. *Research for Seniors.* Both terms. Credit two or more hours a term.

PHYSICAL CHEMISTRY

405a and b. *Introductory Physical Chemistry.* Throughout the year. Three lectures a week.

406a and b. *Physical Chemistry.* Throughout the year. Three lectures a week.

410a and b. *Introductory Physical Chemistry.* Throughout the year. One recitation and two laboratory periods a week.

420. *ADVANCED PHYSICAL CHEMISTRY.* Fall term. Credit three hours. Prerequisite, Chemistry 405a and b. Associate Professor HOARD. Lectures and recitations. M W F 11. Baker 177.

Short course in chemical thermodynamics with applications to thermo-chemistry and physico-chemical equilibria. Emphasis on the solution of simple problems.

425. *APPLICATIONS OF THE PHASE RULE.* Fall term. Credit three hours. Prerequisite, Chemistry 405a and b or an elementary knowledge of the phase rule as applied to systems of one and two components. Professor BRIGGS. Lectures, M W F 12. Baker 7.

The study and interpretation of typical phase diagrams, especially in systems of two and three components, followed by a brief treatment of systems containing

four or more components. Special attention will be given to metal alloy diagrams, to equilibria in saturated salt solutions, and to the problem of indirect analysis.

430. *COLLOID CHEMISTRY.* Spring term. Credit two hours a term. Prerequisite, Chemistry 405a and b or 406a and b. Professor BRIGGS. Lectures, T Th S 11. Baker 7.

The properties of surfaces, including the adsorption of gases by solids, adsorption from solutions, liquid films, and contact catalysis. The general properties of colloidal solutions and suspensions.

435. *CHEMISTRY OF SOLIDS.* Spring term. Credit three hours. Prerequisite or parallel course, Chemistry 405a and b or 406a and b, or special permission. Associate Professor HOARD and Professor MASON. Hours to be arranged.

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 SPECTRA.* Fall term. Credit three hours. Open to qualified students by permission. Assistant Professor BAUER. Hours to be arranged. Baker 18.

Brief review of atomic spectra. Description of the various types of molecular spectra; the rotation and vibration of diatomic molecules, electronic states, and electronic transitions. A résumé of continuous and diffuse molecular spectra, with reference to the subject matter considered in photochemistry. Normal coordinate treatment of the vibrations of polyatomic molecules and the analysis of their Raman and infra-red absorption spectra. Discussion of the relations between molecular structure and molecular constants.

445. *INTRODUCTORY ELECTROCHEMISTRY.* Spring term. Credit three hours. Lectures and laboratory. Prerequisite, Chemistry 405a and b or 406a and b. Professor BRIGGS and assistant. Lectures, M W 12. Baker 7. Laboratory, hours to be arranged following first lecture. Baker 1A.

Theory of electrolysis and of the voltaic cell, including theory and practice of electromotive force measurements, transference, ion activities, and oxidation-reduction.

[450. *APPLIED ELECTROCHEMISTRY.* A two-term course. Fall and spring terms. Credit two hours a term. Prerequisite, Chemistry 405a and b or 406a and b. Professor BRIGGS. Lectures, T Th 10. Baker 7.

Elementary theory of electrolysis and electromotive force. Electrolytic refining and extraction of metals: electroplating; electrolytic preparation of organic and inorganic compounds; electrothermal electrolysis; storage cells.

By electing Course 465 (one or more hours), the student may obtain laboratory practice in many of the subjects which are presented in the lectures. Given in alternate years. Not given in 1946–47.]

455. *KINETICS OF CHEMICAL REACTIONS.* Spring term. Credit three hours. Prerequisite, Chemistry 405a and b or 406a and b. Professor LONG. Lectures, three hours a week to be arranged. Baker 18.

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

460. *CHEMICAL PHYSICS.* Fall term. Credit three hours. Open to seniors and graduate students majoring in chemistry or physics. Professor DEBYE. M W F 10. Baker 207.

An elementary presentation of the principles involved in describing the structure and behavior of matter; atomic structure and the periodic table; interatomic forces; structure of solids; electrons in metals; temperature equilibrium and statistics.

465. *ADVANCED LABORATORY PRACTICE IN PHYSICAL CHEMISTRY.* Both terms. Credit variable, but not to exceed six hours a term. Prerequisite, determined in each case by the professor in charge. Professors BRIGGS and KIRKWOOD, Associate Professor HOARD, and Assistants. Hour and place to be arranged.

470a and b. *THERMODYNAMICS.* A two-term course. Fall and spring terms. Credit three hours a term. Prerequisites, Chemistry 405a and b or 406a and b. Professor KIRKWOOD. M W F 9. Baker 107.

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.* Fall term. Credit three hours. Prerequisite, Chemistry 470a and b. Professor KIRKWOOD. M W F 12. Baker 18.

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. Not given in 1946–47.]

480. *STATISTICAL MECHANICS.* Spring term. Credit three hours. Prerequisite, Chemistry 470a. Professor KIRKWOOD. M W F 12. Baker 18.

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. Given in alternate years.

[490. *INTRODUCTORY QUANTUM MECHANICS WITH CHEMICAL APPLICATIONS.* Spring term. Credit three hours. Open to qualified students by permission. Professor KIRKWOOD. M W F 12. Baker 18.

Elementary presentation of the principles of quantum mechanics. Development of the basic ideas underlying the quantum mechanical theory of the chemical bond. Given in alternate years. Not given in 1946–47.]

495. *Research for Seniors.* Both terms. Credit two or more hours a term.

GEOLOGY AND GEOGRAPHY

Professors O. D. VON ENGELN, C. M. NEVIN, W. S. COLE, A. L. ANDERSON, and J. D. BURFOOT, JR.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

Regional Geography 1, 2	Glacial Geology 1, 2, 3, 4
Mineralogy 1, 2, 3, 4	Structural Geology 1, 2, 3, 4
Economic Geology 1, 2, 3, 4	Stratigraphy 1, 2, 3, 4
Paleontology 1, 2, 3, 4	Sedimentation 1, 2, 3, 4
Petrology 1, 2, 3, 4	Physical Geography 2, 4
Metamorphism 1, 2, 3, 4	Geology 4
Geomorphology 1, 2, 3, 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, and 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. *General Geology and Physiography*. Throughout the year. Two lectures and one laboratory period a week.

100. *Introductory Geology*. One term, repeated each term. Two lectures and one laboratory period a week.

202. *General Geography*. Fall term. Three lectures a week.

401. *Ancient Life*. Spring term. Three lectures a week.

504. *Mineral Resources*. Throughout the year. Two lectures a week.

STRUCTURAL GEOLOGY, SEDIMENTATION, AND PETROLEUM GEOLOGY

Professor NEVIN.

Graduate research in any of these subjects should preferably be based on field work.

102. *STRUCTURAL GEOLOGY*. First term. Credit three hours. Prerequisite, Geology A or equivalent. Professor NEVIN. Two lectures, one laboratory. Day and hours to be arranged. McGraw 150.

Geologic structures and their causes.

103. *SEDIMENTATION*. Second term. Credit three hours. Prerequisite, Geology A or equivalent. Professor NEVIN. Two lectures, one laboratory. Day and hours to be arranged. McGraw 150.

The principles involved in the formation of sediments.

106. *SPECIAL WORK IN STRUCTURAL GEOLOGY, SEDIMENTATION, AND PETROLEUM GEOLOGY.* Throughout the year. Credit variable. Professor NEVIN. McGraw 150.

Advanced course work and original investigation adapted to the needs of the student.

107. *GEOLOGIC SURVEYING.* Given at the summer field camp. Credit six hours. Professor NEVIN.

502. *PETROLEUM GEOLOGY.* Second term. Credit three hours. Prerequisite, Geology A or equivalent. Professor NEVIN. Two lectures, one laboratory. Day and hours to be arranged. McGraw 150.

The geology of oil and natural gas, and a discussion of the methods used to discover them.

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 general geography. This, in correlation with physical geography and geomorphology, may be the preparation for advanced regional study and investigation. For teachers of Physical Geography in the secondary schools who wish to secure a Master's degree a definite program with a thesis subject appropriate to their needs has been outlined. Such work can be pursued in successive Summer Session terms.

200. *GEOMORPHOLOGY.* First term. Three hours credit. Prerequisite, Geology A or equivalent. Professor VON ENGELN. T Th 9. Laboratory, T 1:40–4. McGraw 265.

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.

205. *GLACIERS AND GLACIATION.* Second term. Three hours credit. Prerequisite, Geology A or equivalent. Professor VON ENGELN. T Th 9. Laboratory, T 1:40–4. McGraw 265.

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 GEOMORPHOLOGY, GLACIAL GEOLOGY, EXPERIMENTAL WORK AND RESEARCH PROBLEMS.* Throughout the year. Credit variable. Prerequisite, an adequate background of course work in geology. Professor VON ENGELN. Hours to be arranged. McGraw 265.

Particular problems, especially those of glaciology and the relation of geological structure to topography and physiographic history. In general students with a minor in this branch are expected to undertake work in this course.

MINERALOGY AND PETROLOGY

Assistant Professor BURFOOT.

The laboratory equipment for optical, chemical, physical, and crystallographic investigations in these fields is relatively good. The study collections of minerals and rocks are entirely adequate, and collections from many localities over the earth are available for advanced work and reference. Thin sections have been prepared of the representative specimens of most of the collections of rocks. The collection of minerals includes the Benjamin Silliman, Jr. collection, which was acquired before the opening of the University in 1868.

Advanced work is adapted to the needs of the individual student, but majors and minors are expected to acquire fundamental knowledge of and basic working skill in the advanced and specialized concepts and methods in these fields.

311. *ELEMENTARY MINERALOGY.* Fall term, to be repeated in spring term. Two lectures and one laboratory period a week.

316. *METAMORPHIC GEOLOGY.* Spring term. Credit three hours. Prerequisite, permission of instructor. Assistant Professor BURFOOT. Lectures, M W 9. McGraw 145. Laboratory, S 9–11:30, McGraw 145 and 345. Registration with department before beginning of course required.

A general survey of the field of metamorphic geology with special 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.

317. *OPTICAL MINERALOGY.* Fall term. Credit three hours. Prerequisite, Geology 311. Assistant Professor BURFOOT. Lectures, T Th 10. McGraw 145. Laboratory, F 9–11:30. McGraw 345. Registration with department before beginning of course required.

The theory and use of the petrographic microscope in the determination and study of minerals and rocks. The commoner rock-forming minerals are studied in fragments and in thin sections.

318. *PETROLOGY.* Spring term. Credit three hours. Prerequisite, Geology 317. Assistant Professor BURFOOT. Lectures, T Th 10. McGraw 145. Laboratory, F 9–11:30. McGraw 345. Registration with department before beginning of course required.

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 sections under the petrographic microscope.

319. *SEDIMENTARY PETROGRAPHY.* Spring term. Credit three hours. Prerequisite, Geology 317. Assistant Professor BURFOOT. Lectures, T Th 10. McGraw 145. Laboratory, S 9–11:30. McGraw 345 and B–65. Registration with department before beginning of course required.

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

320. *ADVANCED OR SPECIAL WORK IN MINERALOGY AND PETROLOGY.* Throughout the year. Credit variable. Prerequisites, variable. Assistant Professor BURFOOT. Days and hours to be arranged. McGraw 145, 345, B–65.

Adapted to the needs of the individual student. Specialized topics, advanced methods, special problems, research.

321. *SEMINARY.* Throughout the year. Credit one hour a term. Prerequisite, permission of instructor. Assistant Professor BURFOOT. M 4:15. McGraw 145.

Literature, special topics, advanced methods.

PALEONTOLOGY AND STRATIGRAPHIC GEOLOGY

Professor COLE.

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 escarpment, the Chemung Valley, and the coal fields of northern Pennsylvania.

Facilities are afforded to those desiring to study the later formations, since the department has collections made in the West Indies, Central and South America, as well as different parts of the United States and Europe. There is also the Newcomb collection (10,000 species of recent shells); and a wealth of conchological literature in the geological and the general library.

400. *HISTORIC GEOLOGY.* Fall term. Credit three hours. Prerequisite, Geology A. Professor COLE. Lectures, M W 9. Laboratory, M 1:40–4. McGraw 450.

Systematic study of the geologic history of the earth with reference to the rocks from the earliest periods to the present, their nature and distribution, orogenies, paleogeography, and the fossil remains and other characteristics on which their identification and correlation depend. Special emphasis on Amerian geology. Field studies in the laboratory period in so far as weather and other circumstances permit.

402. *STRATIGRAPHY.* Spring term. Credit three hours. Prerequisite, Geology 400. Professor COLE. Lectures, M W F 11. McGraw 450.

The principles of stratigraphic nomenclature and correlation developed by study of selected North American and European rock sequences.

403. *INVERTEBRATE PALEONTOLOGY.* A two-term course: fall and spring terms. Credit three hours a term. Prerequisite, Geology 400 and, if possible, Biology 16, Invertebrate Zoology. Professor COLE. Lectures, M W 10. McGraw 450. Laboratory, W 1:40–4. McGraw 450.

Fall term: paleobiology and classification of important fossil invertebrate organisms; spring term: key fossils of the geologic periods. Certain laboratory periods will be devoted to the collection and determination of fossil assemblages from selected horizons of the Paleozoic formations of central New York.

409. *GEOLOGY OF NEW YORK STATE.* Spring term. Credit two hours. Prerequisites, Geology A, 400, 402, 403, or permission of instructor. Professor COLE. Lectures in winter months, all day field trips in spring months. Hours and days to be arranged. McGraw 450.

The outstanding geologic phenomena of New York State will be studied through lectures, readings, and field observations. Special emphasis will be given to the classic Paleozoic section of central New York. Course given only if sufficient number of qualified students are registered.

410. *MICROPALEONTOLOGY.* Spring term. Credit two hours. Prerequisite, permission of the instructor. Student should have Geology A, 400, 402, and 403. Professor COLE. Hours to be arranged, in general two laboratory periods a week. McGraw 450.

Study of the microfossils, chiefly Foraminifera, in their relation to correlation of strata, as used in the development of oil fields.

411. *ADVANCED PALEONTOLOGIC AND STRATIGRAPHIC PROBLEMS.* Throughout the year. Credit variable. Prerequisites, Geology 402 and 403. Professor COLE. Day and hours to be arranged. McGraw 450.

Particular problems in paleontology and stratigraphy adapted to the needs of the individual student.

ECONOMIC GEOLOGY

Associate Professor ANDERSON.

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 materials 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 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 regions 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.* A two-term course. Credit three hours a term. Prerequisite, Geology A or 100 or 501 or permission of the instructor. Associate Professor ANDERSON. Lectures, T Th 11. Laboratory, F 1:40–4. McGraw 150.

Nature, mode of occurrence, distribution, and utilization of the more important mineral deposits. Fall term deals with the non-metalliferous deposits such as building stone, ceramic materials, coal, petroleum, phosphate, gypsum, salt, gems, etc.; the spring term deals with the metalliferous deposits such as iron, copper, lead, zinc, gold, silver, platinum, etc. Field trips to be included as a part of the laboratory work.

505. *MINERAL EVALUATION AND TECHNOLOGY.* Two terms. Credit two hours a term. Prerequisites, Geology 311 and 500 or by special permission. Associate Professor ANDERSON. Hours to be arranged. McGraw 150.

Methods of sampling and mine evaluation; mining methods; and principles and methods of mineral concentration. Designed to improve the background of economic geologists and engineers for work in the mineral industry.

507. *MICROSCOPIC STUDY OF ORE MINERALS.* Two terms. Credit one hour a term. Prerequisite, Geology 311. Associate Professor ANDERSON. Hours to be arranged. McGraw 250.

Study of polished sections of metallic ore minerals with reflected light, using etch and microchemical tests as aids to mineral identification, and interpretation of mineral paragenesis with preparation of photomicrographs to illustrate mineral relationships. Designed to assist in the study of ore deposits.

509. *GENESIS OF MINERAL DEPOSITS.* A two-term course. Credit three hours a term. Prerequisites, Geology 311 and 500. Associate Professor ANDERSON. Two lectures, one laboratory. Hours to be arranged. McGraw 150.

Structural occurrence and origin of the economically important mineral deposits. Fall term: the deposits of primary origin associated more or less closely with igneous phenomena; spring term: the deposits of secondary origin associated more or less directly with processes of weathering and sedimentation.

511. *ADVANCED OR SPECIAL WORK IN ECONOMIC GEOLOGY.* Throughout the year. Credit variable. Prerequisite, dependent on the nature of the work. Associate Professor ANDERSON.

Work arranged to meet the needs and training of the student. Guided study of geologic problems of advanced or special nature, and research in Economic Geology.

512. *ECONOMIC GEOLOGY SEMINARY.* Throughout the year. Credit one hour a term. Associate Professor ANDERSON. Hour to be arranged. McGraw 150.

Seminar on timely topics in Economic Geology.

MATHEMATICS

Professors W. A. HURWITZ, W. B. CARVER, R. P. AGNEW, J. B. ROSSER, B. W. JONES, WM. FELLER, V. S. LAWRENCE, JR., W. W. FLEXNER, R. J. WALKER, and MARK KAC; *Doctor* G. K. KALISCH.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

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 recent 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 co-operation of teachers and students in fields other 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.

It is expected that the following and some other courses will be offered. For possible additional courses and changes in these courses, consult the Announcement and Supplementary Announcements of the College of Arts and Sciences. The courses mentioned in brackets will not be given in 1946–47, but are given from time to time.

1. *Elementary Concepts of Mathematics.* Two terms. Three hours a week.

[2. *Cryptanalysis.* One term. Three hours a week. Not given in 1946–47.]

5. *Solid Geometry.* Either term. Three hours a week.

10. *College Algebra.* Either term. Three hours a week.

15. *Plane Trigonometry.* Either term. Three hours a week.

16. *Spherical Trigonometry and Map Projections.* Either term. Three hours a week.

[20. *Elementary Course in Higher Mathematics.* Two terms. Three hours a week. Not given in 1946–47.]

55a, b. *Analytic Geometry and Calculus.* Two terms. Five hours a week.

60a, b, c. *Analytic Geometry and Calculus.* Three terms. Three hours a week.

65a, b, c. *Analytic Geometry and Calculus.* Three terms. Three hours a week.

[70. *Calculus.* One term. Three hours a week. Not given in 1946–47.]

[90. *Teachers' Course.* One term. Three hours a week. Not given in 1946–47.]

[224. *Engineering Mathematics.* Two terms. Three hours a week. Not given in 1946–47.]

ALGEBRA

100. *FOUNDATIONS OF MATHEMATICS.* Fall term. Credit three hours. Prerequisite, Mathematics 65b or the equivalent. Professor ROSSER. T Th S 9. White 123.

A careful study of the most satisfactory system of symbolic logic; its value in furnishing a test for the validity of any instance of mathematical reasoning will be stressed.

110. *SYMBOLIC LOGIC.* Spring term. Credit three hours. Admission by permission of the instructor. Professor ROSSER. T Th S 9. White 123.

A study of advanced topics in symbolic logic. The important theorems of

Church and Gödel will take up most of the time of the course. Knowledge of Mathematics 100 or its equivalent will be presupposed.

133. *DETERMINANTS AND MATRICES.* Spring term. Credit three hours. Prerequisite, Mathematics 65c or the equivalent. Professor JONES. T Th S 11. White 121.

A treatment of such topics as determinants, matrices, linear dependence, linear equations and linear transformations, numerical methods of computation and reduction by means of orthogonal transformations.

135. *LINEAR ALGEBRAS.* Spring term. Credit three hours. Prerequisite, Mathematics 160. Dr. KALISCH. T Th S 11. White 103.

A course dealing with properties of linear algebras such as structure and representation.

137. *ADVANCED THEORY OF MATRICES.* Fall term. Credit three hours. Prerequisite, Mathematics 133 or the equivalent. Professor JONES. T Th S 10. White 121.

Various canonical matrices, equivalent pairs of matrices, composition of matrices, commutative matrices, matric equations and automorphs.

140. *THEORY OF EQUATIONS.* Spring term. Credit three hours. Prerequisite, Mathematics 10 or the equivalent. Professor CARVER. M W F 10. White 101.

Roots of unity, constructions with ruler and compasses, methods of isolating and approximating roots of equations.

160. *GROUPS, RINGS AND FIELDS.* Fall term. Credit three hours. Prerequisite, Mathematics 65b or the equivalent. Dr. KALISCH. M W F 10. White 103.

An elementary course dealing with the simpler theorems of group theory and their extension to rings and fields.

[*THEORY OF FIELDS.* Not given in 1946–47.]

[*MODERN ALGEBRA.* Not given in 1946–47.]

[*ALGEBRAIC NUMBERS.* Not given in 1946–47.]

[*ANALYTIC THEORY OF NUMBERS.* Not given in 1946–47.]

[*ALGEBRAIC INVARIANTS.* Not given in 1946–47.]

[*GALOIS FIELDS.* Not given in 1946–47.]

[*REPRESENTATION OF GROUPS.* Not given in 1946–47.]

ANALYSIS

200. *ELEMENTARY DIFFERENTIAL EQUATIONS.* Either term. Credit three hours. Prerequisite, Mathematics 65c or the equivalent. T Th S 10. White 115.

215. *ADVANCED CALCULUS.* Throughout the year. Credit three hours a term. Prerequisite, Mathematics 65c or the equivalent. M W F 11. White 115.

A careful study of limits, continuity, derivatives and Riemann integrals. Functions of several variables. Multiple and line integrals. The course is designed to

furnish necessary preparation for advanced work in analysis and applied mathematics.

221. *MEASURE AND INTEGRALS.* Spring term. Credit three hours. Prerequisite, Mathematics 215 or the equivalent. Assistant Professor KAC. M W F 10. White 103.

Elements of Lebesgue's theory of measure and integration. Riemann-Stieltjes and Lebesgue-Stieltjes integrals. Applications to orthogonal series, functional equations and Hilbert space.

240. *COMPLEX VARIABLES.* Throughout the year. Credit three hours a term. Prerequisite, Mathematics 215. M W F 11. White 111.

Among the topics considered will be the complex number system; the elementary functions; complex differentiation and integration; Cauchy's theorem; Taylor's series; singularities; conformal mapping; Riemann surfaces; Fourier and Laplace transformations; differential and integral equations. Applications will be made to physical and engineering problems.

[*REAL FUNCTIONS.* Not given in 1946–47.]

[*CALCULUS OF VARIATIONS.* Not given in 1946–47.]

[*THEORY OF ALMOST PERIODIC FUNCTIONS.* Not given in 1946–47.]

[*INFINITE SERIES.* Not given in 1946–47.]

[*INTEGRAL EQUATIONS.* Not given in 1946–47.]

[*FOURIER SERIES AND INTEGRALS.* Not given in 1946–47.]

GEOMETRY

310. *PROJECTIVE GEOMETRY.* Throughout the year. Credit three hours a term. Prerequisite, Mathematics 65b or the equivalent. Professor CARVER. M W F 9.

A first course in projective geometry, including both synthetic and analytic methods.

343. *ALGEBRAIC CURVES.* Throughout the year. Credit three hours a term. Prerequisite, Mathematics 130 or Mathematics 310 or the equivalent of either. Assistant Professor WALKER. M W F 9. White 123.

An introductory course in modern algebraic geometry; treating the more elementary properties of plane algebraic curves during the first term, and continuing through the second term with a discussion of space curves, rational transformations, linear series, and abelian integrals.

361. *DIFFERENTIAL GEOMETRY AND KINEMATICS.* Fall term. Credit three hours. Prerequisite, Mathematics 60c. Professor FELLER. T Th S 11. White 101.

Theory of curves. Kinematics of a moving point. Curves and motion on surfaces. Elements of the intrinsic geometry on surfaces.

[*ANALYTIC GEOMETRY OF SPACE.* Not given in 1946–47.]

[*THEORY OF LATTICES.* Not given in 1946–47.]

[*GEOMETRY OF HYPERSPACE.* Not given in 1946–47.]

[*TENSOR ANALYSIS.* Not given in 1946–47.]

[*NON-EUCLIDEAN GEOMETRY.* Not given in 1946–47.]

[*RIEMANNIAN GEOMETRY.* Not given in 1946–47.]

[*TOPICS IN TOPOLOGY.* Not given in 1946–47.]

APPLIED MATHEMATICS

400a. *PROABILITY AND STATISTICS.* Fall term. Credit three hours. Prerequisite, Mathematics 60c or 65c. T Th S 10. White 103.

Introduction to the modern theory of probability with emphasis on random variables, distribution functions, moment generating functions and limit theorems. Normal distribution with various applications.

400b. *PROBABILITY AND STATISTICS.* Spring term. Credit three hours. Prerequisite, Mathematics 400a. T Th S 10. White 103.

Derivation of fundamental distributions used in practical statistics and Physics.

410. *NUMERICAL AND GRAPHICAL METHODS.* Fall term. Credit three hours. Prerequisite, Mathematics 200 or the equivalent or Mathematics 215. Assistant Professor KAC. T Th S 9. White 103.

Graphs, scales and alignment charts; analytical approximations to empirical curves; interpolation and extrapolation; mechanical quadratures; numerical and graphical solutions of algebraic, transcendental, and differential equations. Applications to problems in chemistry, physics, and engineering will receive special attention.

420. *VECTOR ANALYSIS.* Spring term. Credit three hours. Prerequisite, Mathematics 65c or the equivalent. T Th S 8. White 111.

The algebra and calculus of vectors, with applications.

486. *SPECIAL FUNCTIONS OF MATHEMATICAL PHYSICS.* Fall term. Credit three hours. Prerequisite, Mathematics 65c or the equivalent. Professor FELLER. M W F 10. White 101.

Simple characteristic value and expansion problems. Bessel, Legendre, Hermite, Laguerre functions, with particular reference to serious expansions occurring in physical problems.

[*FOURIER SERIES.* Not given in 1946–47.]

[*ORTHOGONAL FUNCTIONS.* Not given in 1946–47.]

[*POTENTIAL FUNCTIONS.* Not given in 1946–47.]

[*MECHANICS.* Not given in 1946–47.]

[*HYDRODYNAMICS AND ELASTICITY.* Not given in 1946–47.]

[*EXTERIOR BALLISTICS.* Not given in 1946–47.]

[*DIFFERENTIAL EQUATIONS OF MATHEMATICAL PHYSICS.* Not given in 1946–47.]

[*DYNAMICS.* Not given in 1946–47.]

[*RELATIVITY.* Not given in 1946–47.]

METEOROLOGY

Professor R. A. MORDOFF.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

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 elementary statistics.

1. *Elementary Meteorology.* Fall term, to be repeated in spring term. Three hours a week.

2. *CLIMATOLOGY.* Fall 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.

221. *RESEARCH.* Fall term, to be repeated in spring term. Prerequisite, Climatology 2 or the equivalent. Professor MORDOFF. Hours by appointment.

Original investigations in meteorology and climatology.

212. *SEMINARY.* Spring 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 L. P. SMITH, R. F. BACHER, L. L. BARNES, H. A. BETHE, J. R. COLLINS, D. R. CORSON, R. P. FEYNMAN, G. E. GRANTHAM, K. I. GREISEN, H. E. HOWE, B. D. MCDANIEL, P. MORRISON, C. C. MURDOCK, H. F. NEWHALL, L. G. PARRATT, R. L. SPROULL, and D. H. TOMBOULIAN; *Doctors* C. P. BAKER, E. D. COURANT, J. W. DE WIRE, and C. W. GARTLEIN.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

Physics 1, 2, 3, 4	Applied Physics 1, 2, 3, 4
Experimental Physics 1, 2, 3, 4	Mathematical Physics 3
Theoretical Physics 1, 2, 3, 4	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 are especially interested in directing graduate research in the following fields:

EXPERIMENTAL PHYSICS. Nuclear Physics; cosmic rays; atomic spectra, including nuclear effects; absorption spectra; x-rays, x-ray and electron diffraction; electronics, electrical phenomena in gases, and physics of solids.

THEORETICAL PHYSICS. Quantum mechanics, particularly the theory of nuclei, fundamental particles and radiation.

Members of the staff who are in residence in Ithaca during the summer often stand ready to consult with investigators.

NOTE —Since only a limited number of graduate students can be accommodated in physics, students should make arrangements for admission by application to the Dean of the Graduate School before coming to Ithaca.

A colloquium in general physics and a seminar in theoretical physics meets regularly, and seminars in special fields as arranged.

U 3, 4. *Introductory Physics.* Credit three hours.

U 7, 8, 11, 12. *Introductory Physics.* Credit four hours.

U 21, 22. *Intermediate Physics.* Credit three hours.

U 55. *Introductory Physical Experiments.* Credit three hours.

U 60. *Physical Experiments.* Credit three hours.

U 63. *Electrical Measurements.* Credit three hours.

U 64. *Heat.* Credit three hours.

U 65. *Mechanics and Properties of Matter.* Credit three hours.

U 105. *Advanced Laboratory Practice.* Credit three hours a term.

111. *ANALYTICAL MECHANICS.* Fall term. Credit three hours. Prerequisites, Physics 65 and Differential Equations. Assistant Professor SPROULL. M W F 9.

Analytical mechanics of material particles, system of particles and rigid bodies; Lagrange's equations; oscillations, forced vibrations.

123. *ELECTRICITY AND MAGNETISM.* Fall term. Credit three hours. Prerequisites, Physics 21 or Calculus and (or in parallel) Physics 63. Professor MURDOCK. T Th S 9.

Electrostatic and electromagnetic fields, polarization of dielectrics and magnetic media, displacement current, plane electromagnetic waves, the Poynting vector.

124. *ELECTRICITY AND MAGNETISM.* Spring term. Credit five hours. Prerequisites, Physics 123 and Differential Equations. Associate Professor TOMBOULIAN. Lectures, T Th S 9 and two laboratory periods to be arranged.

General circuit theory from the standpoint of Fields; steady current circuits, non-steady current circuits, alternating current circuits; steady current networks; alternating current networks; frequency characteristics of networks; filter circuits.

135. *OPTICS.* Fall term. Credit five hours. Prerequisites, Physics 60 and Calculus. Professor COLLINS. Lectures, M W F 8, and two laboratory periods to be arranged.

Geometrical optics, lens systems, Gauss points, aberrations, stops, photometry of optical systems; interference, application of various forms of interferometers; Fresnel and Fraunhofer diffraction patterns and their applications to optical instruments; polarized light, production, detection, measurements and applications of plane and elliptically polarized light.

165. *WAVE MOTION AND SOUND.* Spring term. Credit five hours. Prerequisite, Physics 111. Professor COLLINS. Lectures, M W F 8, and two laboratory periods to be arranged.

Elasticity, hydrodynamics, vibrations of mechanical systems, propagation of mechanical waves, mechanical and acoustic impedance, characteristics of sound sources and receivers, sound intensity measurements, and simple acoustic filters.

173. *ATOMIC AND MOLECULAR PHYSICS.* Fall term. Credit three hours. Prerequisite, Physics 123. Assistant Professor MORRISON. T Th S 9.

The fundamental particles; classical and quantum mechanical concepts; atomic structure; interaction between atoms and radiation; molecular structure; collision phenomena; fundamentals of nuclear physics.

174. *ELECTRONIC PROPERTIES OF SOLIDS AND LIQUIDS.* Spring term. Credit five hours. Prerequisite, Physics 173. Associate Professor SACK. T Th S 9, and two laboratory periods to be arranged.

Lattice structure of solids; magnetic, dielectric and thermal properties of solids; electrical and optical properties of metals, semi-conductors and ionic crystals; electron emission and barrier layer effect; relaxation phenomena in liquids and solids.

201. *THEORETICAL MECHANICS.* Fall term. Credit three hours. Prerequisite, Physics 111 or its equivalent. Assistant Professor MORRISON. T Th S 11.

Classical mechanics, including the equations of Lagrange and Hamilton, theory of vibrations, special relativity theory.

202. *ELECTRODYNAMICS.* Spring term. Credit three hours. Prerequisite, Physics 123 or its equivalent. Assistant Professor FEYNMAN. T Th S 11.

Maxwell's equations and their applications, including electromagnetic radiation, scattering, refraction and interference of light, waves in guides, cavity resonators, etc.

203. *STATISTICAL MECHANICS AND KINETIC THEORY.* Fall term. Credit two hours. Prerequisites, Physics 201, and (or in parallel) Physics 271. Assistant Professor FEYNMAN. M F 10.

Statistical mechanics, including quantum statistics, application to the properties of gases, vapor pressure, etc., transport phenomena, statistics of radiation and of electrons in metals.

205. *THEORETICAL PHYSICS — READING COURSE.* Either term. Credit two hours. Professor BETHE.

Supervised reading and problem work in thermodynamics and optics. This course should, in general, be completed by physics majors not later than Physics 203.

271. *INTRODUCTORY QUANTUM MECHANICS.* Fall term. Credit three hours. Prerequisites, Physics 201 and 202. Professor BETHE. T Th S 12.

The Schrodinger equation. Uncertainty principle. Oscillator, rotator, hydrogen atom. Perturbation theory.

272. *APPLICATIONS OF QUANTUM MECHANICS.* Spring term. Credit three hours. Prerequisite, Physics 271. Professor BETHE. T Th S 12.

Discussion of various useful applications of quantum mechanics such as collision theory, theory of spectra of atoms and molecules, theory of solids, emission of radiation, theory of measurement in quantum mechanics.

NOTE: More advanced work in special topics in quantum mechanics may be arranged as a reading course under Course 315.

280. *PROBLEMS IN THEORETICAL PHYSICS.* Either term. Credit from two to six hours a term. Prerequisites, Physics 203 and 271, also Physics 405 or its equivalent in Mathematics courses. Assistant Professor FEYNMAN.

Problem work requiring the integration of knowledge acquired in several theoretical physics and mathematics courses.

300. *ADVANCED LABORATORY.* Either term. Credit three hours a term. Prerequisite, Physics 105 or the equivalent. Professor COLLINS and Associate Professor PARRATT. Laboratory periods to be arranged.

A course of experiments designed to broaden the student's acquaintance with the methods of physical measurements and their interpretation and to afford training in the use of modern physical equipment.

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.

Systematic laboratory work together with appropriate lectures and discussions will be offered in the following fields:

(a) Nuclear Physics. Either term. Credit two hours. Assistant Professor MCDANIEL and Dr. DE WIRE. Operation and use of the cloud chamber, Geiger counter, and ionization chamber. The production of artificial radioactivity using the cyclotron, alpha-particle range measurement, half life determination, beta and gamma ray absorption.

[(b) Spectroscopy. Credit two hours. Experiments, to suit the students' needs, such as emission and absorption spectra from various sources, Zeeman effect, nuclear effects, molecular spectra, spectrophotometry, Raman effect, and spectrochemical analysis. Not given in 1946–47.]

(c) X-Rays. Fall term. Credit two or three hours. Associate Professor PARRATT. 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. Fall term. Credit two or three hours. Assistant Professor SPROULL. Vacuum technique and low pressure measurements, ionization and resonance potentials, e and e/m for electrons, mass spectroscopy, work functions, secondary emission, photoelectric effects, and construction of special tubes.

(e) Crystal Structure by X-ray and Electron Diffraction. Spring term. Credit two hours. Professor ———. 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. Application of radiation methods to the measurements of temperature. Not given in 1946–47.]

405. *MATHEMATICAL METHODS IN PHYSICS.* Throughout the year. Credit three hours a term. Prerequisites, Mathematics 65c, or the equivalent, and at least two years of general physics. Assistant Professor FEYNMAN.

Lectures and problem work designed to give the student a working knowledge of the principal mathematical methods used in advanced physics.

461. *THE THEORY AND PROPERTIES OF SOLIDS.* Fall term. Credit three hours. Prerequisite, Physics 271 or its equivalent. Professor SMITH. M W F 11.

Lectures covering the theory and experimental techniques connected with the principal properties of the various solid types. The topics will include the structure of solids and their cohesive properties, the electronic behavior of metals, ionic crystals, series conductors, etc., and the magnetic and optical properties of solids.

481. *ADVANCED QUANTUM MECHANICS.* Fall term. Credit three hours. Prerequisite, Physics 272. Professor BETHE. W F 4:30.

Theory of radiation, self-energy of the electron, positron theory, meson theory of nuclear physics.

592. *X-RAY CRYSTALLOGRAPHY.* Spring term. Credit three hours. Prerequisite, Physics 123 or consent of the Instructor. Professor MURDOCK. M W F 10.

Crystal symmetry, lattices, and space groups, the reciprocal lattice, diffraction of waves by three dimensional gratings, the wave properties of x-rays and of beams of electrons, the interpretation of x-ray and electron diffraction data, structure determination by Fourier synthesis, resolving power of crystalline powders, interpretation of diffraction patterns of polycrystalline metals and of fluids.

598. *X-RAYS.* Spring term. Credit three hours. Open to qualified students by permission. Associate Professor PARRATT. M W F 10.

X-ray production and measurement, scattering, absorption, diffraction, and spectra; the relation of these processes to modern concepts of atomic and solid structure.

642. *ADVANCED ELECTRONICS AND ULTRA-HIGH FREQUENCIES.* Spring term. Credit three hours. Prerequisites, Physics 173 and 320d. Professor SMITH and ————. Laboratory periods as arranged.

Advanced laboratory work partly of a semi-research type designed to furnish experience and modern techniques in such topics as thermionics, secondary and field emission, excitation and ionization cross-sections, electrical phenomena in gases, generation and behavior of super-high-frequency electromagnetic fields.

711. *NUCLEAR PHYSICS.* Fall term. Credit two hours. Prerequisites, Physics 201 and 202. Professor BACHER. M F 9.

General properties of nuclei and the particles observed in nuclear disintegrations, including experimental methods used to determine these properties, results obtained and their interpretation.

712. *THEORY OF NUCLEI.* Spring term. Credit two hours. Prerequisites, Physics 271 and 711, or the equivalent. Professor BETHE. M F 9.

Properties of atomic nuclei and fundamental particles. Theory of simple nuclear systems. Theory of nuclear transformations.

752. *COSMIC RAYS.* Spring term. Credit two hours. Prerequisite, a course in quantum theory or registration in Physics 271. Assistant Professor GREISEN. M W F 8.

Properties of the high energy particles which form the cosmic radiation; experimental results and theoretical interpretation. Secondary effects of cosmic rays in matter; cascade theory of showers. Variation of cosmic rays with altitude and latitude; influence of the earth's magnetic field; decay of mesotrons; nature and energy distribution of the primary cosmic rays.

AGRICULTURE, INCLUDING FORESTRY

AGRICULTURAL ECONOMICS

(BUSINESS MANAGEMENT, FARM MANAGEMENT, FARM FINANCE, LAND ECONOMICS and AGRICULTURAL GEOGRAPHY, MARKETING, PRICES and STATISTICS, PUBLIC ADMINISTRATION AND FINANCE.)

Professors G. P. Scoville, E. G. Misner, 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, W. M. Curtiss, T. N. Hurd, H. F. DeGraff, I. R. Bierly, and L. B. Darrah.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

Agricultural Economics 4

Business Management 1, 2, 3, 4

Farm Management 1, 2, 3, 4

Farm Finance 1, 2, 3, 4

Land Economics and Agricultural Geography 1, 2, 3, 4

Marketing 1, 2, 3, 4

Prices and Statistics 1, 2, 3, 4

Public Administration and Finance 1, 2, 3, 4

BUSINESS MANAGEMENT

Attention is directed to the courses in administrative engineering in the College of Engineering, in economics in the College of Arts and Sciences, and in administration in the Department of Hotel Administration.

120. *Personal Financial Management.* Spring term. Credit three hours. Associate Professor Curtiss. T Th 8. Warren 225. Discussion, T 1:40–4. Warren 240.

Planning an individual's financial program; sources and terms of credit; savings and investments; insurance of property and income; acquisition and disposition of property; provision for dependents.

121. *FINANCIAL STATEMENTS.* Fall term. Credit three hours. Professor Powell. Lectures, M W 11. Warren 225. Discussion and quiz, W 2–4. Warren 201.

For persons who wish to understand and interpret the statements of financial condition and income of cooperatives and other businesses. Content of and relationship between balance sheet, operating statement, and statement of surplus; methods of valuing assets; analysis by means of ratios.

122. *ACCOUNTING METHOD.* Spring term. Credit three hours. Professor POWELL. Lectures, M W 8. Warren 225. Practice period, M 1:40–4. Warren 201.

For persons who wish to understand the records and procedures commonly used in keeping accounts of cooperatives and other businesses. Recording business transactions and deriving financial statements; analyses of costs and budgets.

126. *FARMERS' COOPERATIVES.* Spring term. Credit three hours. Professor POWELL. Lectures, M W 8. Warren 225. Discussion, Th 1:40–4. Warren 201.

What cooperatives have tried to do and what they have done; their special problems of organization, finance, and control.

127. *BUSINESS LAW.* Fall term. Credit three hours. Mr. ALLAN H. TREMAN. Lectures, M W F 8. Warren 25.

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.

FARM MANAGEMENT

102. *FARM MANAGEMENT.* Spring term. Credit five hours. Professors WARREN. Lectures, M W F 10. Warren 25. Laboratory, F 4–6. Warren 101. On days when farms are visited laboratory period will be 1:40–6.

Farming as a business; farm accounts; factors affecting profits; size of business; choice of enterprise; forms of tenure and leases; methods of getting started in farming; choosing a farm; planning the organization and management of specific farms. One all-day trip and five half-day trips are taken to visit farms in nearby regions.

103. *FARM RECORDS AND ACCOUNTS.* Fall term. Credit three hours. Two lectures and one laboratory period a week. [Not given in 1946–47.]

Planning an accounting system designed to meet the needs of the individual farm and farmer; practice in keeping the records; training in the interpretation and analysis of farm records.

203. *BUSINESS ORGANIZATION AND MANAGEMENT OF SUCCESSFUL NEW YORK FARMS.* Fall term. Credit four hours. Prerequisite, course 102 or its equivalent. Professor SCOVILLE. F 1:40–4, S 8–10. Warren 101. Approximate transportation expenses for trips, $20.

During the term some all-day trips are taken, usually on Saturdays. Two two-day trips are taken, leaving Friday morning and returning Saturday night.

207. *METHODS AND RESULTS OF RESEARCH IN FARM MANAGEMENT AND LAND ECONOMICS.* Fall and spring terms. Credit two hours each term. Professors HILL and WARREN and other members of the departmental staff. Th 4–6. Warren 140.

A discussion of research problems in farm management and land economics. Opportunity will be given to study special problems suggested by members of the group.

FARM FINANCE AND FARM APPRAISAL

184. *FARM FINANCE.* Fall term. Credit three hours. Lecture, Th 10. Lecture and discussion, Th 1:40–4. Warren 125.

A study of the credit institutions which serve agriculture.

187. *FARM APPRAISAL.* Fall term. Credit two hours. Professor WARREN. Lecture, T 10. Laboratory, T 1:40–5. Warren 101.

A study of factors governing the price of land; methods of land valuation; the appraisal of farms for use, for sale, for the purpose of making loans, and for taxation.

LAND ECONOMICS AND AGRICULTURAL GEOGRAPHY

2. *AGRICULTURAL GEOGRAPHY.* Fall term. Credit three hours. Associate Professor DEGRAFF. Lectures, W F 11. Warren 25. Discussion and laboratory, W Th or F 2–4. Warren 101.

Historical perspective on present-day agriculture; adjustment of agriculture to natural and to economic environment; crop and livestock production in New York State, the United States, and other countries; interregional trade in agricultural products.

181. *LAND ECONOMICS.* Fall term. Credit three hours. Professor HILL. Lectures, T Th 8. Warren 125. Discussion and laboratory, T 1:40–4. Warren 140. One or two field trips are taken, the expenses of which do not exceed $2.50.

Physical characteristics of land as related to land use; population, technological advance, institutions, and other factors as they affect land utilization; economics of land use; local, regional, and national land-use problems and policies, including tenancy, land valuation, credit, taxation, and conservation.

MARKETING

141. *MARKETING.* Fall term. Credit three hours. Professor HARPER. Lectures, W F 10. Warren 225. Laboratory and discussion; graduate students, Th 1:40–4. Warren 225; undergraduates, F 1:40–4. Warren 225.

A general course dealing with problems of distribution of farm products. Characteristics of consumer demand; factors to be considered in judging the best marketing plan from the standpoint of when, where, in what form, and through what channels to sell; public regulation and controls.

142. *MARKETING FRUITS AND VEGETABLES.* Fall term. Credit four hours. Professor RASMUSSEN. Lectures, M W F 9. Warren 225. Laboratory, W 1:40–4. Warren 240.

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 ratings; terminal problems; aspects of retailer and consumer-demand.

143. *MARKETING DAIRY PRODUCTS.* Spring term. Credit three hours. Professor SPENCER. Lectures, M W 9. Warren 225. Laboratory, Th 2–4. Warren 240. Field trips to visit dairy plants will be arranged in place of one or more laboratory meetings.

This course is designed to give the student a general view of the marketing system for dairy products and to acquaint him with significant facts and principles that pertain to the pricing and distribution of milk. Fee for trip expenses, $3.

144. *MARKETING POULTRY, EGGS, AND LIVESTOCK.* Spring term. Credit three hours. Associate Professor CURTISS. Lectures, T Th 10. Warren 225. Laboratory, Th 1:40–4. Warren 240.

A study of the economic factors involved in the marketing of eggs, poultry, hogs, cattle, sheep, and wool. Subjects to be considered include: 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.* Spring term. Credit one hour. Associate Professor CURTISS in charge. Representatives of other departments cooperate in the course. Given only if twenty or more students register. Enrollment limited to 40.

Five days of the spring vacation are spent in New York City inspecting and studying the marketing of dairy products, eggs, poultry, fruits, vegetables, livestock, and meat. A short series of introductory lectures precede the trip, at hours to be arranged.

A $5 deposit for bus hire and incidental expenses is payable 10 days before the trip. Total cost of the trip need not exceed $30 in addition to transportation to and from New York City.

160. *FOOD ECONOMICS.* Fall term. Credit two hours. Professor HARPER. Designed especially for students in the School of Nutrition. Lectures and discussion, T Th 8. Warren 225.

This course deals with economic aspects of the food problem, including: history of the world's food problem; differences around the world in food consumption, production, and trade; the forms and importance of "food wastage"; the factors that limit food production; possibilities of expanded production of food from land and water; income and its effects on food consumption; reasons for difference in the expensiveness of various foods; differences between foods in the amounts of nutrients per acre, per hour of work, and per dollar of production costs; the costs and purposes of marketing services; the population problem as related to food.

240. *RESEARCH IN MARKETING.* Fall and spring terms. Credit two hours a term. Designed to be taken continuously by graduate students interested in marketing. W 4–6. Warren 201. Members of the staff will have charge in rotation.

Among the subjects to be considered are: the scope of marketing research; analyses of marketing problems; planning of projects; collecting and analyzing data; presentation of results; critical reviews of marketing research at various institutions.

243. *MARKETING PROBLEMS IN THE FLUID MILK INDUSTRY.* Spring term. Credit three hours. Professor SPENCER. Discussion periods, T Th 11–12:30. Warren 240. Open to those who have done superior work in course 143, and to others by special permission.

This course provides for the study of some major problems that arise in connection with the pricing and distribution of fluid milk, such as balancing supply and demand in the city milk sheds, reduction of spread between consumer and producer prices, and the like.

PRICES AND STATISTICS

Attention is directed to Mathematics 10 (Mathematics for students of economics and statistics) and to Mathematics 400 (Statistics), in the College of Arts and Sciences.

111. *STATISTICS.* Fall term. Credit three hours. Professor PEARSON. Lecture, M 8. Warren 125. Laboratory, M 1:40–4. Warren 25.

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.* Spring term. Credit three hours. Professor PEARSON. Prerequisite, course 111. Lecture, M 8. Laboratory, M 1:40–4. Warren 125.

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.* Spring term. Credit three hours. Professor PEARSON. Lectures, T Th 9. Laboratory, W 1:40–4. Warren 25.

A study of prices of farm products in relation to agricultural and industrial conditions.

215. *PRICES.* Fall and spring terms. Credit one hour a term. Professor PEARSON. Prerequisite, course 115. W 2–4. Warren B–17.

PUBLIC ADMINISTRATION AND FINANCE

Attention is directed to the courses in Government and to Economics 52 (Federal Taxation) in the College of Arts and Sciences.

135. *LOCAL GOVERNMENT.* Fall term. Credit three hours. Two lectures and one laboratory a week.

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.* Spring term. Credit three hours. Professor KENDRICK. Lectures, M W F 11. Warren 225.

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, inheritance, business, and personal income taxation; and the problem of post-war finance.

235. *PROBLEMS IN FINANCIAL ADMINISTRATION.* Fall term. Credit three hours. Alternates with course 236. Time and room to be arranged. [Not given in 1946–47.]

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.* Fall term. Credit three hours. Alternates with course 235. Time and room to be arranged. [Not given in 1946–47.]

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 organizations.

238. *SEMINARY IN PUBLIC FINANCE.* Spring term. Credit two hours. Professor KENDRICK. W 2–4. Room to be arranged.

An examination of basic problems in public finance.

AGRICULTURAL POLICY

[151. *PUBLIC PROBLEMS OF AGRICULTURE.* Spring term. Credit two hours. Time and place to be arranged. Not given in 1946–47.]

A discussion of some of the more important problems of agriculture that involve collective or governmental action.

DEPARTMENTAL SEMINARY

299. *SEMINARY.* Continues through fall and spring terms. Departmental staff. M 4. Warren 401.

AGRICULTURAL ENGINEERING

Professors B. B. ROBB, A. M. GOODMAN, B. A. JENNINGS, L. M. ROEHL, and F. B. WRIGHT.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

Farm Structures 1, 2, 3, 4

Farm Equipment 1, 2, 3, 4

Agricultural Engineering 1, 2, 3, 4

Engineering of Soil Management 1, 2, 3, 4

The laboratories of the Department are well equipped for the usual types of investigations in the fields listed. Special equipment can generally be supplied when needed.

Students desiring to undertake work in Agricultural Engineering should have, first of all, adequate grounding in the fundamentals of the phase studied and ability to perceive the applications of these fundamentals, since the applications of engineering practices to agriculture, though of great economic importance, are usually successful in proportion as they are direct and simple. First hand knowldege of farm life and of rural conditions generally are most essential for some problems. Whether a student's preparation is adequate for any given line of advanced study can be determined only by special consideration of each case.

1. *Farm Mechanics.* Either term. Three hours a week.

101. *Electricity on the Farm.* Second term. Three hours a week.

102. *Farm Power.* First term. Three hours a week.

103. *Field Machinery.* First 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. Not given in 1946–47.]

122. *Drainage and Irrigation.* Second term. Two hours a week. Given in alternate years.

24. *Farm Concrete.* First term. Two hours a week.

31. *Farm Structures.* First term. Three hours a week.

40. *Farm Shop Work.* Either term. Two hours a week.

41. *Shop Work for Rural High School Teachers.* Either term. 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 ROBB, GOODMAN, JENNINGS, and ROEHL, and Associate 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. T 4:30–5:45. Presentation and discussion of papers on special problems in agricultural engineering.

AGRONOMY

Professors R. BRADFIELD, H. O. BUCKMAN, J. K. WILSON, A. F. GUSTAFSON, F. B. HOWE, H. B. HARTWIG, D. B. JOHNSTONE-WALLACE, R. F. CHANDLER, JR., R. B. MUSGRAVE, MICHAEL PEECH, M. G. CLINE, H. A. MACDONALD, M. B. RUSSELL, and J. E. DAWSON; at Geneva, *Professor* H. J. CONN.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

Soils 1, 2, 4

Field Crop Production 1, 2, 4

The laboratories of the Department are well equipped for chemical, physical, and microbiological investigations of soil 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 field as listed: Professor BRADFIELD, in soil fertility; Professor PEECH in soil chemistry; Professor RUSSELL in soil physics; Professor BUCKMAN in soil genesis and geography; Professors HOWE and CLINE in the morphology, classification, and cartography of soils; Professor J. K. WILSON and Professor H. J. CONN in soil microbiology; Professor DAWSON in organic soils; Professor CHANDLER in forest soils; Professor GUSTAFSON in soil erosion control; Professor HARTWIG in field crop production; Professors JOHNSTONE-WALLACE and MACDONALD in pasture management; and Professor MUSGRAVE in field crop ecology. 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, mathematics through calculus, 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.

AGRONOMY

A. *Introductory Agronomy.* Fall term. Credit three hours. Open to freshmen only.

SOIL SCIENCE

1. *The Nature and Properties of Soils.* Fall or spring term. Credit five hours.

6. *Soils.* Fall term. Credit three hours. For two-year students only.

101. *ORIGIN, MORPHOLOGY, CLASSIFICATION, AND MAPPING OF SOILS.* Spring term. Credit three hours. Prerequisite, course 1. Lectures, T Th 10. Caldwell 100. Field trips to be arranged. Professor HOWE.

A course dealing with the origin, profile characteristics, classification, and mapping of soils in the field. An important part of the course is devoted to the interpretation of soil maps with particular reference to their use in farm planning. Cost of field trips is included in laboratory fee.

102. *SOIL CONSERVATION.* Spring term. Credit two hours. Prerequisite, courses 1 or 6 and 2 or 11 or their equivalent. Farm background essential. Lectures, T Th 11. Caldwell 143. Professor GUSTAFSON.

An analysis of the causes of the decline in the inherent productivity of soils and of the practical methods of management that will hold them in place and permanently maintain their productivity. The causes of erosion and its control by agronomic methods receive special emphasis. Two all-day Saturday field trips.

[103. *ORGANIC SOILS.* Fall term. Credit two hours. Given in alternate years. Prerequisite, course 1 and Chemistry 201. Assistant Professor DAWSON. Not given in 1946–47.]

A course designed primarily for students specializing in soil technology. Emphasis is placed on the composition and properties of organic soils. One all-day Saturday field trip.

104. *FOREST SOILS.* Fall term. Credit two hours. Given in alternate years. Prerequisite, course 1 and Botany 31. Associate Professor CHANDLER.

Assigned readings and semi-weekly discussions of the more important forest-soils literature. There are occasional field trips.

106. *SOIL MICROBIOLOGY.* Spring term. Credit three hours. With the approval of the instructor, the lectures without the laboratory may be taken for two-

hours credit. Prerequisite, course 1, except for students majoring in bacteriology, Bacteriology 1, and Chemistry 201 or its equivalent. Lectures, M W 8. Caldwell 143. Laboratory, F 1:40–4. Caldwell 201. Professor WILSON.

A course in biological soil processes designed primarily for students specializing in soil technology or bacteriology. The laboratory work is supplemented by reports and by abstracts of important papers on the subject.

201. *SOIL CHEMISTRY, LECTURES.* Spring term. Credit three hours. Prerequisite, course 1 and Qualitative and Quantitative Analysis. A course in physical chemistry is recommended. M W F 9. Caldwell 143. Associate Professor PEECH.

Chemical composition and properties of soils. Discussion of chemical processes and changes in the soil, including the behavior of different plant-nutrient elements.

202. *CHEMICAL METHODS OF SOIL ANALYSIS.* Spring term. Credit three hours. Prerequisite, course 1 and Qualitative and Quantitative Analysis. Enrollment limited. M W 1:40–4. Caldwell 350. Associate Professor PEECH.

Lectures, laboratory exercises, and demonstrations designed to familiarize the student with different chemical techniques for studying soils.

203. *THE GENESIS, MORPHOLOGY, AND CLASSIFICATION OF SOILS.* Fall term. Credit three hours. Lectures, M W F at 9. Caldwell 143. Associate Professor CHANDLER and Assistant Professor CLINE.

A course dealing with the factors and processes of soil formation with particular reference to the development and utilization of the great soil groups of the world. An advanced treatment of soil classification systems is included. Two all-day Saturday field trips.

205. *SOIL FERTILITY, ADVANCED COURSE.* Fall term. Credit three hours. Prerequisite, course 1 and Chemistry 201 or its equivalent. Lectures, T Th S 8. Caldwell 143. Professor BRADFIELD.

A study of the soil as a source of the mineral nutrients needed for efficient crop production and of the properties and use of liming materials, fertilizers, and manures.

207. *SOIL PHYSICS, LECTURES.* Fall term. Credit three hours. Prerequisite, course 1, Physics 3 and 4, and Chemistry 201. A course in physical chemistry is recommended. M W F 8. Caldwell 143. Professor RUSSELL.

A study of physical processes and changes that take place in soils, with emphasis upon their application and significance.

208. *PHYSICAL PROPERTIES OF SOILS, LABORATORY.* Fall term. Credit three hours. Must be preceded or accompanied by course 207. Enrollment limited. M W 1:40–4. Caldwell 294. Professor RUSSELL.

Lectures, laboratory exercises, and demonstrations designed to familiarize the student with different physical and physicochemical techniques used in soil investigations.

209. *RESEARCH IN SOIL SCIENCE.* Fall and spring terms. Professors BRADFIELD, BUCKMAN, CONN, GUSTAFSON, HOWE, WILSON, and RUSSELL, Associate Professors CHANDLER and PEECH, and Assistant Professor CLINE.

210. *SPECIAL TOPICS IN SOIL SCIENCE.* Fall and spring term. Credit one to three hours. Prerequisite, ten credit hours in Soil Science. Time to be arranged.

Topics for 1946–47 to be announced.

FIELD CROPS

2. *Introduction to Field Crops.* Spring term. Credit three hours. Open to freshmen.

11. *Production of Field Crops.* Fall term. Credit four hours.

[211. *FIELD CROPS, ADVANCED COURSE.* Spring term. Credit two hours. Given in alternate years. Prerequisite, course 11, Plant Breeding 211, and Botany 31 or their equivalent. Professor HARTWIG. Not given in 1946-47.]

A literature course organized to meet the needs of students specializing in field crops. Current problems involving crops other than pasture are considered. The emphasis is on forage crops. In addition to lectures, papers are assigned for reading and abstracting.

212. *PASTURES.* Spring term. Credit three hours. Primarily for graduate students. Juniors and seniors must obtain permission of the instructor. Prerequisite, courses 1 and 11 or their equivalent. Lectures and discussions, T Th 9. Caldwell 143. Laboratory and field trip, Th 1:40–4. Assistant Professor JOHNSTONE-WALLACE.

Special attention is devoted to the principles involved in the improvement and management of pastures in humid temperate climates. Historical and current literature is studied.

213. *CROP ECOLOGY.* Fall term. Credit three hours. Given in alternate years. Prerequisite, course 11 and Botany 31 or their equivalent. Assistant Professor MUSGRAVE.

An analysis of the environment of crop plants and their ecological responses, with emphasis on the cereals and on the legumes and grasses used for forage.

214. *GRASSLAND, ITS PRODUCTION, MANAGEMENT, AND USE.* Fall term. Credit three hours. Prerequisite, courses 1 and 11. Plant Breeding 102 and Botany 31 or their equivalent. Assistant Professor MACDONALD. Not given in 1946–47 unless specially arranged.

Consideration of principles and practices in relation to hay and pasture production; characteristics, adaptation, production, management, and use of various grassland plants; current problems and research methods. Special problems and discussion will be arranged for graduate students.

219. *RESEARCH IN FIELD-CROP PRODUCTION.* Fall and spring terms. Professor HARTWIG and Assistant Professors JOHNSTONE-WALLACE, MUSGRAVE, and MACDONALD.

290. *SEMINARY.* Fall and spring terms. Required of graduate students taking work in the department, S 11–12:30. Caldwell 143.

ANIMAL BREEDING

See under ANIMAL SCIENCES.

ANIMAL HUSBANDRY

Professors K. L. TURK, S. A. ASDELL, J. K. LOOSLI, L. A. MAYNARD, C. M. MCCAY, J. I. MILLER, F. B. MORRISON, G. W. SALISBURY, and J. P. WILLMAN; *Associate Professor* A. A. SPIELMAN.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

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)

Dairy Husbandry 1, 2, 4

Note. If the major for the Ph.D. degree lies in one of these 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 includes a herd of over 300 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 registers 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.

Also, the student should have basic courses in general biology or zoology, introductory chemistry, organic chemistry, animal physiology, and genetics. In the course of their graduate study, candidates for the doctor's degree will be expected to take training in biochemistry, physiology, genetics, biometry, and other related fields.

1. *Livestock Production.* Fall term. Two lectures and one laboratory period a week. Laboratory fee, $2.

10. *Livestock Feeding.* Spring term. Three lectures and one laboratory period a week.

20. *Animal Breeding.* Fall term. Two lectures and one laboratory period a week.

41. *Livestock Judging: Beef Cattle, Horses, Sheep, and Swine.* Fall term. One lecture and laboratory period a week.

42. *Advanced Livestock Judging: Beef Cattle, Horses, Sheep, and Swine.* Spring term. Two lectures and laboratory periods a week.

43. *Advanced Livestock Judging: Beef Cattle, Horses, Sheep, and Swine.* Fall term. Two lecture and laboratory periods a week.

50. *Dairy Cattle.* Spring term. Two lectures and one laboratory period a week. Laboratory fee, $2.

51. *Advanced Judging, Dairy Cattle.* Fall term. Hours by appointment.

60. *Beef Cattle.* Spring term. Two lectures and one laboratory period a week.

70. *Swine.* Spring term. Two lectures and one laboratory period a week.

80. *Sheep.* Fall term. Two lectures and one laboratory period a week.

90. *Meat and Meat Products.* Fall term, to be repeated in spring term. One lecture and two laboratory periods a week.

93. *Meat Cutting.* Fall term, to be repeated in spring term. One period a week.

110. *PRINCIPLES OF NUTRITION.* Fall term. See *ANIMAL NUTRITION.*

111. *LABORATORY WORK IN NUTRITION.* Fall term. Laboratory course. See *ANIMAL NUTRITION.*

115. *ADVANCED LIVESTOCK FEEDING AND APPLIED ANIMAL NUTRITION.* Spring term. Credit two hours. Prerequisites, a course in livestock feeding and course in animal nutrition. Professor MORRISON. Lectures and discussions, T Th 9. Wing E.

A presentation and discussion of recent developments in the feeding and nutrition of farm animals, study of experimental methods, and critical analysis of published data.

120. *PROBLEMS IN ANIMAL BREEDING.* Fall term. Given in alternate years. See *ANIMAL BREEDING.*

125. *ENDOCRINOLOGY, REPRODUCTION, AND LACTATION.* Spring term. See *ANIMAL BREEDING.*

126. *PROBLEMS IN ANIMAL PHYSIOLOGY.* Fall term. Given in alternate years. See *ANIMAL BREEDING.*

213. *BIOCHEMISTRY OF LACTATION.* Spring term. Given in alternate years. See *ANIMAL NUTRITION.*

214. *SPECIAL TOPICS IN ANIMAL NUTRITION.* Spring term. Given in alternate years. See *ANIMAL NUTRITION.*

215. *HISTORY OF NUTRITION.* Fall term. See *ANIMAL NUTRITION.*

219. *SEMINARY IN ANIMAL NUTRITION.* Fall term, to be repeated in spring term. See *ANIMAL NUTRITION.*

229. *SEMINARY IN ANIMAL BREEDING.* Fall and spring terms. See *ANIMAL BREEDING.*

150. *DAIRY CATTLE, ADVANCED COURSE.* Spring term. Credit two hours. Prerequisite, course 50. Professor SPIELMAN. Lecture, T 11. Practice, T 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.

151. *MILK SECRETION.* Fall term. Credit three hours. Prerequisites, course 50, 125, and a course in physiology. Professor ————. Lectures, T Th 9. Laboratory, W 1:40–4. Wing B. Given in alternate years.

Anatomy, development, and functioning of the mammary gland of dairy cattle and hormonal control of lactation.

200. *RESEARCH.* Fall and spring terms. Hours by arrangement. Professors MORRISON, MILLER, SALISBURY, TURK, and J. P. WILLMAN, ASDELL, LOOSLI, MAYNARD, MCCAY, and SPIELMAN.

201. *SEMINARY IN ANIMAL HUSBANDRY.* Fall term, to be repeated in spring term. Required of all graduate students taking either a major or minor subject in Animal Husbandry. Professor TURK and departmental staff. M 11.

DAIRY SCIENCE

Professors J. M. SHERMAN, H. E. ROSS, A. C. DAHLBERG, B. L. HERRINGTON, E. S. GUTHRIE, R. F. HOLLAND, W. E. AYERS, D. B. HAND, and V. N. KRUKOVSKY.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

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.* Spring term. Credit five hours. Prerequisites, course 1, and Bacteriology 1 or its equivalent. Professors ROSS and HOLLAND. Lecture and laboratory practice, T Th 12:30–5:30. Dairy Building 119 and 146.

The scientific, technical, and sanitary aspects of the fluid milk industry.

103. *MILK-PRODUCTS MANUFACTURING.* Fall 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.

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.* Spring term. Credit five hours. Prerequisite, course 1; should be preceded or accompanied by course 5. Assistant Professor AYRES. Lectures, recitation, and laboratory practice, F 12–5, S 8–1.

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.* Spring term. Credit four hours. Prerequisite, quantitative analysis. Professor HERRINGTON. Lectures, T Th 10. Laboratory practice, T 1–5. Dairy Industry Building 120.

An advanced course in the chemical analysis of products and materials important in the dairy industry.

113. *CHEMISTRY OF MILK.* Fall term. Credit two hours. Prerequisites, qualitative and quantitative analysis and organic chemistry; must be preceded or accompanied by course 112 or its equivalent. Professor HERRINGTON. 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 191.)

[220. *CHEMISTRY OF MILK PRODUCTS.* Spring term. Credit four hours. Must be preceded by course 113. Professor ———. Lectures, M T W Th 8. Dairy Building 218. Not given in 1946–47.]

An advanced consideration of the scientific and technical aspects of milk products.

252. *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.

FLORICULTURE AND ORNAMENTAL HORTICULTURE

Professors L. H. MACDANIELS, KENNETH POST, J. P. PORTER, A. M. S. PRIDHAM, and M. T. FOSSUM.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

Floriculture and Ornamental Horticulture 1, 2, 4

Studies in the propagation, nutrition, culture, and improvement of ornamental plants may be undertaken. Also monographic studies of ornamental groups and their adaptability to use are suitable problems.

Most of the problems in this field are basically those of plant response with relation to environment and thus the student majoring in the department should have adequate preparation in Botany, Plant Physiology, Genetics, Biometry, Agronomy, Plant Pathology, Entomology, Chemistry, and elementary Floriculture and should have had experience in the growing and handling of horticultural material. Minor subjects should be chosen in the above-named basic science fields. A candidate for the doctor's degree may find it expedient to arrange a joint major in Floriculture and one of the basic science departments. Under these circumstances the problem would be worked out with horticultural material under the joint supervision of committeemen from the two departments.

The greenhouse, nursery, plant materials, and laboratory facilities of the department are adequate for research in practically any phase of the field. This, with the strong departments in the basic sciences, gives an outstanding opportunity for graduate work with ornamental plants at Cornell.

1. *General Floriculture and Ornamental Horticulture.* Fall term. Two lectures and one laboratory period a week.

2. *Introduction to Landscape Design.* Spring term. Three lectures a week.

5. *Flower Arrangement.* Spring term. One lecture and one laboratory period a week.

10. *Taxonomy of Cultivated Plants.* Fall term. One lecture and two laboratory periods a week.

12. *Herbaceous Plant Materials.* Spring term. Two lectures and one laboratory period a week.

13. *Woody Plant Materials.* Spring term. Two lectures and two laboratory periods a week.

32. *Elementary Landscape Planning and Planting of Small Properties.* Fall term. One lecture and two laboratory periods a week.

112. *Herbaceous Plant Materials,* advanced course. Fall term. One laboratory period a week.

113. *WOODY-PLANT MATERIALS, ADVANCED COURSE.* Fall term. Credit two hours. Prerequisite, course 13. Laboratory, T Th 1:40–4. Plant Science 29. Associate Professor PRIDHAM.

A continuation of course 13 for students in the landscape nursery service. An opportunity for the more intimate study of important groups of ornamental plants, particularly their adaptability to landscape use. A trip is taken to the Rochester parks.

114. *TURF.* Spring term. One lecture and one laboratory period a week.

115. *PLANT PROPAGATION.* Fall term. Credit three hours. Prerequisite, courses 12 and 13 and Botany 31 or their equivalent. Lectures, T Th 11. Plant Science 37. Laboratory, S 8–10:30. Greenhouses and nurseries. Assistant Professor ———.

A study of the principles and methods involved in the propagation of woody and herbaceous plants by seeds, division, layers, cuttings, budding, and grafting. The class visits nurseries at Geneva and Newark, New York.

125. *Flower Store Management.* Spring term. One lecture and one laboratory period a week.

123. *COMMERCIAL GREENHOUSE PRODUCTION.* Fall term. Credit four hours. Prerequisites, courses 1 and 115, Botany 31, Agronomy 1, and the practice requirement. Professor POST. Lectures and recitation. M W F 9. Plant Science 37. Laboratory, W 1:40–4. Greenhouses.

A comprehensive study of the application of basic science to the culture of ornamental plants.

124. *COMMERCIAL GREENHOUSE PRODUCTION.* Spring term. Credit three hours. Prerequisite, course 123. Professor POST. Lectures, M W 9. Plant Science 37. Laboratory, W 1:40–4. Greenhouses.

A course supplementary to course 123 dealing with the study of the commercial production of florists' crops with emphasis on the practical problems concerned. A trip made to nearby commercial greenhouses.

119. *OUTDOOR CULTURE OF ORNAMENTAL PLANTS.* Spring term. Credit three hours. Prerequisites, Botany 31 and Floriculture 12, 13, and 115. Associate Professor PRIDHAM. Lectures, T Th 11. Plant Science 37. Laboratory, F 1:40–4.

A study of the principles and practices employed in the production of plants in the nursery and in transplanting, fertilizing, pruning, and winter protection of landscape materials.

132. *LANDSCAPE PLANNING AND PLANTING OF SMALL PROPERTIES.* Both terms. Credit four hours a term. Prerequisites, courses 1, 2, 12, 13, 32, and Drawing 15. Associate Professor PORTER. Lectures, T Th 10. Plant Science 141. Two laboratories.

An advanced course in the design of small properties to follow course 32.

134. *CONSTRUCTION AND PLANTING OF SMALL GARDENS.* Fall term. Credit three hours. Intended for advanced students specializing in landscape service. Prerequisite, course 132. Associate Professor PORTER. Lecture, Th 9. Plant Science 143. Two laboratories. Plant Science 433.

A study of the design, construction, and planting of intimate garden areas with special attention to plant and flower combinations.

241. *SEMINARY.* Fall term. One hour to be arranged. Required of all graduate students in the department and recommended for senior majors. Plant Science 37.

FORESTRY

Professors C. H. GUISE and E. F. WALLIHAN.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

Forest Conservation 2, 4

Forest Ecology 2, 4

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 whether the work desired is available.

POMOLOGY

Professors A. J. HEINICKE, M. B. HOFFMAN, R. M. SMOCK, DAMON BOYNTON.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

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 chemi-

cal, 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 244.)

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 Geneva or in the field investigating their special subject. This is expected of graduates working for a Doctor's degree.

1. *General Pomology.* Spring term. Credit three hours.

102. *Fruit Varieties.* First term. Credit two hours.

111. *Handling, Storage, and Utilization of Fruit.* Fall term. Credit three hours.

[112. *Advanced Laboratory.* Second term. Credit two hours. Not given in 1946–47.]

[121. *ECONOMIC FRUITS OF THE WORLD.* Professor BOYNTON. Lectures, T Th 12. Laboratory, F 1:40–4. Plant Science 107. Given in alternate years, not in 1946–47.]

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.* Credit four hours. Prerequisites, Pomology 1 and 2 and Botany 31. Professor HEINICKE. Lectures, M W F 10. Conference, W 11. Plant Science 141. Given in alternate years. Not given in 1946–47.]

A systematic study of the sources of knowledge and opinion as to practices in pomology. The results of experiences and research pertaining to pomology are discussed with reference to their application in the solution of problems in modern fruit growing.

231. *SPECIAL TOPICS IN EXPERIMENTAL POMOLOGY.* Fall term. Credit three hours. Prerequisite, Pomology 131. Professor HEINICKE, Associate Professors BOYNTON and SMOCK. Conference periods, M W F 10. 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.

201. *RESEARCH PROBLEMS IN POMOLOGY.* Fall and spring terms. Professors HEINICKE, HOFFMAN, SMOCK, BOYNTON, and EDGERTON.

200. *SEMINARY.* Members of the staff. T 11. Plant Science 404.

POULTRY HUSBANDRY

Professors J. H. BRUCKNER, R. K. COLE, G. O. HALL, G. F. HEUSER, F. B. HUTT, L. C. NORRIS, A. L. ROMANOFF.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

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 5000 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. 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.* Fall term. Credit three hours.

20. *Poultry Breeds, Breeding, and Judging.* Fall term. Credit three hours.

30. *Poultry Incubation and Brooding.* Spring term. Credit three hours.

50. *Marketing Poultry Products.* Spring term. Credit two hours.

110. *Poultry Nutrition.* Spring term. Credit three hours.

170. *Poultry Hygiene and Disease.* Fall term. Credit two hours.

120. *POULTRY GENETICS.* Spring term. For details see Animal Breeding.

125. *HEREDITY AND EUGENICS.* Fall term. For details see Animal Breeding.

140. *ANATOMY OF THE FOWL.* Fall term. Credit two hours.

209. *SEMINARY IN POULTRY BIOLOGY.* Throughout the year. Members of departmental staff. F 4:15. Rice 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.* Fall term. For details see Animal Nutrition.

219. *ANIMAL NUTRITION SEMINAR.* Fall and spring term. For details see Animal Nutrition.

229. *SEMINARY IN ANIMAL BREEDING.* Fall, to be repeated in spring term. For details see Animal Breeding.

VEGETABLE CROPS

Professors H. C. THOMPSON, PAUL WORK, E. V. HARDENBURG, ORA SMITH, HANS PLATENIUS, G. J. RALEIGH, R. D. SWEET, and H. M. MUNGER; at Geneva, *Professors* C. B. SAYRE and W. T. TAPLEY.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

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, 112. 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, 225, and to attend the seminary.

Students majoring in vegetable crops will ordinarily find it necessary to spend at least one summer in Ithaca, in order to grow and study plant materials used in their research work.

1. *Vegetable Crops.* Spring term. Credit three hours.

2. *Special Cash Crops.* Spring term. Credit three hours. Botany 1 should precede or accompany this course.

[3. *Vegetables for Processing.* Spring term. Credit three hours. Not given in 1946–47.]

101. *ADVANCED VEGETABLE CROPS.* Fall term. Credit three hours. Prerequisites, course 1 and Botany 31. Professor Thompson. Lectures, M W F 9. East Roberts 223.

This course is devoted to a systematic study of the sources of knowledge relating to problems involved in vegetable production. Results of research are studied with reference to their application in the solution of problems in vegetable growing.

112. *GRADING AND HANDLING VEGETABLE CROPS.* Fall term. Credit three hours. Prerequisite, Vegetable Crops 1 and Botany 31. Lectures, T Th 8. East Roberts 222. Laboratory, M or T 1:40. East Roberts 223, greenhouses or gardens. Professor WORK.

Geography of vegetable production and distribution. Factors of environment, culture, and handling as affecting quality, condition, and marketing of vegetable crops. Principles and practices concerned in harvesting, grades and grading, packing, shipping-point and terminal-market inspection, transportation, refrigeration, and storage are discussed with reference to the various crops. A two-day trip is required; maximum cost $10. This course with Pomology 111 and Agricultural Economics 142 afford training in marketing of vegetables and fruits.

113. *Types and Varieties of Vegetables.* Credit three hours. Prerequisite, course 1 or 2 or permission to register. Professor WORK. Field work, 8 a.m. to 4:00 p.m. Monday, Sept. 16 to Tues., Sept. 23 inclusive. Lecture and laboratory, Friday 1:40–4. p.m. throughout the term. There will be a required class trip during the pre-semester period. Maximum cost $3. Department should be notified of intention to register.

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.

[225. *SPECIAL TOPICS IN VEGETABLE CROPS.* Spring term. Credit three hours. Prerequisites, course 101 and Botany 31. It is recommended that Botany 231 and 232 precede or accompany this course. Professors THOMPSON, RALEIGH, and SMITH, and Associate Professor PLATENIUS. Discussions, M W F 9. East Roberts 223. Given in alternate years. Not given in 1946–47.]

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. *SEMINARY.* Fall and spring 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 246.

SCHOOL OF EDUCATION

EDUCATION AND RURAL EDUCATION

Professors H. R. ANDERSON (on leave), T. L. BAYNE, J. E. BUTTERWORTH, L. A. EMERSON, F. S. FREEMAN, E. R. HOSKINS, M. L. HULSE, M. HUTCHINS, I. E. KING, P. J. KRUSE, C. B. MOORE, A. G. NELSON, R. A. OLNEY, E. L. PALMER, H. I. PATTERSON, H. W. RANNEY, W. A. SMITH, F. M. THURSTON, and A. D. WOODRUFF.

APPROVED MAJOR AND MINOR SUBJECTS FOR A.M., M.S., M.S. IN AGR., AND PH.D. (key to symbols on p. 44)

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

Guidance and Personal Administration 1, 2

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, 2, 3, 4

Science Education 1, 2, 3, 4

Secondary Education 1, 2, 3, 4

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 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 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.

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.

Persons interested in becoming candidates for these degrees should address inquiries to the Director of the School of Education. Formal application for admission should be sent to the Dean of the Graduate School.

THE DEGREE OF MASTER OF EDUCATION

The student who enters the University with the intention of preparing for secondary school teaching will be expected to complete a five-year program. He will register in 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, the professional degree, Master of Education, will be awarded.

THE DEGREE OF MASTER OF SCIENCE IN EDUCATION

The various programs leading to this degree are planned primarily for those who, having had experience in teaching or other type of educational work, wish to prepare themselves for such specialized forms of service as supervision, counseling, or the administration of an elementary, secondary, vocational, or technical school. For the present, teachers of industrial arts and of industrial and technical subjects should also ordinarily seek this degree. Information regarding requirements for admission to candidacy for this degree will be found in the *Announcement of the School of Education.*

For information regarding rooms in which classes will be held see the Announcement of the School of Education.

PRE-PROFESSIONAL AND PROFESSIONAL COURSES FOR SECONDARY SCHOOL TEACHERS

Introduction to Social Science, A, B. A two-term course: Fall and spring terms. Credit three hours a term.

Human Growth and Development, A, B. A two-term course: Fall and spring terms. Credit three hours a term.

100. *Educational Psychology* (Ed. and R.E.) Fall or spring term. Credit three hours.

120. *Social Foundations of Education* (Ed. and R.E.) Fall or spring term. Credit three hours.

130. *The Art of Teaching* (Ed. and R.E.) Throughout the year. Credit five hours a term.

131. *Introduction to Teaching in Vocational Agriculture* (R.E.) Fall term. Credit three hours.

132. *The Teaching of Agriculture in the Secondary School* (R.E.) A two-term course: fall and spring terms, in two sequences beginning in either term. Credit four hours during the fall term, three hours during the spring term.

R.E. 133. *Directed Teaching of Students in Agricultural Education.* Fall or spring term. Credit to be arranged.

200. *APPRENTICE TEACHING.* (Ed. and R.E.) An eight-week period off-campus to be arranged. Credit six hours. Members of the staff. Required of all candidates for the M.Ed. degree. Prerequisite: satisfactory completion of the first four years of the five-year program, or the equivalent, or special permission.

Students will be assigned to cooperating schools so selected as to provide the most favorable conditions for this type of experience. They will be expected to carry a half-time teaching program including the usual related responsibilities of the teacher. Preparation for teaching and work on special problems under the direction of University instructors will occupy the remainder of the student's time. Each student will be under the immediate supervision of the principal, of a competent local teacher, and of a member of the staff of the School of Education.

210. *SPECIAL PROBLEM IN TEACHING.* (Ed. and R.E.) Fall or spring term. Credit two hours. Members of the staff.

A critical study of some phase of teaching undertaken during the period of apprentice teaching.

220. *PHILOSOPHY OF EDUCATION.* (Ed. and R.E.) Credit two hours. Offered for an eight-week period during the spring term at such time as will not interfere with the student's apprentice teaching. Time and place of meeting to be arranged.

For fifth-year students in preparation for secondary school teaching under the five-year program. A coordinating course in the professional sequence designed chiefly to develop a critical appreciation of teaching enterprise. It centers, therefore, upon the question of values in education and calls for examination and judgment of aims and content from that standpoint. Every student is required to undertake a study in valuation of the teaching enterprise in his own field of specialization.

Ed. 20. *SEMINARY IN HUMAN DEVELOPMENT AND BEHAVIOR.* Spring term. Credit two hours. Professor FREEMAN. M 4–6. Goldwin Smith 248.

EDUCATIONAL PSYCHOLOGY

R.E. 110. *Psychology: An Introductory Course.* Fall or spring term. Credit three hours.

R.E. 112. *Psychology for Students of Education.* Fall or spring term. Credit three hours.

Psychology for Students of Hotel Administration. (Hotel Administration 114.) Fall term. Credit three hours.

R.E. 117. *Psychology of Childhood and Adolescence.* Spring term. Credit three hours.

Personnel Administration. (Hotel Administration 119.) Fall or spring term. Credit three hours.

Ed. 8. *EXPERIMENTAL EDUCATIONAL PSYCHOLOGY.* Fall or spring 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.

The application of psychological and statistical methods to problems in education.

Ed. 18. *INDIVIDUAL DIFFERENCES.* Spring term. Credit three hours. Prerequisite, a course in general or educational psychology, or Human Growth and

Development. It is desirable, though not required, that Education 7 precede this course. Professor FREEMAN. T Th 2–3:15. Goldwin Smith 248.

The nature, causes, and implications of individual differences in abilities and behavior. Study and observation of atypical groups.

[R.E. 211a. *PSYCHOLOGY FOR STUDENTS OF EDUCATION.* Fall term. Credit three hours. Professor KRUSE. Not given in 1946–47.]

R.E. 211b. *EDUCATIONAL PSYCHOLOGY.* Spring term. Credit two hours. For members of the staff. Professor KRUSE. T 4:15–5:45. Stone 309.

The field of psychology in relation to education, teaching, and learning; motivation; the learning process; individual differences; behavior adjustment: in relation to the problems of the college teacher.

R.E. 212. *PSYCHOLOGY OF LEARNING.* Spring term. Credit two hours. Professor KRUSE. Th 4:00–5:30.

R.E. 213. *PSYCHOLOGY OF LEARNING IN THE SCHOOL SUBJECTS.* Fall term. Credit two hours. Assistant Professor BAYNE. S 9–10:30. Stone 309.

R.E. 216. *SEMINARY IN HUMAN MOTIVATION.* Spring term. Credit two hours. Assistant Professor WOODRUFF. M 4–6. Stone 309.

[R.E. 218. *SEMINARY IN EDUCATIONAL PSYCHOLOGY.* Spring term. Credit two hours. Professor KRUSE. Not given in 1946–47.]

Seminary in Personnel Administration. (Hotel Administration 219.) Spring term. Credit two hours. Prerequisite, Hotel Administration 119. Professor WINSOR. Th 4:15–6. Warren 340.

METHOD

R.E. 121. *Method and Procedure in Secondary School Teaching.* Fall term. Credit three hours.

[R.E. 127. *Visual and Auditory Aids in Teaching.* Fall term. Credit two hours. Not given in 1946–47.]

R.E. 134a. *Special Education for Out-of-School Youths and Adults.* Fall term. Credit two hours. Associate Professor HOSKINS. Th 4:30–6.

R.E. 134b. *Adult Homemaking Education: Organization and Policies.* Fall term. Credit three hours. Estimated cost of trips, $8.

R.E. 134c. *Adult Homemaking Education: Program Planning and Methods.* Fall and spring terms. Credit two or three hours. Estimated expenses for field work, $2 to $5.

R.E. 226. *RESEARCH IN SCIENCE TEACHING.* Fall or spring term. Credit one or two hours a term. Professor PALMER. M 12:30. Fernow 8.

Special problems in science teaching.

R.E. 227. *SEMINARY IN ELEMENTARY EDUCATION.* Spring term. Credit two hours. Professor MOORE. S 9–10:40. Stone 309.

R.E. 228. *SEMINARY IN CHILD GUIDANCE* (Child Development and Family Relationships 350). Spring term. Credit two hours. Professor WARING. F 4–6. Martha Van Rensselaer G–58.

Ed. 230. *SEMINARY IN SOCIAL STUDIES EDUCATION.* Fall or spring term. Credit as arranged. Professor ———. M 4:15. Stone 211.

[R.E. 232a. *ADVANCED PROBLEMS OF TEACHING IN VOCATIONAL AGRICULTURE.* Fall term. Credit two hours. Associate Professor HOSKINS. Not given in 1946–47.]

R.E. 233. *PROBLEMS IN SECONDARY AGRICULTURE.* Hours and courses to be arranged. Extramural. Staff in Agricultural Education.

[R.E. 234. *SEMINARY.* Spring term. Credit two hours. Open to graduate students contemplating research in education, and who have permission to register. Associate Professor W. A. SMITH. Not given in 1946–47.]

R.E. 235. *SEMINARY IN TEACHING HOME ECONOMICS.* Spring term. Credit two hours. Students will need to consult the instructor before registering. Professor THURSTON. Hours to be arranged.

This course provides opportunity for graduate study of methods in home economics education and for field work. It is intended for secondary school teachers, extension workers, college teachers, and leaders in home economics. Individual problems may include experiments, observation, and practice in teaching and supervision. It is especially recommended in connection with courses R.E. 248, R.E. 249, and R.E. 269.

R.E. 237. *ADULT HOMEMAKING EDUCATION.* Graduate credit two or three hours. Fall or spring term. T 4–5:30 and other hours to be arranged. Assistant Professor PATTERSON.

Planned for teachers, extension agents and other leaders in adult homemaking education. This course deals with philosophy, organization, administration, program planning, promotion, leadership, teaching methods, and evaluation of adult programs.

R.E. 249. *SEMINARY IN HOME ECONOMICS EDUCATION.* A two-term course. Fall and spring terms. Credit two to four hours either term. Total credit for the year not to exceed six hours. Students will need to consult the instructor before registering. Professor THURSTON. S 10–12 and hours to be arranged. Field work will be required.

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, guidance, curriculum, and measurement are recommended as prerequisites or parallel.

PREPARATION OF TEACHERS FOR NORMAL SCHOOLS AND COLLEGES

[R.E. 241. *THE PREPARATION OF TEACHERS FOR NORMAL SCHOOLS AND COLLEGES.* Spring term. Credit two hours. Professor MOORE. Not given in 1946–47.]

R.E. 245. *THE TECHNICAL AND PROFESSIONAL PREPARATION OF TEACHERS OF AGRICULTURE FOR THE SECONDARY SCHOOL.* Spring term. Credit three hours. Should follow course 211a or its equivalent. T Th 11–12:30. Professor ———. East Roberts 223.

A course designed to study critically in the light of the teaching of agriculture

in secondary schools the programs of teacher education in the colleges of agriculture.

R.E. 248. *PREPARATION OF TEACHERS OF HOME ECONOMICS FOR SECONDARY SCHOOLS.* Graduate; credit two hours. Fall term. Associate Professor HUTCHINS.

Planned for cooperating teachers participating in teacher education programs and for experienced teachers who desire to prepare for positions in the field of teacher education. See *Announcement of College of Home Economics.*

R.E. 250. *SEMINARY IN AGRICULTURAL EDUCATION.* Fall term. Credit two hours. For students whose progress in graduate study is satisfactory. Professor OLNEY. T 4:20–6. East Roberts 223.

MEASUREMENT AND STATISTICS

Ed. 7. *MENTAL MEASUREMENTS.* Fall term. Credit three hours. Prerequisite, a course in general or educational psychology or human growth and development. Professor FREEMAN. T Th S 9. Goldwin Smith 234.

Development of individual and group tests of intelligence and personality; principles underlying their construction and use; their use in schools, psychological clinics, the armed services, and in other fields. The nature of mental abilities. Use of educational tests. Demonstrations in administering and interpreting tests.

R.E. 251. *EDUCATIONAL MEASUREMENT.* Spring 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. S 11–12:30 and an additional hour to be arranged. Roberts 492.

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. *INTRODUCTION TO EDUCATIONAL STATISTICS.* Fall term. Credit three hours. Assistant Professor BAYNE. T Th 10 and an hour to be arranged. Stone 309.

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.

R.E. 253a. *STATISTICAL INSTRUMENTS IN EDUCATION.* Spring term. Credit two hours. Prerequisite, a first course in statistics and permission of the instructor. Assistant Professor BAYNE. T 10 and a period to be arranged. Stone 309.

INDUSTRIAL AND TECHNICAL EDUCATION

R.E. 143a. *CURRICULUM CONSTRUCTION IN INDUSTRIAL AND TECHNICAL EDUCATION.* Spring term. Credit two hours. Assistant Professor RANNEY. Th 4:15–5:45. Sibley Dome Basement.

Deals with principles and procedures of curriculum construction for industrial and technical schools. Some attention will be paid to problems of curriculum development for technical institutes.

R.E. 143b. *DEVELOPMENT OF INSTRUCTIONAL MATERIAL IN INDUSTRIAL AND TECHNICAL EDUCATION.* Spring term. Credit two hours. Assistant Professor RANNEY. S 11–12:30. Sibley Dome Basement.

Study of the preparation of instructional material based on job and activity analysis. Deals with kinds of instructional material for industrial and technical classes; types of lesson sheets; organization of content in instructional order; study of format for lesson sheets, and procedures in the preparation of the material for reproduction.

R. E. 143d. *ACTIVITY ANALYSIS FOR INDUSTRIAL SUBJECTS.* Fall term. Credit two hours. Assistant Professor RANNEY. Th 4:15–5:45. Sibley Dome Basement.

Deals with analysis of industrial processes, including trade and technical content. Drafting and elementary design, operation and maintenance of technical equipment, testing of equipment, technical processes of production, and other work of technician character will be analyzed for data useful in course construction and the development of instructional material.

R.E. 143e. *INDUSTRIAL AND TECHNICAL EDUCATION IN THE UNITED STATES.* Fall term. Credit two hours. Professor EMERSON. S 9–10:30. Sibley Dome Basement.

An overview course dealing with the various types of programs in industrial and technical education. Study will be made of industrial arts education, unit trade programs in vocational high schools, apprentice training, technical high schools, and technical institutes. Some attention will be given to private trade schools, diversified occupation programs, and special programs for veterans.

R.E. 143f. *INDUSTRIAL PLANT TRAINING FOR WORKERS AND SUPERVISORS.* Spring term. Credit two hours. Professor EMERSON. S 9–10:30. Sibley Dome Basement.

Study of the various types of industrial training programs found in industrial plants. Deals with on-the-job training for operators and skilled mechanics, apprentice training, company schools for customer service men, evening classes of supplementary type, and training of foremen and supervisors. Special attention will be given to the technique of the conference method for the training of supervisors.

R.E. 243. *ADMINISTRATION OF INDUSTRIAL AND TECHNICAL EDUCATION.* Spring term. Credit two hours. Professor EMERSON. W 4:15–5:45. Sibley Dome Basement.

A course in school administration dealing with the responsibilities of the principal and administrative assistants in industrial and technical high schools, and in technical institutes. Consideration will also be given to the problems of the city director of vocational education.

R.E. 243a. *SUPERVISION OF INDUSTRIAL AND TECHNICAL EDUCATION.* Fall term. Credit two hours. Assistant Professor RANNEY. S 11–12:30. Sibley Dome Basement.

Principles and practices in the improvement of instruction in all phases of industrial high school, technical high school, and technical institute courses.

R.E. 243b. *SEMINARY IN INDUSTRIAL AND TECHNICAL EDUCATION.* Fall term. Credit two hours. Professor EMERSON. W 4:15–5:45. Sibley Dome Basement.

A study of current problems in industrial and technical education, including legislation, veterans' education, and trends in the development of programs. Special attention will be given to technical institute education.

ADMINISTRATION AND SUPERVISION

[R.E. 260a. *ORGANIZATION AND ADMINISTRATION OF THE SECONDARY SCHOOL.* Fall term. Credit two hours. Professor ————. Not given in 1946–47.]

R.E. 261a. *FUNDAMENTALS OF EDUCATIONAL ORGANIZATION AND ADMINISTRATION.* Fall term. Credit three hours. Professor BUTTERWORTH. T Th 11–12:30. Stone 309.

A consideration of the main problems in organizing and administering the school program, including the services provided when school and community cooperate in meeting educational needs.

R.E. 262a. *SCHOOL FINANCE.* Fall term. Credit two hours. Prerequisite, R.E. 261a or equivalent. Professor BUTTERWORTH. T 4:15–5:45. Stone 309.

Typical problems: how local school funds are levied, collected, and disbursed; cost accounting; budget making; bonding; sources of state funds and their distribution. The discussion 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.* Spring term. Credit two hours. Prerequisite, R.E. 261a or equivalent. Professor BUTTERWORTH. S 11–12:30. Stone 309.

The planning and utilization of the school building to serve community needs. Each student will work on a project for his community.

R.E. 263. *PROCEDURES AND TECHNIQUES IN SUPERVISION.* Fall term. Credit three hours. Candidates for the principal's certificate may register for two hours' credit. Professor MOORE. M W F 10. Stone 309.

Designed for superintendents, supervisors, and principals. Students taking this course must be prepared to spend four full days or more in observing supervisory procedures in various school systems.

R. E. 264. *SEMINARY IN RURAL SCHOOL ADMINISTRATION.* Spring term. Credit two hours. Professor BUTTERWORTH. T 4:15–5:45. Stone 309.

Topic to be announced.

R.E. 264a. *SEMINARY IN CITY SCHOOL ADMINISTRATION.* Spring term. Credit two hours. Superintendent Kulp. S 9–10:30. Stone 309.

Current problems in the organization and administration of a city school system.

R.E. 265. *SEMINARY FOR PRINCIPALS.* Fall term. Credit two hours. Required of all graduate students who are candidates for a principal's certificate. Professor MOORE. S 9–10.

R.E. 266. *THE SUPERVISION OF THE ELEMENTARY SCHOOL.* Spring 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.

[R.E. 267. *THE ORGANIZATION AND ADMINISTRATION OF VOCATIONAL AGRICULTURE IN THE PUBLIC SCHOOLS.* Spring term. Credit three hours. Should follow or accompany course 261. Not given in 1946–47.]

[267b. *THE SUPERVISION OF VOCATIONAL AGRICULTURE IN THE SECONDARY SCHOOL.* Fall term. Credit two hours. Open to teachers, supervisors, principals, district superintendents, and other educational leaders responsible for supervision in this field. Hours to be arranged. Associate Professor W. A. SMITH. Not given in 1946–47.]

A consideration of the supervisory and professional improvement needs of teachers of vocational agriculture and the procedures and techniques to supervision.

R.E. 268. *SEMINARY IN RURAL EDUCATIONAL LEADERSHIP.* Spring term. Credit three hours. Professor BUTTERWORTH and others. T Th 11–12:30. Stone 309.

A consideration of problems especially significant in the rural areas. Planned for superintendents, principals, extension specialists, social workers, and others preparing for leadership responsibilities in rural education.

R.E. 269. *THE SUPERVISION OF HOME ECONOMICS EDUCATION.* Spring term. Credit two hours. Students will need to consult instructor before registering. Professor THURSTON. Hours to be arranged. Field work will be required.

For persons who are now engaged in 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.* Fall term. Credit three or four hours. Professor ———. T Th 2–3:30 and an additional hour to be arranged for those wishing to carry further the 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.* Spring term. Credit two hours. Associate Professor HOSKINS. T Th S 4–5:30. East Roberts 223.

[R.E. 278. *SEMINARY IN RURAL SECONDARY EDUCATION.* Spring term. Credit two hours. Professor ———. Not given in 1946–47.]

R.E. 293. *SEMINARY IN THE SOCIAL AND ECONOMIC PROBLEMS OF THE SCHOOL ADMINISTRATOR.* Fall term. Credit two hours. S 11–12:30. Stone 309. Professor BUTTERWORTH and specialists from the fields of economics and sociology.

An analysis of the social and economic characteristics of the community that affect the work of the school, and a consideration of as many specific problems as is practicable in the time available. Among these problems are: racial and national composition of the population; occupational pattern; standards of living; delinquency; welfare; income and its distribution; taxation; labor, agricultural, and business groups in relation to education.

EDUCATIONAL THEORY

R.E. 194. *Principles of Vocational Education.* Fall term. Credit two hours. Associate Professor W. A. SMITH.

R.E. 281. *Rural Secondary Education.* Fall term. Credit three hours. Professor _____. M W F 9. Stone 309.

A 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. 291. *THE EDUCATIONAL PROGRAM IN UNDEVELOPED COMMUNITIES.* Spring term. Credit two hours. Professor BUTTERWORTH. M 10–11:30. East Roberts 223.

Using the Casa del Pueblo of Mexico as one type of school suitable for undeveloped communities, attention is focused upon the principles that should govern the planning and the implementation of educational programs for situations of this type. Several different countries will be called upon for illustrations.

R.E. 294. *PHILOSOPHY OF EDUCATION.* Spring term. Credit two hours. Professor MOORE. W 4–5:40.

[R.E. 295. *COMPARATIVE EDUCATION.* Fall term. Credit two hours. Professors BUTTERWORTH and MOORE. Not given in 1946–47.]

NATURE STUDY

R.E. 106. *Outdoor Living.* Fall term. Credit two hours.

R.E. 107a. *The Teaching of Nature Study and Elementary School Science.* Spring term. Credit two hours.

R.E. 108. *Field Natural History.* Fall or spring term. Credit two hours a term. Professor PALMER.

R.E. 202. *NATURE LITERATURE.* Fall term. Credit two hours. Miss GORDON. M W 10. Fernow 8.

A survey of nature and science prose, poetry, and fiction, with some attention to their significance at elementary- and secondary-school levels.

R.E. 205. *THE TEACHING OF CONSERVATION.* Spring term. Credit two hours. Professor PALMER. T Th 10. Fernow 8.

Consideration of the principles, materials, and methods of conservation education useful to teachers and others engaged in teaching wise use of the resources of the nation.

R.E. 206. *THE TEACHING OF SCIENCE IN SECONDARY SCHOOLS.* Spring term. Credit two hours. Lectures, S 10–11:40. Fernow 8.

A study and evaluation of current reports and other materials relating to the teaching of science with exercises in integrating useful suggestions into classroom plans.

[R.E. 209. *THE NATURE MOVEMENT AND ITS MAKERS.* Fall term. Credit two hours. Not given in 1946–47.]

GUIDANCE

Ed. 25. *PROCEDURES IN CLINICAL CHILD GUIDANCE.* Fall term. Credit three hours. All students must have consent of the instructor. Professor FREEMAN. M W 4–6 and conferences.

Procedures and instruments used in case studies of psycho-educational problems of learning and adjustment. Study of case materials. Participation in making actual case studies of pupils.

USE AND ADMINISTRATION OF TESTS IN GUIDANCE AND PERSONAL ADMINISTRATION (Hotel Administration 217). Spring term. Credit three hours. Open to students in guidance or personnel administration. Professor WINSOR. M W F 8. Warren 140.

This course deals with the development, use, and interpretation of aptitude tests as a basis for guidance and selection.

R.E. 182. *GUIDANCE FUNCTIONS OF THE TEACHER.* Fall term. Credit two hours. Assistant Professor NELSON.

R.E. 282. *EDUCATIONAL AND VOCATIONAL GUIDANCE.* Fall term. Credit two hours. Primarily for graduate students who wish to be certified as counselors. F 4:20–6. Warren 140.

Principles and practices of educational and vocational guidance. Historical and theoretical background of the guidance movement; educational, vocational, and community information needed; the study of the individual; group methods; counseling; placement and follow-up; and the organization, administration, and appraisal of guidance programs.

R.E. 283. *COUNSELING METHODS.* Spring term. Credit four hours. Prerequisite, course 282 or its equivalent. Assistant Professor NELSON. W F 4:20–6. Warren 140.

Techniques for counseling with individuals concerning various types of educational, social, and vocational adjustment problems. Case studies and field work.

R.E. 284. *THE TEACHING OF OCCUPATIONS AND ORIENTATION CLASSES.* Spring term. Credit two hours. Assistant Professor NELSON. M 4:20–6. Warren 140.

Methods and materials for presenting occupational and orientation information to students. Deals with classes in occupations, orientation groups, field trips, clubs, work-experiences programs, and other media.

R.E. 285. *OCCUPATIONAL AND EDUCATIONAL INFORMATION.* Credit four hours. Assistant Professor NELSON.

R.E. 286. *SEMINARY IN EDUCATIONAL AND VOCATIONAL GUIDANCE.* Fall term. Credit two hours. Assistant Professor NELSON. W 4:20–6. Warren 140.

Open to graduate and special students who have had some training and experience in educational and vocational guidance, and who wish to study recent developments in this field. Reports on and the appraisal of current guidance literature will comprise the major content of the course.

INFORMAL STUDY AND RESEARCH

R.E. 199. *INFORMAL STUDY IN EDUCATION.* Maximum credit, three hours each term. Members of the staff.

R.E. 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, associate 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 student's 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*, 124 Olin Hall; C. C. WINDING, *Secretary*, 228 Olin Hall; C. W. MASON, 318 Olin Hall.

CIVIL ENGINEERING — W. L. MALCOLM, *Chairman*, 122 Lincoln Hall; R. Y. THATCHER, *Secretary*, 308 Lincoln Hall; E. W. SCHODER, 206 Lincoln Hall.

ELECTRICAL ENGINEERING — C. R. BURROWS, *Chairman*, 107 Franklin Hall; R. F. CHAMBERLAIN, *Secretary*, M–125 Franklin Hall; T. MCLEAN.

MECHANICAL ENGINEERING — W. N. BARNARD, *Chairman*, 18 West Sibley; W. R. CORNELL, *Secretary*, 304 West Sibley; F. S. ERDMAN, Mechanical Laboratory.

DIVISION REPRESENTATIVE on the General Committee of the Graduate School, and Chairman of Group E — E. M. STRONG.

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.*

Due to the war and the accelerated programs there is great uncertainty as to what term any one course will be given. Anyone interested in a course should inquire of the School concerned.

ADVANCED DEGREES OFFERED

The degrees of Master of Aeronautical Engineering (M.Aero.E.), Master of Chemical Engineering (M.Chem.E.), Master of Civil Engineering (M.C.E.), Master of Electrical Engineering (M.E.E.), Master of Mechanical Engineering (M.M.E.), Master of Science in Engineering (M.S. in Engineering), 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.AERO.E., 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.Aero.E., 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.).

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]

FELLOWSHIPS AND SCHOLARSHIPS

See above in 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.

[1] See pages 9ff., —, —.

[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.

(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 7, 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 field of study, both major and minor, so that he 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.Aero.E., 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 paragraph 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 is 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) 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 Graduate Work in that subdivision (M.Aero.E., 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.

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[1] Members of the Faculty who are qualified to supervise the work of graduate students are Professors, Associate 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."

(15) When a candidate for an advanced degree in Engineering takes a course specified by the Committee 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 requirements 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.Aero.E., 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 below. 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 (key to symbols on p. 44)

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.)

[1] Any of the basic sciences are also available as minors.

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

Radio and Communication 1, 2, 3, 4

Electric Power Utilization 1, 2, 3, 4

Electric Power Generation and Distribution 1, 2, 3, 4

Industrial Electronics 1, 2, 3, 4

Illumination 2, 4

Electric Circuit Analysis 1, 2, 3, 4

Electrical Measurements 1, 2, 3, 4

High Voltage Technique 1, 2, 3, 4

Materials of Engineering (in Electrical Engineering) 1, 2, 3, 4

IN MECHANICAL ENGINEERING

Administrative Engineering 1, 2, 3, 4

Aeronautical Engineering 2, 4

Automotive Engineering 1, 2, 4

Experimental Mechanical Engineering 1, 2, 3, 4

Fluid Mechanics 1, 2, 3, 4

Heat-Power Engineering 1, 2, 3, 4

Industrial Engineering 1, 2, 3, 4

Machine Design 1, 2, 3, 4

Materials of Engineering 1, 2, 3, 4

Mechanical Processing 1, 2, 3, 4

Mechanics 1, 2, 3, 4

Metallography 1, 2, 4

GRADUATE SCHOOL OF AERONAUTICAL ENGINEERING

The Gradaute School of Aeronautical Engineering was established in October 1945. Two degrees are authorized in this field of study, Master of Aeronautical Engineering (M.Aero.E.), and Doctor of Philosophy (Ph.D.). A Committee on

Graduate Work will supervise the graduate students in the School, within the jurisdiction of the Engineering Division.

The gift to the University by the Curtiss-Wright Corporation of the Cornell Aeronautical Laboratory at Buffalo provides unexcelled facilities for aeronautical research and engineering training. Students who have a Bachelor's degree in an appropriate branch of engineering will be admitted in the Fall, 1946. The School will provide instruction and opportunity for research in all phases of aerodynamics, design of aircraft structures and power plants, mechanics of flight, materials and aeronautical equipment.

The laboratory in Buffalo contains a wind-tunnel with working section eight and one-half by twelve feet, where model airplanes can be tested under wind velocities up to 740 miles an hour and pressures from one-fourth to four atmospheres; fans are driven by two motors of 14,000 horsepower. It has also three smaller wind-tunnels where air is driven faster than the speed of sound, which can be rigged as required for specific tests; an altitude chamber thirty-four feet long and ten feet in diameter, with oxygen equipment for twelve persons and where pressures and temperatures simulating those up to 80,000 feet are automatically controlled, with lowest temperature 85 below zero and observation and control devices for studying effects of high altitude on both equipment and personnel; a shop and preparation area for constructing models for testing; well-equipped laboratories for studying materials, metal processes, fuels, electrical equipment, static tests of airplanes and their parts; and others completely equipped for research and development in metallurgy, physics, chemistry, radiography, spectroscopy, and hydraulic systems.

Facilities are available in Ithaca and Buffalo for flight research and testing. A hangar and engine laboratory are being built on a new modern airport at Ithaca developed for commercial air service. The graduate student may expect, therefore, to spend part of his time in Ithaca and part in Buffalo, dependent on the program he is studying.

For further information, write to the Dean, College of Engineering.

AGRICULTURAL ENGINEERING

See above under AGRICULTURE.

AUTOMOTIVE ENGINEERING

Professor W. N. BARNARD and *Assistant Professor* L. L. OTTO.

Special problems related to Automotive Engineering may be selected for advanced study. Laboratory facilities of the Department of Mechanical Engineering Laboratory 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*. Professor L. L. OTTO. Two lectures and two computing periods a week. Offered if conditions permit.

General study of automotive road vehicles and their functioning; driving, braking, steering, springing, power required for operation.

3B42, 3B44. *AUTOMOTIVE DESIGN.* Professor L. L. Otto. Two lectures and two computing periods a week. Offered if conditions permit.

Power plants of automotive field, particularly internal combustion types. General design and functioning, lubrication, mechanical efficiency, volumetric efficiency, valving, balancing, carburation, ignition, performance.

3B50. *ADVANCED AUTOMOTIVE ENGINEERING.* For qualified graduate students and seniors. Professor L. L. Otto.

CHEMICAL ENGINEERING

Professors F. H. Rhodes, C. W. Mason, O. J. Swenson, W. G. Gortner, 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	*CHEMICAL ENGINEERING ECONOMICS*
UNIT PROCESSES	*CHEMICAL PLANT DESIGN*

530. *INTRODUCTORY CHEMICAL MICROSCOPY.* Fall term; repeated in spring term. Credit three hours. Prerequisite or parallel course, Chemistry 405 or 406. Professor Mason and assistants.

Lectures and laboratory practice. The use of microscopes and their accessories in chemical and technical investigations. Micrometry; particle size determinations; quantitative estimations; microscopical characteristics and physical chemistry of crystals; illumination, ultramicroscopy and photo-micrography; study of industrial materials such as textile and paper fibers.

531. *SPECIAL METHODS IN CHEMICAL MICROSCOPY.* Fall term; repeated in spring term. Credit, one or more hours. Prerequisite, 530 and special permission. Professor Mason.

Laboratory practice may be elected in various fields, such as optical crystallography, photomicrography, and the microscopy of industrial materials.

535. *MICROSCOPICAL QUALITATIVE ANALYSIS (INORGANIC).* Fall term; repeated in spring term. Prerequisite, 530. Professor Mason. Credit, two or more hours. Laboratory periods to be arranged. Olin 305.

540. *MICROSCOPICAL METHODS IN ORGANIC CHEMISTRY.* Credit, two or more hours. Prerequisite, 530, Chemistry 340, and special permission. Professor Mason. (Not given in 1946–47.)

545. *INTRODUCTORY METALLOGRAPHY.* Fall term. Credit, three hours. Prerequisite, 755, or Mechanical Engineering 3X31. Professor Mason and assistant. One lecture and two laboratory periods, to be arranged.

Microstructures of alloys, as related to composition, thermal history and physical properties, and explained in terms of general crystallographic phenomena. Preparation of specimens, and principles and use of metallographic microscopes.

550a, b. *ADVANCED METALLOGRAPHY.* Fall term, 550a; spring term, 550b.

Credit; lectures, two hours; laboratory optional, one or more hours. Prerequisite, 545 and consent of the instructor. Fee variable. Professor MASON and assistant.

Lectures 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 and non-ferrous alloys, or minor research problems.

701a, b. *Chemical Engineering Technology.* A two-term course. Credit, two hours a term.

705a, b. *Unit Operations of Chemical Engineering.* A two-term course. Credit, three hours a term.

710a, b. *Unit Operations Laboratory.* A two-term course. Credit two hours a term.

745. *Chemical Engineering Stoichiometry.* Each term. Credit, two hours a term.

715. *SYNTHETIC RESINS AND PLASTICS.* Fall term. Credit, three hours. Prerequisite or parallel course, Chemical Engineering 705. Associate Professor WINDING.

Polymerization reactions; manufacture and properties of synthetic resins, plastics, and rubbers.

720a, b. *FOOD TECHNOLOGY.* A two-term course. Credit, two hours a term. Prerequisite, Chemistry 305, 310, and 405. Assistant Professor GORTNER.

The chemistry of foods, vitamins, methods of food processing, dehydration, freezing.

725. *PETROLEUM REFINING.* Spring term. Credit, three hours. Prerequisite, Chemical Engineering 705. Associate Professor WINDING. Three lectures a week.

Processes used in petroleum refining.

730a, b. *CHEMICAL PLANT DESIGN.* A two-term course. Credit, three hours a term. Prerequisite, Chemical Engineering 705a and b. Professors RHODES and MASON, Associate Professors SWENSON and WINDING, Assistant Professor GORTNER.

Practice in the development of a chemical engineering process and the design of a chemical engineering plant; the work is largely individual work by the student, under supervision.

740a, b. *CHEMICAL ENGINEERING COMPUTATIONS.* A two-term course. Credit, two hours a term. Prerequisite, Chemical Engineering 705a and b, and 710a and b. Associate Professor WINDING.

Advanced computations in unit operations of Chemical Engineering.

755a, b. *MATERIALS OF CONSTRUCTION.* A two-term course; 755a, fall term; 755b, spring term. Credit two hours a term. Prerequisite or parallel course, Chemistry 405. Professor MASON. Lectures, W F 10, Olin R.

A discussion of the nature, behavior, and application of the important structural materials used in chemical engineering.

760. *CHEMICAL ENGINEERING INSTRUMENTATION.* Credit two hours. Prerequisite course, Chemical Engineering 705.

Lectures. Basic Principles of instrumentation and process control.

780a, b. *CHEMICAL ENGINEERING EQUIPMENT DESIGN.* A two-term

course. Credit, two hours a term. Prerequisite, Chemical Engineering 705a and b and 710a and b. Associate Professor SWENSON.

Detailed design of individual units of chemical engineering equipment.

790. *SPECIAL TOPICS IN CHEMICAL ENGINEERING.* Spring term. Credit, one hour. Prerequisite, Chemistry 405B. Professors RHODES and MASON.

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 thesis work.

792. *CHEMISTRY OF EXPLOSIVES.* Credit two hours. Professor RHODES.

Lectures. Manufacture and properties of primers, propellants, and high explosives. Open to officers of U. S. Navy, to others by special permission only.

793. *INTERIOR BALLISTICS.* Credit, two hours. Professor RHODES.

Lectures. Open to officers of U. S. Navy; to others by special permission only.

DESCRIPTIVE GEOMETRY AND DRAWING

IN CIVIL ENGINEERING

Professor H. T. JENKINS.

202. *Drawing.* Sophomore. Any term. Credit one hour.

203. *Drawing.* Sophomore. Any term. Credit two hours.

204. *Descriptive Geometry.* Sophomore. Any term. Credit three hours.

205. *ADVANCED DRAWING.* 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.

IN MECHANICAL ENGINEERING

Professors C. E. TOWNSEND and S. F. CLEARY.

3C11. *Drawing and Descriptive Geometry.* Any term. Credit three hours.

3C12. *Mechanical Drafting.* Any term. Credit three hours.

3C15a and b. *Drawing.* Throughout the year. Credit two hours a term.

TOPICS SUGGESTED FOR ADVANCED WORK

SPECIAL APPLICATIONS OF DESCRIPTIVE GEOMETRY.

ECONOMIC ORGANIZATION OF GEOMETRIC STRUCTURES.

DRAFTING TOOLS AND EQUIPMENT.

ELECTRICAL ENGINEERING

Professors C. R. BURROWS, W. C. BALLARD, R. F. CHAMBERLAIN, L. A. BURCKMYER JR., E. M. STRONG, M. G. MALTI; *Associate Professors* B. K. NORTHROP, T. MCLEAN, W. E. MESERVE, A. B. CREDLE, H. G. SMITH, W. W. COTNER, S. W. ZIMMERMAN; *Assistant Professors* P. D. ANKRUM, J. BAIRD, C. L. COTTRELL, W. H. ERICKSON, R. E. OSBORN, M. M. PETERSON, S. L. SCHAUSS, J. H. SMITH.

The School of Electrical Engineering has laboratories suitable for graduate work, divided according to the following general classification.

Advanced Electrical Machinery Laboratory

Electrical Measurements and Standardization Laboratory

Radio and Communications Laboratory

Industrial Electronics Laboratory

Electronics Apparatus and Project Laboratory

High-Vacuum and Tube-Construction Laboratory

High-Voltage Testing and Development Laboratory

Special equipment for experimental research is provided for the graduate student through a fully equipped and manned machine shop.

Graduate Courses and Topics: In addition to the formal courses listed below, members of the faculty are prepared to guide individual students in special topics. Seminars are conducted by members of the faculty for groups of graduate students interested in closely related lines of study and research.

RADIO AND COMMUNICATIONS

4K11. *Electron Tubes and Circuits.* Three hours.

4L11. *Electronics Laboratory.* Two hours.

4K12. *Electronic Circuit Elements.* Four hours.

4R10. *Basic Communications Systems.* Two hours.

4R11 and 4R12. *RADIO AND COMMUNICATION THEORY.* Three hours each. Professor BALLARD and Associate Professor MCLEAN.

Prerequisites, 4B12, 4K11, 4L11, 4K12, 4R10. Two lectures and one recitation or computing period each week. Text: Electronics, M.I.T. Staff, Radio Engineering Handbook, Terman, Ultra High Frequency Techniques, Brainerd and others, also mimeographed notes on selected topics.

These courses are intended to be taken in sequence through two terms. Detailed theoretical analysis of communication equipment and measurements constitutes the bulk of the course. Special emphasis is laid on the theory of transmission lines, and an introduction to vector analysis and Maxwell's electromagnetic theory and its applications to radio communication.

4S11 and 4S12. *RADIO AND COMMUNICATION LABORATORY.* Three hours each. Associate Professors CREDLE and MCLEAN.

Intended to accompany courses 4R11 and 4R12. Credit three hours each term. One laboratory or computing period and one recitation each week.

A series of experiments for this course has been selected following the outline of theoretical material in 4R11 and 4R12. The experiments are detailed studies of the characteristics of selected pieces of communication equipment, or experimental studies of measurement methods.

4R21. *COMMUNICATION NETWORKS.* Three hours. Associate Professor McLEAN.

Three recitations each week. Prerequisite or concurrent course, Radio and Communication Theory, 4R11. Texts: Transmission Networks and Wave Filters, T. E. Shea; Supplementary Notes.

After a review of fundamental principles dealing with linear networks, a study is made of two-terminal networks, reciprocal structures, ideal reactance structures, and balancing networks. A generalized analysis of the four-terminal transmission network is made. There is an introductory study of filter characteristics and design, and of amplitude- and delay equalizers. The course includes: general equivalence theorems; analogies between lumped networks and smooth lines; continuous and concentrated loading of lines; use of line segments as network elements.

4R51. *TELEGRAPH AND TELEPHONE SYSTEMS.* Three hours. Professor BALLARD.

4R53. *RADIO BROADCASTING.* Three hours. Associate Professor SMITH.

Two lectures and one laboratory or computing period each week. Prerequisite courses, Radio and Communication Theory, 4R11 and 4R12, concurrently.

The course deals with the engineering aspects of radio broadcasting, including the following topics: studio equipment, and problems of studio operation; transmitting equipment, and problems of operation; determination of coverage; station interference, allocation of channels, and use of directional radiating systems; performance tests and maintenance procedures; network interconnections; purpose and policy of governmental regulating bodies.

The alternate laboratory and computing periods offer an opportunity to gain practical knowledge through the facilities of the University broadcasting station and through inspection of other nearby stations.

4R55. *TELEVISION SYSTEMS.* Three hours. Associate Professor CREDLE.

4R57. *ULTRA HIGH FREQUENCY SYSTEMS.* Three hours. Professor BALLARD.

Elective. Prerequisite, 4R10, Basic Communication Systems. Three recitations a week.

A detailed coverage of micro-wave generators and detectors is followed by discussion of the uses of micro-waves in radar systems, blind landing systems for aircraft, point-to-point relay links, and broad band applications for multiplex telephony and television.

4R59. *AIRCRAFT AND MARINE ELECTRONIC NAVIGATION.* Two hours. Associate Professor McLEAN.

Two recitations a week. Prerequisite, 4R10, Basic Communication Systems.

The course begins with a thorough coverage of directive antennas of the particular types used in navigation systems. This is followed by applications to long wave and medium wave direction finders and radio beacons. Limitations on the accuracy of determinations due to equipment and propagation errors are

considered. Medium frequency pulsed transit time systems and high frequency return signal systems are considered in detail.

4R61. *APPLIED ACOUSTICS.* Two hours. Associate Professor McLEAN.

One recitation and one laboratory period each week. Text: Assigned reference reading.

A review of the laws of ideal gases, the thermo-dynamic properties of air, and the laws of the propagation of compressional waves precedes a study of the transmission of sound through tubes, horns, and unbound media. The design of sound sources, microphones, loudspeakers, and disc recorders in keeping with acoustical principles is considered. The phenomena of reflection, absorption, and reverberation, and the limitations which these phenomena impose upon architectural design, are studied. There are laboratory experiments on absolute-pressure calibration and free-field directivity characteristics of microphones and loudspeakers, the measurement of reverberation time, and the measurement of reflection coefficients and absorption coefficients of samples of typical materials for acoustic treatment.

4B61. *ELECTROMAGNETIC WAVES AND RADIATION.* Three hours. Professors BALLARD and BURROWS.

Credit three hours. Three lecture-recitations a week. Text: Electromagnetic Waves. Schelkunoff, and supplementary notes.

A detailed and critical study of Maxwell's electromagnetic theory and its modern developments and applications. Included in the topics studied are: radiation from doublet antennas, slot and loop antennas, properties of directive arrays, wave guides and cavity resonators, electro-magnetic horns and beam concentrators, propagation of electric waves through space.

4K51. *DESIGN AND CONSTRUCTION OF VACUUM TUBES.* Three hours. Professor BALLARD.

One recitation and two laboratory periods a week. Prerequisite, Electronics courses 4K11, 4K12, and 4L11.

Methods of calculation, design, and dimensioning simple vacuum tubes to attain prescribed characteristics, are studied in some detail. Laboratory demonstrations and practice in the techniques of glass fabrication, spot welding of small parts, exhaustion and heat treatment, as applied to the simpler types of high vacuum and vapor tubes.

POWER UTILIZATION

4D12. *Direct Current Machinery.* Three hours.

4E12. *Electrical Machinery Laboratory.* Four hours.

4D13. *Alternating Current Machinery.* Three hours.

4E13. *Electrical Machinery Laboratory.* Four hours.

4K11. *Electron Tubes and Circuits.* Three hours.

4L11. *Electronics Laboratory.* Two hours.

4K12. *Electronic Circuit Elements.* Four hours.

4D14. *MACHINE THEORY.* Two hours. Professor STRONG, Associate Professor MESERVE.

Two recitations each week. Prerequisite course: Alternating-Current Machinery 4D13. Text: Alternating-Current Machinery, Bryant and Johnson; supplementary notes.

This course extends the analysis of certain subjects of the prerequisite course. Among its topics are: Analysis of magnetomotive force and of air-gap flux in synchronous and in induction machines for harmonics in time and in space; effects of such harmonics on induced voltage and on torque; two-reaction analysis of salient-pole synchronous machines; analyses of single-phase induction motors and commutator alternating-current motors.

4G21. *LOW FREQUENCY HEATING AND INDUSTRIAL DISTRIBUTION SYSTEMS.* Three hours.

Two lectures and one computing period each week. Accompanying course: Advanced Circuit Analysis, 4B14. Text: Industrial Electric Heating, Stansel.

The first part of this course deals with the construction, characteristics, and application of all varieties of electric heating apparatus commonly employed in industry except those based on high-frequency dielectric heating. Principal emphasis is given to arc furnaces and to low-frequency induction furnaces.

The remainder of the course is devoted to current practice and to the apparatus employed in the design of electric-power distribution systems in industrial plants.

4E14. *POWER LABORATORY.* Two hours. Professor BURCKMYER.

One lecture and one laboratory period each week. Prerequisite courses, Electrical Machinery Laboratory, Advanced Circuit Analysis, 4B14, 4D14. Text: Mimeographed Notes.

This course continues the study of basic principles of alternating-current magnetization, and the exemplification of these principles under the favorable conditions provided by selected transformers. Salient-pole synchronous-machine principles are examined from the standpoint of the two-reaction theory. The reactances are measured by several methods and the theory is applied to the analysis of torque-angle relations, steady-state stability, and the voltage regulation of generators. The measurement and the significance of the transient reactances are briefly studied. The special combinations of conditions that arise in commutating alternating-current motors are analyzed for a selected machine. The course includes circuit studies applied to selected alternating-current bridges and to symmetrical-component analysis of faults on transmission lines.

4G11. *MOTOR CONTROL.* Two hours. Associate Professor MESERVE.

One lecture and one recitation each week. Prerequisite courses, Direct-Current Machinery, 4D12; Alternating-Current Machinery, 4D13; Electrical Machinery Laboratory, 4E12 and 4E13. Text: Controllers for Electric Motors, James and Markle.

The course is a study of the design and the functioning of typical controllers and protective devices for direct-current and for alternating-current motors. Among the topics are: problems of manual and automatic acceleration, dynamic braking, power regeneration, plugging, and voltage control for direct-current motors, design of resistors and magnetic contactors; interpretation of controller diagrams.

4G22. *ELECTRICAL DESIGN ECONOMICS.* Three hours.

Two recitations and one computing period each week. Prerequisite courses, Direct Current Machinery, 4D12; Alternating Current Machinery, 4D13.

The object of the course is to acquaint the student with technical and economic problems encountered in the design of resistors, electromagnets, cables, condensers and condenser bushings, transformers, and rotating electrical machines.

4G23. *APPLICATION OF MOTORS.* Three hours. Associate Professor MESERVE.

One lecture, one recitation, and one computing period each week. Prerequisite courses, Motor Control, 4G11; Power Laboratory, 4E14. Text: Electric Motors in Industry; Shoults, Rife, and Johnson.

Characteristics of motors and requirements of typical loads are analyzed and correlated so that the motor selected for the load will be proper in type and rating. The course includes a study of motor duty cycles, adjustable-speed alternating-current drives, coordinated-drive systems, and "synchro" systems.

Inspection trips may replace several of the computing periods.

4G52. *AIRCRAFT AND MARINE ELECTRIC POWER AND CONTROL SYSTEMS.* Two hours. Associate Professor MESERVE.

Two recitations each week. Prerequisite courses, Machine Theory, 4D14; Motor Control, 4G11. Text: Mimeographed Notes.

Modern developments in aircraft electric systems are studied, with attention given to meeting the special requirements imposed by rapid and extreme changes in temperature, pressure, and humidity. Selected topics include: relative advantages of alternating-current and direct-current systems; selection of voltage and of frequency; methods of driving generators; reliability of operation; saving of weight.

After outlining the problems and principles of ship propulsion, a study is made of the relative advantages of available main drives, the design of power-distribution systems, and the selection of motors and control equipment.

POWER GENERATION AND DISTRIBUTION

4D12. *Direct Current Machinery.* Three hours.

4E12. *Electrical Machinery Laboratory.* Four hours.

4D13. *Alternating Current Machinery.* Three hours.

4E13. *Electrical Machinery Laboratory.* Four hours.

4K11. *Electron Tubes and Circuits.* Three hours.

4L11. *Electronics Laboratory.* Two hours.

4K12. *Electronic Circuit Elements.* Four hours.

4B14. *ADVANCED CIRCUIT ANALYSIS.* Three hours. Professor MALTI.

Two lectures and one computing period each week. Prerequisite courses, Alternating-Current Machinery, 4D13; Differential Equations, M200.

This course treats of typical circuits by which electric energy is transmitted. The physical meaning of the parameters which are used in describing transmission

circuits is considered. A review of single-energy transients precedes a detailed analysis of double-energy transients. Ladder networks are viewed as approximate equivalents of circuits having distributed parameters. The behavior of polyphase circuits on which there are faults or unbalanced loads is analyzed by the method of symmetrical components.

4D14. *MACHINE THEORY.* Two hours. Professor STRONG, Associate Professor MESERVE.

4G31. *POWER SYSTEMS.* Three hours.

Two recitations and one computing period each week. Prerequisite course, Alternating-Current Machinery, 4D13.

The objective of the course is to develop a knowledge of the function and the form of the electrical apparatus included in modern power systems. Among the power-system components considered are generators, switchgear, protective devices, power transformers, converters, transmission-line towers and conductors, and voltage-regulating devices.

Inspection trips to nearby power stations are planned to supplement class-room discussions.

4E14. *POWER LABORATORY.* Two hours. Professor BURCKMYER.

4G32. *TRANSMISSION OF ELECTRIC ENERGY.* Three hours.

Two recitations and one computing period each week. Prerequisite courses, Advanced Circuit Analysis, 4B14; Power Systems, 4G31.

The performance of transmission lines is analyzed through the following sequence of topics: evaluation of transmission-line parameters from the physical dimensions of the circuit; expressions for voltage and for current at sending and at receiving ends; classification of lines as short, moderately long, and long; equivalent π and T networks; development of circle diagrams to facilitate calculations of performance.

4H31. *HIGH VOLTAGE PHENOMENA.* Three hours. Associate Professor ZIMMERMAN.

Two lectures and one laboratory period each week. Prerequisite course, Transmission of Electric Energy, 4G32.

The course is a study of the problems encountered in the normal operation of electric-power systems at very high voltages, of the abnormal conditions imposed by lightning, of the methods employed to assure proper operation of power systems and apparatus under high-voltage conditions, and of the devices available for laboratory testing of equipment under actual or simulated conditions.

A considerable portion of the laboratory work is done in the High-Voltage Research Laboratory, located in East Ithaca.

4G51. *ECONOMICS OF PUBLIC UTILITIES.* Three hours.

Prerequisite course, Economics.

The course is a study of the following topics: the development of public utilities and governmental regulatory bodies; principles of capitalization and depreciation of utility property; the capital structure of power companies; analysis of costs, and principles of rate-making; long-term trends of size of plant, efficiency, costs, and rates; the relation of the industry to other segments of the economic system.

4G53. *PROTECTION AND RELAYING ON POWER CIRCUIT.* Two hours.

Two lectures each week. Prerequisites, 4G31, Power Systems; 4G32, Transmission of Electric Energy; 4H31, High Voltage Phenomena.

The types and applications of relays are considered. A detailed and critical study of the operation of power systems with various relaying systems is made. The principles of telemetering and supervisory control are considered in detail.

4G54. *STABILITY OF ELECTRIC POWER SYSTEMS.* Two hours.

Two lectures each week. Prerequisites, 4G31, Power Systems; 4G32, Transmission of Electric Energy; 4H31, High Voltage Phenomena.

A critical study of the loading characteristics of machines together with a study of reactances and loading of systems is made. The effects of transient loads on stability, and conditions for stability in simple system networks are considered. This course is essentially mathematical in character.

INDUSTRIAL ELECTRONICS

4B12. *Alternating Current Circuits.* Four hours.

4D12. *Direct Current Machinery.* Four hours.

4D13. *Alternating Current Machinery.* Three hours.

4E13. *Electrical Machinery Laboratory.* Four hours.

4K11. *Electron Tubes and Circuits.* Three hours.

4L11. *Electronics Laboratory.* Two hours.

4K12. *Electronic Circuit Elements.* Four hours.

4B14. *ADVANCED CIRCUIT ANALYSIS.* Three hours. Professor MALTI.

4D14. *MACHINE THEORY.* Two hours. Professor STRONG, Associate Professor MESERVE.

4E14. *POWER LABORATORY.* Two hours. Professor BURCKMYER.

4N11. *ELECTRONIC CONTROL EQUIPMENT.* Three hours. Associate Professor NORTHROP.

Two lectures and one laboratory period each week. Prerequisite course, Electronic Circuit Elements, 4K12.

The course deals with the principles of electronic instrumentation and electronic control systems. A study is made of the methods of interpreting electronically a stimulus appearing in the form of heat, light, sound, or mechanical movement; and of typical electronic circuits through which such electrical effect causes the controlled device to make the desired response.

Among the subjects of laboratory experiments are timing circuits, welder controls, motor controls, voltage regulators, frequency-varying circuits, and frequency-discriminating circuits.

4G11. *MOTOR CONTROL.* Two hours. Associate Professor MESERVE.

4N–12. *ELECTRONIC POWER CONVERTERS.* Three hours. Associate Professor NORTHROP.

Two lectures and one laboratory period each week. Prerequisite course, Electronic Control Equipment, 4N11.

This course continues the study of the characteristics and the applications of some of the electronic power-converting devices that were considered in introductory courses; such as power amplifiers, oscillators, single-phase and polyphase rectifiers, X-ray equipment, and welders. Laboratory work includes inspection and testing of typical equipment, with an analysis of performance.

4N51. *HIGH FREQUENCY HEATING.* Three hours. Associate Professor NORTHROP.

Two lectures and one laboratory period each week. Prerequisite course, Electronic Power Converters, 4N12.

The course develops the theory of high-frequency heating of dielectrics of high and of low power factor; and of induction heating, with some consideration of unusual coil forms required for surface heating or other special applications. A study is made of the operation and the adjustment of oscillators of the usual types for these purposes.

4N53. *ELECTRONIC INVERTERS.* Three hours. Associate Professor NORTHROP.

Two lectures and one computing period each week. Prerequisite course, Electronic Power Converters, 4N12.

After a survey of electronic inverter circuits of series and of parallel types, the course proceeds to the problems of inversion from high direct voltage to alternating voltages; combined conversion changing 60-cycle alternating voltages to alternating voltages of higher frequency; and feed-back inversion. The operation of the parallel inverter is analyzed mathematically. Theoretical and laboratory studies are analyzed and coordinated to determine the effects of loads, supply voltage, and circuit components upon wave form, frequency, and output voltage.

4N54. *ELECTRONIC CONTROLS.* Three hours. Associate Professor NORTHROP.

Two recitations and one computing period each week. Prerequisite course, Electronic Power Converters, 4N12. Text: References and Mimeographed Notes.

This course is an intensive study of the theory and the operating characteristics of electronic circuits and equipment used to control and regulate welders, motors, generators and other machines. These circuits are generalized, compared, and analyzed rigorously. Methods of precise control of time intervals, voltage, current, and frequency are included.

ILLUMINATION

4U11. *Introductory Illumination.* Four hours. Professor STRONG.

Credit four hours. Two recitations, one laboratory period, and one computing period each week. Prerequisite course, Elementary Optics. Text: Electrical Illumination, Kraehenbuehl.

The course is intended to acquaint the student with the general nature of the field of illuminating engineering. Introductory study in several basic aspects of the subject is sufficiently pursued to provide an appreciation of the problems commonly encountered and of the methods of solution.

The following topics are considered: sources of light; visual perception and illusion; light control, both spectral and directional; the units and the measurement of the strength of light sources and of the intensity of illumination; general illumination design; perception, production, and mixing of colors; shadows, desirable and undesirable; architectural objectives.

4U12. *ILLUMINATING ENGINEERING.* Three hours. Professor STRONG.

Two recitations and one laboratory period each week. Prerequisite course, Introductory Illumination, 4U11. Text: Scientific Basis of Illuminating Engineering, Moon.

This course extends the study of some of the topics introduced in the prerequisite course. Study of current literature supplements the text. Computation of light-flux distribution and study of more difficult lighting problems are pursued. Emphasis is placed on industrial lighting problems more specialized than the problems of general lighting.

4U13. *ILLUMINATION SEMINARY.* Two hours. Professor STRONG.

One two-hour period each week. Prerequisite course, Introductory Illumination, 4U11.

Reports on selected topics of current interest in illuminating engineering are presented and discussed.

Physics 135. *OPTICS.* Three hours.

Three lecture-recitations each week. Prerequisite course, Elementary Physics.

The course includes the following topics: Geometrical optics, lens systems, Gauss points, aberrations, stops, photometry of optical systems; interference, applications of various forms of interferometers; diffraction, Fresnel and Fraunhofer diffraction patterns; polarized light; reflection and transmission at optical boundaries; emission and absorption spectra; color temperatures.

Psychology 11a. *Physiological Psychology of Vision.* Three hours.

Two recitations and one laboratory period each week. Prerequisite courses, Elementary Psychology and General Physics.

The course is a study of the total process of visual perception. Among the topics are: structure and functioning of the eye; sensitiveness of the eye to light of various wave lengths; effects of spatial and temporal patterning, (contrast and adaptation); color mixture; discrimination of color and of brightness; theories of color vision; space perception; problems of visual fatigue; psychological studies of reading.

Public Speaking 45a. *Dramatic Production; Stage Lighting.* Two hours.

Credit two hours. One laboratory period each week.

The course is a laboratory study of the problems encountered in lighting dramatic productions, and of the principles applied to the solution of such problems. (This course is suggested for its applicability to problems of show-window and display lighting.)

ELECTRIC CIRCUIT ANALYSIS

4B14. *ADVANCED CIRCUIT ANALYSIS.* Three hours. Professor MALTI.

4B51. *OPERATIONAL ANALYSIS.* Three hours. Professor MALTI.

Two recitations and one computing period each week. Prerequisite course, Advanced Circuit Theory, 4B14.

Among the topics of the course are: functions of real and of complex variables; infinite series; integral equations; Laplace and Fourier transforms; generalized expansion theorems for differential equations and difference equations. The course concludes with analyses of ladder networks and of transients in circuits with lumped and with distributed parameters.

SEMINARY IN CIRCUIT ANALYSIS. Throughout the year. One period of two hours each week. Prerequisites, a general knowledge of Circuit Analysis and of the principles of electric machines. Professor MALTI.

This seminar reviews the developments in the fields of circuit analysis and electrical machinery and provides opportunity to discuss the research work of graduate students in these fields.

ELECTRICAL MEASUREMENTS

4E14. *Power Laboratory.* Two hours. Professor BURCKMYER.

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.

HIGH VOLTAGE TECHNIQUE

4H31. *High Voltage Phenomena.* Three hours. Associate Professor ZIMMERMAN.

High Voltage Practice. Credit to be assigned. Associate Professor ZIMMERMAN.

Insulation tests of apparatus and insulators. Low frequency and impulse tests, wet and dry. Corona measurements. Radio influence.

The new high voltage laboratory has unexcelled facilities for research in the field of high voltage phenomena. Individual graduate students may be assigned special problems by the professor in charge.

GRADUATE TOPICS. Behavior of insulating materials under electrical stress. Dielectric strength of solid, liquid, and gaseous insulating materials. Partial and complete breakdown and corona. Lightning studies with models.

MATERIALS OF ELECTRICAL ENGINEERING

Solid Dielectrics. Professor MALTI. Prerequisite, 4B14.

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. Professor MALTI. Prerequisite, 4B14.

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. Professor BURCKMYER. Prerequisites, 4B14 and 4E14.

The testing of engineering materials for determining their magnetic and electrical properties.

EXPERIMENTAL MECHANICAL ENGINEERING

Professors C. O. MACKEY, V. R. GAGE; *Associate Professors* W. C. ANDRAE, F. S. ERDMAN, H. N. FAIRCHILD; *Assistant Professors* D. DROPKIN and L. L. OTTO.

The numerous laboratories and the shops of the Mechanical Engineering Laboratory Department are available for carrying on the many activities in Experimental Mechanical Engineering. See the *Announcement of the College of Engineering.*

Students contemplating experimental research in mechanical engineering should communicate with the department as far as possible in advance of beginning work in order to arrange for the use of available equipment.

3X40 (a) or (b). *Introductory Mechanical Laboratory.* One laboratory period a week and a written report on the work.

3X41. *Mechanical Laboratory.* One laboratory period a week and a written report on the work.

3X51. *EXPERIMENTAL ENGINEERING RESEARCH.* Any term. Prerequisites dependent upon field of investigation selected.

Open to a limited number of students who have available at least one laboratory period 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. One hour of credit for forty hours of work.

3X53. *TEMPERATURE MEASURING INSTRUMENTS.* Credit two hours. Prerequisites, 3X32 or 3X34. Dr. DROPKIN.

Theory, construction, calibration, and application of: liquid-in-glass thermometers, solid expansion thermometers, pressure-spring thermometers, electrical resistance thermometers, thermocouples, optical pyrometers, and radiation pyrometers. (Offered when conditions permit.)

TOPICS SUGGESTED FOR ADVANCED WORK

INSTRUMENTATION
HEAT TRANSFER
HEATING AND VENTILATION
REFRIGERATION
AIR CONDITIONING
FLOW OF FLUIDS
POWER TRANSMISSION
STEAM ENGINEERING
COMPRESSORS AND PUMPS
INTERNAL COMBUSTION ENGINES

HEAT-POWER ENGINEERING

Professor F. O. ELLENWOOD; *Associate Professors* R. E. CLARK and W. H. HOOK; *Assistant Professors* L. T. WRIGHT and B. J. CONTA.

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 related 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 deficiency.

The following courses, which are described in the *Announcement of the College of Engineering*, are open to both undergraduate and graduate students:

3P35, 3P36. *Heat-Power Engineering.* Three hours a week.

3P43A. *Heat-Power Engineering.* Three hours a week. Two lectures and one laboratory period a week.

3P44, 3P45. *STEAM AND OIL-ENGINE PLANTS.* Two hours a week. Prerequisites, 3D31, 3D32, 3D33, 3P31 and 3P32 and must be accompanied or preceded by 3P41 and 3P42. Assistant Professor WRIGHT.

Performance characteristics and design features of steam and internal-combustion prime movers, steam generators, condensers, feedwater heaters, evaporators, deaerators, oil engines, pumps, fans, and cooling towers; power-plant piping; automatic control; power plant instruments, fuel-burning equipment; coal-and-ash-handling equipment.

3P46, 3P47. *POWER PLANT COMPUTING AND DESIGN.* Must be accompanied by 3P44 and 3P45. Two computing periods a week. Assistant Professor WRIGHT.

3P48. *HEATING, VENTILATING, AIR CONDITIONING.* Credit three hours. Prerequisite, Course 3P32. Professor MACKEY.

Principles and practice in the conditioning of air, including cooling, heating, dehumidifying, humidifying, and ventilating.

[3P50. *POWER PLANT ECONOMICS; EQUIPMENT SELECTION.* Two hours a week. Prerequisite, 3P32 or 3P34. Assistant Professor WRIGHT. Not given in 1946–47.]

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.* Alternate terms. Two hours a week. Prerequisite, 3P32 or 3P34. Associate 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.* Alternate terms. Two hours a week. Prerequisites, 3D31, 3D32, 3D33, and 3P32 or 3P34. Associate 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.* Two hours a week. Prerequisites, 3D31, 3D32, 3D33, and 3P32 or 3P34. Associate 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.* Each term. Two hours a week. Assistant Professor WRIGHT.

Slide rules; construction of net work charts and alignment charts for the solution of equations; and derivation of empirical equations from experimental curve.

[3P57, 3P58. *HEAT ENGINEERING.* Prerequisite, 3P32. Must be accompanied or preceded by 3P41 and 3P42. Professor MACKEY. Two lectures and two computation periods a week. Not given in 1946–47.]

Properties of mixtures, dimensional analysis, fluid flow, heat transmission, selection of fans and pumps and refrigeration; applications to problems in air conditioning.

3P61, 3P62. *ADVANCED HEAT-POWER ENGINEERING.* Summer and fall terms. Credit two hours a term. Two recitations a week. Professor ELLENWOOD.

Consideration of advanced problems dealing with internal-combustion-engine and steam-power plants.

[3P63. *ADVANCED THERMODYNAMICS.* Two recitations a week. Prerequisite, permission of the instructor. Assistant Professor WRIGHT. Not given in 1946–47.]

The Carnot Principle; temperature scales; entropy; the state properties of a substance; their experimental determination and correlation; equations of state; kinetic theory of gases; mixture of ideal gases; special topics in mathematics will be considered as needed.

3P70. *ADVANCED HEAT-POWER ENGINEERING RESEARCH.* Each term. Work and credit as arranged. Professors ELLENWOOD and WRIGHT.

Advanced analytical and experimental investigations in this field.

The following group offerings for seniors may be used as minors by graduate students:

3P81. *INTERNAL-COMBUSTION ENGINES.* Each term. Credit three hours. Prerequisites, 3P35 and 3P36 or their equivalent. Assistant Professor WRIGHT.

The principles of operation of spark and compression-ignition, internal-combustion engines and their auxiliaries; petroleum fuels and their properties; combustion; detonation and octane rating; engine cooling, rating, and performance; supercharging of aircraft and compression- ignition engines; gas turbine cycles.

3P82. *STEAM-POWER PLANTS.* Each term. Credit three hours. Prerequisites, 3P35, 3P36 or their equivalent. Professor ELLENWOOD and Associate Professor CLARK.

A review of the thermodynamics of vapor is followed by a further study of combustion and combustion-control equipment, draft apparatus; boilers, condensers, evaporators, feedwater heaters, feed pumps, economizers, and air preheaters; turbines, and plant auxiliaries; performance and cost of steam engines, turbines, and plants.

3P88. *REFRIGERATION AND AIR CONDITIONING.* Repeated each term. Credit three hours. Prerequisites, 3P35, 3P36 or their equivalent. Three periods a week. Assistant Professor WRIGHT.

The general principles of refrigeration with particular emphasis on the equipment; principles and practice in the conditioning of air, including cooling, heating, dehumidifying, and ventilating; application of refrigeration in cold storage.

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. MALCOLM 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.

265A. *LOW COST ROADS.* Either term. Credit three hours. Prerequisite, 265 or its equivalent.

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, 265 or its equivalent; may be taken concurrently with course 265.

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.

266A. *ADVANCED HIGHWAY LABORATORY.* Credit three hours. Prerequisites, 265 and 266. 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.* Credit three hours. Prerequisite, 265 or its equivalent. 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 special emphasis on the economics of contracting, etc.

268. *MODERN HIGHWAY PLANNING AND DESIGN.* Credit three hours. Prerequisite, 265 or its equivalent. Professor CLARKE.

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.* Credit three or more hours. Prerequisites, 265, 270, 271, and 280. 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.* Credit three or more hours. Prerequisites, 265 and 266. Hours to be arranged.

Studies of traffic and traffic regulations 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 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 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; *Assistant Professors* M. BOGEMA and M. S. PRIEST.

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.* 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.* 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 modern 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 permissable 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

Associate Professor L. D. DOTY.

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.* Any term. Credit three hours.

231. *HYDRAULIC CONSTRUCTION.* Credit three hours. Prerequisite, 230 or the equivalent. Professor DOTY.

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.* Credit three hours. Prerequisites, 230 and 240, or the equivalent. Professor DOTY. 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.* Credit three hours. Prerequisite, 230 or the equivalent. Professor DOTY. 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.* Credit three hours. Prerequisites, 230 and 240, or the equivalent. Professor DOTY. Lectures, recitations, and abstracting of references.

Flood flow estimates; planning for and designing of flood protection structures, irrigation and drainage works. The Miami Conservancy work will be the chief source of material for the course.

236. *WATER POWER AND PUMPING PLANTS.* Credit three hours. Prerequisite, 232. May be taken concurrently with course 232. Professor DOTY.

This is a computing and designing course devoted to the problems of designing and detailing power and pumping plants.

291c. *HYDRAULIC ENGINEERING DESIGN.* Credit three hours. Prerequisite, 240. For best results Hydraulic Design should be preceded by course 230, but the two may be taken concurrently. Professor DOTY.

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 sheduled courses in hydraulic and structural engineering.

TOPICS SUGGESTED FOR ADVANCED WORK

HYDRAULIC TURBINES

DRAFT TUBE DESIGN AND PERFORMANCE

CENTRIFUGAL PUMPS

ECONOMICS OF WATER POWER PLANTS

INDUSTRIAL AND ENGINEERING ADMINISTRATION

Professors H. J. LOBERG, S. S. GARRETT, G. R. HANSELMAN; *Associate Professors* C. I. MILLARD, K. C. WHITE; *Assistant Professors* M. W. SAMPSON, C. R. SCOTT.

The facilities of the department permit a wide range of choice for the student interested in the industrial-management aspects of engineering. For example, in the micro-motion laboratory, 16 mm. motion picture cameras and projectors with 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.

3A21. *Economic Organization.* Each term. Credit three hours.

3A31. *Principles of Industrial Accounting and Cost Finding.* Each term. Credit three hours.

3A34. *Corporation Finance.* Each term. Credit three hours.

3A35a. *Industrial Organization and Management.* Each term. Credit three hours.

3A41. *Elementary Industrial Statistics.* Alternate terms. Credit three hours.

3A42. *Personnel Management in Industry.* Each term. Credit two hours.

3A43. *Engineering Business Law.* Alternate terms. Credit three hours.

3A44. *Industrial Marketing.* Credit three hours.

3A45. *Industrial Marketing.* Credit two hours.

3A46. *Engineering Business Law.* Alternate terms. Credit two hours.

3A47. *Principles of Cost Control.* Alternate terms. Credit three hours.

3A49. *Industrial Relations.* Alternate terms. Credit two hours.

3A51. *BUSINESS AND INDUSTRIAL RESEARCH.* Credit one hour for each forty hours of actual work. Professor BANGS and others. 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.* Credit two hours.

3A54. *Standard Costs and Management Control.* Alternate terms. Credit three hours.

3I43, 3I44. *Industrial Engineering.* Each term. One lecture and two computing periods a week.

3I48. *Industrial Engineering Economy.* Each term. Two recitations or discussions periods a week.

3I51. *ADVANCED INDUSTRIAL ENGINEERING.* Each term. Credit one hour for forty hours of actual work. Open to a limited number of seniors and graduates. Associate Professor MILLARD and Mr. MABIE.

Special problems and investigations which are carried on under the direction of members of the department staff.

3I52. *INDUSTRIAL AUDITING.* Each term. One lecture and one computing period a week.

3I54. *MOTION AND TIME STUDY.* Each term. One recitation and one laboratory period 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

Professors J. N. GOODIER, F. S. ROGERS; *Associate Professors* P. H. BLACK and W. A. JOHNSON.

Under this head is included advanced work in 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 kinematics, machine design and construction, mechanical technology, structural design, and other books on related subjects.

3D25. *Kinematics, Recitations.* Each term. Credit three hours.

3D26. *Kinematic Drawing.* Each term. Credit two hours.

3D27. *Kinematics, Recitations.* Each term. Credit two hours.

3D37. *Machine Design, Drawing.* Each term. Credit three hours.

3D38. *Machine Design, Drawing.* Each term. Credit two hours.

3D51. *Tool Engineering.* Each term. Credit two hours. An elective for juniors and seniors in engineering. Assistant Professor JOHNSON. One discussion and two computing periods a week.

The course deals with the theory and principles of operation underlying the design of punches, dies, jigs, and fixtures and with the application of such tools to the production of parts of appliances and machines in small and in large quantities.

3D52. *ADVANCED KINEMATICS AND KINETICS.* Prerequisites, 3D25 and 3D26. Professor ROGERS. 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. (Temporarily discontinued.)

3D53. *MATERIALS HANDLING.* Prerequisites, 3D25 and 3D26. 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. (Temporarily discontinued.)

3D54. *DYNAMICS AND VIBRATIONS OF MACHINERY.* Each term. Credit three hours. Prerequisites, 3D37 and 3M24. Associate Professor BLACK. Two lecture and discussion periods and one laboratory period a week.

Graphical and analytical treatment of velocities, accelerations, static forces, inertia forces, and combined forces. Balancing of engines. Transverse and torsial vibrations, critical speeds, and balancing machines.

3D55. *ADVANCED MACHINE DESIGN.* Credit three hours. Prerequisites,

3M24 and 3D37. Associate Professor BLACK. Three lecture and discussion periods a week.

Advanced problems in stress and analysis of machine and structural members including consideration of fatigue, creep, stress concentration, stability, etc. Vibrations and a few special topics.

[3D56. *DESIGN OF PRESSURE VESSELS.* Credit two hours. An elective for seniors in engineering and an alternative course for Option I. Mr. CARRIER. Two lecture and discussion periods a week. Temporarily discontinued.]

The course deals with the design of thin and thick pressure vessels under internal or external pressure or both and with the stresses in such vessels and in flat plates, flanges, heads, openings, and connections.

[3D57. *WELDING IN MACHINE DESIGN.* Credit two hours. An elective for seniors in engineering and an alternative course for Option I. One discussion and one computing period a week.]

The course deals with flame cutting and methods of welding, with shrinkage, warpage, and stress relieving, with inspection and testing, with the design of welded joints, and with the application of fusion welding in the design of appliances and machines.

[3D59. *SPECIAL INVESTIGATIONS IN MACHINE DESIGN.* Credit as arranged. Professors GOODIER, ROGERS, BLACK, or JOHNSON. Opportunity is offered to qualified students, individually or in small groups, to pursue, under direction, special investigations in machine design and related fields. Not given in 1946–47.]

TOPICS SUGGESTED FOR ADVANCED WORK

KINEMATICS AND DYNAMICS

SPECIAL DESIGN PROBLEMS

VIBRATIONS AND CRITICAL SPEEDS

INVESTIGATIONAL WORK

MANAGEMENT ENGINEERING

IN CIVIL ENGINEERING

Associate Professors R. Y. THATCHER, CARL CRANDALL, and J. E. PERRY.

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.

290A. *ADVANCED ENGINEERING LAW.* Credit three hours. Prerequisite, 290. Associate Professor 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, em-

ployer-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.* Credit three hours. Prerequisites, 264 and 290. May be taken concurrently with course 290. Associate 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.* Any term. Credit three hours or more.

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 investigations 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 of 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, 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 J. R. MOYNIHAN, J. O. JEFFREY; *Associate Professor* H. S. SACK; *Assistant Professors* G. W. EHRHART and J. R. YOUNG.

Experimental problems related to the testing, control of the properties and engineering applications of ferrous and non-ferrous metals and alloys, non-metallic materials, such as plastics, fuels, lubricants, woods, refractories, and foundry sands, may be carried on in this department.

The Materials Testing Laboratory is equipped for tension, transverse, and compression tests with an Olsen 200,000-lb. hydraulic machine, an Olsen 100,000-lb. three-screw machine, an Amsler 100,000-lb. hydraulic machine, a Baldwin-Southwark 50,000-lb. hydraulic machine, together with several small testing machines. The laboratory also contains an Olsen torsion machine of 140,000 inch-pounds capacity, two Upton-Lewis fatigue testing machines, an R. R. Moore fatigue tester, and an Amsler-Charpy-Izod impact testing machine. The other equipment includes hardness testing machines, cupping testing machines, metallographic microscopes, polishing equipment, extensometers, gas and electric furnaces, tempering baths, and photographic apparatus.

In addition, there is available a fuel laboratory for fuel analysis and calorimetry, an oil laboratory for determining the properties of oils and the behavior of oils in bearings, and a sand laboratory for room and high temperature properties of foundry sands.

3T21, 3T22. *Engineering Materials.* Throughout the year. Three lectures a week.

3T31. *Engineering Materials Laboratory — Metals and Alloys.* Alternate terms. One lecture period and one laboratory period a week and a written report of the work.

3T32. *Engineering Materials Laboratory — Non-Metallic Materials.* Alternate terms. One laboratory period a week and a written report of the work.

3T51. *ENGINEERING MATERIALS RESEARCH.* Each term. Prerequisites, 3T21, 22, 31 and 32. Professors MOYNIHAN, JEFFREY, and EHRHART. Credit one hour for forty hours of actual work. Open to a limited number of seniors and graduate students who have shown a proficiency in this field. Special problems and investigations are carried on under the general supervision of the members of the department.

3T52. *APPLIED PHYSICAL METALLURGY.* Alternate terms. Credit three hours. Prerequisites, 3T21, 3T22, and 3T31. Professor JEFFREY. This course covers the applications of physical metallurgy to problems in engineering. This will include all processing operations including casting, mechanical working, and heat treatment, and the subsequent inspection and use of ferrous and non-ferrous metals and alloys. The significance and control of mechanical properties will be emphasized.

3T53. *PHYSICS OF ENGINEERING MATERIALS.* Any term. Credit variable. Open to graduate students by permission. Associate Professor SACK.

This course offers opportunity for individual research in the field of physical properties of engineering materials and applications of physical methods to production control.

TOPICS SUGGESTED FOR ADVANCED WORK

APPLIED PHYSICAL METALLURGY.

CONTROL OF PROPERTIES OF ENGINEERING MATERIALS

FUELS

INSULATING MATERIALS

LUBRICATION

PHYSICS OF ENGINEERING MATERIALS

PROPERTIES OF ENGINEERING MATERIALS

PROPERTIES OF FOUNDRY SANDS

PROPERTIES OF LUBRICANTS

THERMAL QUALITIES OF QUENCHING LIQUIDS

MECHANICAL PROCESSING

Assistant Professor R. L. GEER.

The shops available for graduate research 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.

3S11. *Metal Working.* Any term. One laboratory period a week.

3S14. *Casting Processes.* Any term. One laboratory period a week.

3S15. *Casting Processes.* Any term. Two laboratory periods a week.

3S23. *Machine Tool Processes.* Any term. Two laboratory periods a week.

3S24. *Measuring Instruments.* Any term. One laboratory period a week.

3S50. *ADVANCED MECHANICAL PROCESSING.* Any term. Work and credit as arranged. Assistant Professor GEER.

TOPICS SUGGESTED FOR ADVANCED WORK

CUPOLA PRACTICE; FOUNDRY PRACTICE

SELECTION, TESTING, AND HANDLING OF FOUNDRY SANDS

ARC AND OTHER TYPES OF WELDING

MACHINABILITY OF MATERIALS

CUTTING TOOLS; CUTTING AND DYNAMOMETRIC STUDIES

DIES, JIGS, AND FIXTURES

MEASURING AND GAGING

MECHANICS

IN CIVIL ENGINEERING

Professor J. N. Goodier; *Associate Professor* E. V. Howell; *Assistant Professor* M. S. Priest.

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.* Credit five hours.

220A and 220B. *Mechanics Laboratory and Computations.* Credit two hours.

221. *Mechanics of Materials.* Credit four hours.

221A. *Mechanics Laboratory.* Credit one hour.

222. *ADVANCED MECHANICS.* Credit three hours. Prerequisites, 220 and 221. Associate Professor Howell. 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.* Credit two hours. Prerequisites, 220, 221, and 240. Associate Professor Howell. Two computing periods a week.

224A. *ENGINEERING MATHEMATICS.* Credit three hours. Prerequisite, Mathematics 55. 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.

224B. *ADVANCED ENGINEERING MATHEMATICS.* Credit three hours. Prerequisite, 224A.

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 is essential to the course.

224C. *ADVANCED DIFFERENTIAL EQUATIONS.* Credit three hours. Prerequisites, 224A and 224B or their equivalents.

A systematic study of differential equations. Partial differential equations and their solutions are emphasized.

224D. *SPECIAL MATHEMATICAL TOPICS.* Credit three hours. Prerequisites, 224A and 224B.

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.

228A, B. *APPLIED ELASTICITY.* Throughout the year. Credit three hours each term. Prerequisites, 224A, 224B, or Mathematics 200 or 70. Professor GOODIER.

General theorems of the elastic solid, reciprocal theorem, sudden loading. Tension, flexure, and torsion of bars of arbitrary section. Castigliano's theorem with application to frames, rings loaded in and normal to plane, spiral, and helical springs. Stress in thick cylinders and discs due to pressure, heating, and rotation. Beams on elastic foundations. Symmetrical deformation of thin tubes. Propagation of stress waves in bars.

In the second term the topics are chosen from: Thermal stress, stress-analysis, stability, and vibration, of plates and shells. Vibration of beams.

228C. *ENGINEERING PHYSICS OF METALS.* Credit three hours.

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.

229A. *THEORY OF ELASTIC STABILITY.* Credit three hours. Prerequisite, course, 3M22a, 3M22b, 3M24, or equivalents. Professor GOODIER. Given only in alternate years.

Mathematical analysis of the conditions under which columns, beams, rings, tubes, thin plates and thin curved shells may fail by general or local buckling. Applications to mechanical, civil, naval, and aeronautical structures.

229B. *MECHANICS OF VIBRATION.* Credit three hours. Prerequisite, 3M24 or 224A. 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 diagnoses and preventive measures.

IN MECHANICAL ENGINEERING

Professors J. N. GOODIER, W. R. CORNELL; *Assistant Professors* H. C. PERKINS and C. B. MANSKY.

The libraries of the University are well equipped for students engaged in both analytical and experimental investigation. In addition to the regular laboratories, facilities are available for the construction and accommodation of special ap-

paratus for research and testing. These include a photo-elastic laboratory for investigation of two- and three-dimensional stress.

3M21. *Theoretical and Applied Mechanics.* Each term. Five hours a week.

3M22a. *Strength of Materials.* Each term. Three hours a week.

3M22b. *Strength of Materials, continued.* Each term. Two hours a week.

3M24. *Applied Mathematics.* Each term. Three hours a week.

3M55. *PHOTOELASTICITY.* Any term.* Prerequisite, 3M22b. Assistant Professor LEE. Two lectures or laboratory periods and reports 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.

3M54. *ADVANCED ENGINEERING MATHEMATICS.* Any term.* Credit three hours. Prerequisite, 3M24 or equivalents. Mr. CARRIER. Elective, juniors, seniors, and graduates.

An introduction to the mathematics used in the solution of advanced engineering problems. Partial differentiation. Line and surface integrals. Ordinary differential equations, power series solutions. Fourier series. Fourier integrals. Partial differential equations.

3M56. *APPLIED ELASTICITY.* Any term.* Credit three hours. Prerequisite, 3M24 or 224A or Mathematics 41. Professor GOODIER. Three lectures a week.

General theorems of the elastic solid. Castigliano's Theorem with application to bending and twisting of curved bars, rings, arches, and springs. Fundamentals of general stress analysis. Torsion of non-circular bars. Stress in thick cylinders and disks due to pressure, heating, and rotation.

3M57. *APPLIED ELASTICITY.* Any term.* Credit three hours. Prerequisite, same as 3M56. Professor GOODIER. Three lectures a week.

This course is a continuation of 3M56. Beams on elastic foundations and thin cylindrical shells. Plane stress in flat plates. Bending, buckling, and vibration of bars and flat plates.

3M58. *MECHANICS OF VIBRATION.* Any term.* Credit three hours. Prerequisite, 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.

3M59. *SEMINARY IN APPLIED MECHANICS.* Any term.* Credit one hour each term. One discussion period each week. Prerequisites, 3M56 and 3M57 or equivalents. Professor GOODIER.

Current research papers in applied mechanics reported and discussed by members of the group.

* Will be given any term when there is demand, and staff is available.

3M60. *THEORY OF ELASTIC STABILITY.* Any term.* Credit three hours. Prerequisites, 3M22a, b, 3M24, or equivalents. Professor GOODIER.

Mathematical analysis of the conditions under which columns, beams, rings, tubes, thin plates, and thin curved shells may fail by general or local buckling. Applications to mechanical, civil, naval, and aeronautical structures.

3M61. *ADVANCED FLUID MECHANICS.* Any term.* Credit three hours. Prerequisites, CE6, 3M24, or equivalents. Professor GOODIER.

The study of various fluid phenomena, modern methods of rational analysis being correlated with empiricism and research; dimensional analysis; elementary principles of flow; generalized equations; irrotational motion, conformal mapping; fundamental equations of viscous flow; fluid turbulence; boundary layer phenomena; flow around immersed bodies; flow in closed conduits; flow in open channels; wave phenomena.

TOPICS SUGGESTED FOR ADVANCED WORK

THEORY OF ELASTICITY
ELASTIC STABILITY
VIBRATION
FLUID MOTION
PHOTO-ELASTIC STRESS ANALYSIS

RAILROAD ENGINEERING

Associate Professors R. Y. THATCHER, CARL CRANDALL, and J. E. PERRY.

The library of the School of Civil Engineering contains an excellent collection of books, periodicals, and publications of railway and 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.

260A. *Location Surveying.* Credit one hour. One week during summer vacation following sophomore year.

260B. *Route Surveying and Drawing.* Credit three hours.

261. *RAILROAD MAINTENANCE OF WAY.* Credit three hours. Prerequisite, 260B. Associate 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.

* Will be given any term when there is demand, and staff is available.

262. *RAILROAD OPERATION AND MANAGEMENT.* Credit three hours. Prerequisite, 260B. Associate 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.* Credit three hours. Prerequisites, 260A and 260B. 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.* Associate Professor PERRY.

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 to promote more efficient use of the various transportation agencies in the United States by better coordination, polling of facilities, etc., and economics studies are made of some of the new projects which are under discussion.

291 (e). *RAILROAD ENGINEERING DESIGN.* Any term. Credit three or more hours. Associate 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 enginehouses; 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.* Any term. Credit three or more hours.

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

Professor C. L. WALKER; *Associate Professor* H. M. GIFFT.

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*. Credit three hours.

251. *Sanitary Biology*. Credit two hours.

252. *Sewage and Sewage Disposal*. Credit three hours.

253A. *Treatment of Water*. Credit two hours.

258. *Water and Sewage Analysis*. Credit two hours.

253. *CONTROL AND TREATMENT OF WATER SUPPLIES*. Credit three hours. 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 filtration, tastes and odor control, softening and iron removal, corrosion control, sterilization, and miscellaneous treatment methods. Also some study of the design and operation of water treatment plants is included.

254. *SEWERAGE WORKS*. Credit three hours. Prerequisite, 252. 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 dilution 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.* Credit three hours. Prerequisite, 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.

256. *MUNICIPAL ADMINISTRATIVE ENGINEERING.* Credit three hours. Lectures, recitations, and readings. Three periods a week.

A study of municipal organizations and the relationships between the civil engineer in public service and various city, county, state, federal, and special government 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.

256A. *PUBLIC HEALTH ENGINEERING.* Credit three hours. Lectures and recitations, and readings. Three periods a week.

A study of the position of the engineer in public health work. Organization and operation of Boards of Health, vital statistics, public health laws, and the sanitary code.

256B. *RURAL SANITATION.* 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. Lectures, reports, and recitations.

257A. *CONFERENCE ON PRESENT METHODS OF WATER TREATMENT.* Any term. Credit three hours. Readings, investigations, inspections, and reports. Hours to be arranged.

A critical study of selected problems in water treatment, control of watersheds; the construction and operation of existing water treatment plants.

257B. *CONFERENCE ON PRESENT METHODS OF SEWAGE TREATMENT.* Any term. Credit three hours. Readings, investigations, inspections, and reports. Hours to be arranged.

A critical study of selected problems in sewage disposal; sewage treatment methods; the construction and operation of existing sewage treatment plants.

259. *A LABORATORY COURSE FOR GRADUATES.* Professor WALKER. 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.* Any term. Credit three hours. This course should be preceded by courses 252 and 253A or equivalent courses. Professor WALKER.

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 RESEARCH.* Any 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. Professor 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 (in service), C. E. O'ROURKE; *Associate Professors* E. N. BURROWS, H. T. JENKINS, H. M. GIFFT; *Assistant Professor* GEORGE WINTER.

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 stress 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.* First term. Credit three hours.

287. *Soil Mechanics.* Either term. Credit three hours.

272. *ADVANCED STRUCTURAL ANALYSIS.* Credit three hours. Prerequisite, 270. Professor 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.* Credit three hours. Prerequisites, 220, 221, and 271,

or their equivalents. Associate 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 whole 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.* Credit three hours. Prerequisite, 271 or the equivalent. Associate Professor BURROWS. Computations and drawings, 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.* Credit three hours. Prerequisite, 271 or the equivalent. Associate 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.* Credit three hours. Prerequisite, 280. Professor 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.* Credit three hours. Prerequisites, 270, 271, and 280. Professor 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.* Credit three hours. Prerequisite, 280 or the equivalent. Professor O'ROURKE. Not given in 1946–47.]

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.* Credit three hours. Prerequisite, 280. Professors URQUHART and O'ROURKE. Three 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.

286. *ELASTIC FOUNDATIONS AND THIN STRUCTURAL SHELLS.* 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.

[288. *APPLIED SOIL MECHANICS.* Credit three hours. Prerequisite, 287 or its equivalent. Not given in 1946–47.]

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.* Any term. Prerequisites, 270, 271, and 280. Professor O'ROURKE and Associate 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.* Professor O'ROURKE and Assistant Professor WINTER.

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 the 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

Professor P. H. UNDERWOOD; *Associate Professor* L. A. LAWRENCE; *Assistant Professor* F. J. SPRY.

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.

182. *Elements of Field Astronomy.* Any term. Credit two hours. (Given in Department of Astronomy.)

211. *Advanced Surveying.* 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.* Credit two hours.

215. *Problems in Adjustment of Observations.* Credit one hour.

216. *LEAST SQUARES; ADJUSTMENT OF OBSERVATIONS.* 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.* Credit two hours. Prerequisite, 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.

218. *Geodesy and Geodetic Laboratory.* Credit three hours. Prerequisites, courses 182 and 211. Professor UNDERWOOD. Lectures, reading, discussions, and laboratory work. Three periods a week.

A course for the consideration of special problems in geodetic work. Precise leveling, deflection of the plumb line, figure of the earth, use and investigation of geodetic instruments and apparatus such as circles, levels, micrometer microscopes, standards of length, thermometers, pendulums, magnetic apparatus, etc. Subject to arrangement to meet the special needs of students.

219. *PHOTOGRAPHIC AND AERIAL SURVEYING.* Credit three hours. Prerequisite, 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.* Any term. Credit three or more hours. Prerequisites will depend upon the line of work to be pursued. Professor UNDERWOOD.

Special problems in least squares, geodetic surveying, 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, in general, 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 italic small letters, will be found in the *Announcement of the College of Home Economics.*

Unless otherwise noted all classes meet in Martha Van Rensselaer Hall.

Attendance for at least one semester during the regular academic year is usually necessary for candidates for the master's degree on the A Plan.

CHILD DEVELOPMENT AND FAMILY RELATIONSHIPS

Professors ROBERT H. DALTON, ETHEL B. WARING, LEMO R. ROCKWOOD, HELEN D. BULL; *Associate Professors* KATHERINE REEVES; *Assistant Professors* MARY FORD, RUSSELL C. SMART, and OLIVE WOODRUFF.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

Child Development and Family Relationships 1, 2, 3, 4

Family Relations and Marriage 2, 3, 4

Child Development and Child Guidance 2, 3, 4

(Candidates for the Ph.D. degree with a major in Child Development and Family Relationships may not take both minors in the other two subjects.)

Advanced study 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 courses in psychology, sociology, and child development and family relationships.

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 and anthropology, 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 Child Development and Family Relationships — 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 and in the Federal and Settlement Nurseries in Ithaca.

102A. *The Individual and the Family.* Fall and spring. Credit three hours. *This course and 102B must be taken in sequence and credit will not be given for one*

without the other. Not to be taken by students who have had Family Life 100. Primarily for freshmen and sophomores.

102B. *The Individual and the Family.* Continuation of course 102A. Fall and spring terms. Credit three hours. Primarily for freshmen and sophomores.

120. *Home Nursing.* Fall and spring. Credit one hour.

130. *Experience with Children.* Fall and spring. Credit two hours. For sophomores and second-term freshmen.

140. *Creative Materials in Child Development.* Fall and spring terms. Credit three hours a term. For sophomores, juniors, and seniors, and freshmen by permission.

150. *Literature for Children.* Spring. Credit two hours.

260. *Family Relationships and Personality Development.* Fall. Credit three hours.

300. SPECIAL PROBLEMS. Fall and spring. Credit and hours to be arranged. Department staff. For undergraduates and graduates.

For students recommended by advisers and approved by the head of the department and the instructor in charge for independent, advanced work not otherwise provided in the department.

302. *Health of the Family.* Spring term. Credit two hours. Primarily for juniors and seniors.

305. METHODS OF CHILD STUDY. Spring. Credit two hours. Primarily for seniors and graduate students. Limited to ten students. Prerequisite, one of the following courses: Child Development and Family Relationships 260, 310, 360, Human Growth and Development or Rural Education 117. Assistant Professor FORD. T Th 9. Room 124.

This course deals with techniques which contribute to the understanding of the preschool child. Methods to be considered are observational records, rating scales, mental tests, and play techniques. The student is expected to gain some understanding of the use and interpretation of various techniques through limited practice in one or more areas.

310. PRINCIPLES FOR CHILD GUIDANCE. Fall term. Credit three hours. Professor WARING. M W F 8. Room 124. Weekly small group discussions.

Observation in the nursery school includes study of individual children and their guidance; the aspects of their behavior — routine and creative, individual and social — as they are related in their personalities; and the guidance which promotes behavior that gives them social sanction, personal satisfaction, and optimum growth and development. Principles of guidance as the basis for selecting procedures and for predicting and evaluating their outcomes. Application to person-to-person relations at any age; and especially to older children, the sick, convalescent, and handicapped.

315. *CHILD DEVELOPMENT.* Advanced course. Spring. Credit three hours. Open to juniors, seniors, and graduate students. Prerequisite: Human Growth and Development and two or more credit hours of Child Development and Family Relationships or permission of the instructor. Mr. YARROW and Assistant Professor FORD. M W F 3. Room 3M13.

Systematic consideration of the growth of the child as a whole, and analysis of the forces determining developmental changes. Integration of the social, emo-

tional, intellectual, motor, and physical aspects of the behavior and development, the general tendencies and individual variations. Critical analysis of relevant research literature, and planned observation of children.

325. *EXCEPTIONAL CHILDREN IN THE FAMILY.* Fall. Credit two hours. Open to juniors, seniors, and graduate students. Prerequisite: one of the following courses: Child Development and Family Relationships 260, 310, 360, Human Growth and Development or Rural Education 117. Assistant Professor FORD. T Th 9. Room 301.

This course deals with the personal-social development of exceptional children (gifted, retarded, temporarily or permanently physically handicapped, and cultural deviates); family attitudes and responsibilities in relation to them; and community resources which supplement the family in providing for exceptional children. The primary emphasis is on the exceptional child in relation to his own family group.

330. *A.B.C. PARTICIPATION IN NURSERY SCHOOL.*

A. Junior Nursery School

B. Senior Nursery School

C. Ithaca City Nursery Schools and Child Care Centers

Fall and spring. Credit three or four hours for each section of the course. (Students may register in successive terms but section A or B must precede C.) 84 hours of participation required for three hours' credit; 112 hours for four hours' credit.

Open to qualified upperclass and graduate students who are preparing for nursery-school teaching, secondary-school teaching, extension, social work, or homemaking. Prerequisite, course 310. Principles for Child Guidance. Registration by permission of the instructor. Associate Professor REEVES and Nursery School teachers.

Study of young children in the nursery school group and in their homes. Consideration of the development of nursery education and its relation to Home Economics. Scheduled participation in the nursery school program.

In addition to participation, students will be responsible for the following conferences or discussions:

Students registered for Participation for the first time, A or B: Class discussion. Th 8. Room 124. Conference with teacher of nursery school group; A, T 12. Room G 62, 1st term; Room 124, 2nd term; B, T 8. Room 124.

Some home care of a nursery school child; some observation in the public schools; some attendance at parent group meetings.

Students registered for Participation for the second time, A or B: Same, except that instead of the class discussion Th 8 a period of field or clinical observation will be planned for each week.

Students registered for Section C. Conferences and special problems arranged individually.

360. *DYNAMICS OF PERSONALITY.* Fall. Credit three hours. Professor DALTON and Mr. YARROW. M W F 11. Room 124.

A study of the development of the personality. Attention will be given to some of the various ways of studying personality, the basic aspects of growth, and the

determinants of personality. Special emphasis will be directed toward an understanding of unconscious processes, the psychological experiences of the growing child, and the directive forces in adult behavior.

370. *MARRIAGE.* Spring. Credit three hours. Open to juniors and seniors and to graduate students by permission of the instructor. Professors ROCKWOOD and BULL, Assistant Professor SMART. M W F 10 or 11. Each section limited to 40 students. Room 121.

Emotional and social maturity and readiness for marriage; health and hereditary factors related to marriage; courtship, choice of mate, and engagement; predicting success or failure in marriage; marriage in wartime; personality and social factors in marriage adjustment; prevention and adjustment of marital conflicts; sex life in marriage; fertility and sterility, planned parenthood, pregnancy and parenthood; economic problems of young families and the administration of the home; the role of the modern homemaker; the married woman and outside employment; philosophy of marriage.

380. *THEORY AND TECHNIQUES OF FAMILY COUNSELING.* Spring. Credit three hours. Open to graduate students and seniors. Limited to twelve students. Prerequisite, Child Development and Family Relationship 260 or 360 and permission of the instructor. Professors DALTON and ROCKWOOD. Th 2–4. Room 114.

The place of counseling in human relationships — theories underlying its effectiveness. Consideration will be given to some diagnostic procedures and to some techniques utilized in counseling.

405. *SEMINARY — METHODS AND TECHNIQUES OF RESEARCH.* Fall. Credit two hours. Open to graduate students, and seniors by permission of the instructor. Mr. YARROW. W 2–4. Room 121.

The planning or research, techniques of experimentation, analysis of research data, introduction to elementary statistical concepts and methods. Critical evaluation of the techniques of current research studies in child development and family relationships; opportunity to plan research problems in which the student is interested.

420. *PROSEMINARY IN CHILD DEVELOPMENT AND FAMILY RELATIONSHIPS.* Fall. Credit three to six hours. Open to graduate students only. Required of all students majoring in the Department of Child Development and Family Relationships during their first year of graduate study. Staff. Th 2–4. Room 114.

The purpose of the proseminar is to provide students with an opportunity to achieve a working knowledge of the major fields included in the study of child development and family relationships — facts, theories, experiments, methods, and points of view. It is designed to give the student a background preparatory to specialization in the area of his choice.

The work of the proseminar will consist of: (a) readings, (b) lectures, (c) discussions, (d) reports.

430. *RESEARCH IN CHILD DEVELOPMENT AND FAMILY RELATIONSHIPS.* Fall and spring. Credits vary according to the nature of the problem. Professor WARING, Assistant Professors FORD and SMART.

For graduate students who are actively engaged in research or in special studies in Child Development and Family Relationships.

[440. *SEMINARY — THE FAMILY.* Throughout the year. Credit two hours. Not offered in 1946–47.]

450. *SEMINARY—CHILD GUIDANCE.* See Rural Education 228. Spring. Credit two hours. Prerequisite, some work in Child Development and Family Relationships. Professor WARING. W 4–6. Room G 58.

460. *FAMILY RELATIONSHIPS AND PERSONALITY DEVELOPMENT.* Fall. Credit three or four hours. Professor ROCKWOOD. M W F 10 or 11, Room 121 and T 11–12:30, for those registered for four hours' credit. Room 124.

A study in the regular progression in the type of family relationship which the individual sustains to other members of the family throughout the life cycle.

Among the topics considered are the importance of the family experience in the personality development and the socialization of the child; problems of family relationships which are inherent in the structure of the family or arise out of the current milieu.

ECONOMICS OF THE HOUSEHOLD AND HOUSEHOLD MANAGEMENT

Professor HELEN CANON; *Associate Professors* ELLA M. CUSHMAN, MABEL ROLLINS, and LUCILLE WILLIAMSON; *Assistant Professor* ANN AIKIN.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

Economics of the Household and Household Management 1, 2, 4

Students selecting a major in economics of the household and household management are expected to take courses in both phases of the field; for the Ph.D. degree the minor subjects are usually selected to support one phase or the other. Appropriate minor subjects may be chosen from a variety of fields including, besides other branches of home economics, agricultural economics, economics, education, psychology.

As a background for graduate work in this field, a well-rounded undergraduate program in home economics is preferable in general to specialization. Undergraduate courses in mathematics, statistics, economics, history, psychology, physics, chemistry, and bacteriology are also useful.

120. *Household Processes.* Fall and spring. Credit two hours. Primarily for freshmen and sophomores.

130. *Economic Conditions in Relation to the Welfare of Families.* Fall and spring. Credit three hours. Primarily for freshmen and sophomores.

260. *Problems in Providing Consumers' Goods.* Fall term. Credit three hours. For undergraduate and graduate students.

300. *Special Problems.* Fall and spring. Credit to be arranged individually.

308. *Management in Homes.* Fall and spring. Credit one hour. For sophomores and juniors.

310. *Management in Family Living.* Fall and spring. Credit three hours. For juniors, seniors, and graduate students.

320. *Management in Relation to Household Equipment.* Spring term. Credit three hours. For juniors, seniors, and graduate students.

330. *Management in Relation to Personal Finances.* Fall and spring. Credit three hours. For juniors, seniors, and graduate students.

410. *ECONOMIC PROBLEMS OF FAMILIES.* Spring. Credit two hours. The instructor should be consulted before registering. Professor CANON. Th 2–4. Room 108.

Analysis of a few outstanding contributions to economic thought related to this field. Examination of methods of research.

415. *PROBLEMS IN THE DISTRIBUTION OF CONSUMERS' GOODS.* Spring. Credit two hours. Prerequisite, Economics of the Household 260 or the equivalent. The instructor should be consulted before registering. Associate Professor ROLLINS. F 2–4. Room 124.

Analysis of some of the important problems in distribution. Practice in locating and in using sources of data bearing on marketing problems. Discussion of contributions from research in marketing.

418. *PERSONAL FINANCES.* Fall. Credit two hours. The instructor should be consulted before registering. Assistant Professor AIKIN. F 2–4. Room 133.

Examination of the nature of personal financial problems, and of adjustments in individuals' financial practices under changing conditions. The operation and regulation of financial institutions of importance in personal management. Analysis of teaching materials.

420. *SEMINARY.* Fall and spring. For graduate students. Department Staff. T 4–5:15. Room 114.

FOOD AND NUTRITION AND INSTITUTION MANAGEMENT

Food and Nutrition: *Professors* CATHERINE PERSONIUS, L. A. MAYNARD, FAITH FENTON, HAZEL HAUCK, HELEN MONSCH, MARION PFUND; *Associate Professors* J. K. LOOSLI, GRACE STEININGER; *Assistant Professors* ALICE BRIANT, GRACE FOSTER, CHARLOTTE YOUNG, ———.

Institution Management: *Professor* KATHERINE HARRIS; *Associate Professor* ALICE BURGOIN.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

Food and Nutrition 1, 2, 3, 4	Food 2, 3, 4
Nutrition 1, 2, 3, 4	Institution Food 2, 4

As a basis for graduate work in food and nutrition, elementary courses in home economics and courses in inorganic and organic chemistry are expected. A knowledge of quantitative chemical analysis, biochemistry, physiology, bacteriology, physics, physical chemistry, and statistics is desirable.

Before applying for admission to the Graduate School a prospective student is advised to communicate with a member of the faculty in the field in which she

wishes to do research or with the chairman of the department: Food and Nutrition, Professor PERSONIUS; Institution Management, Professor HARRIS. Animal Nutrition, see above.

FOOD AND NUTRITION

100. *Food Preparation in Relation to Meal Planning.* Spring. Credit three hours.

103. *Elementary Food and Nutrition.* Fall and spring. Credit five hours.

190. *Nutrition and Health.* Fall. Credit two hours. For students outside the College of Home Economics.

[210. *Food Preparation: Principles and Comparative Methods.* Fall. Credit four hours. Not given in 1946–47.]

214. *Science Related to Food Preparation.* Fall. Credit five hours.

215. *Science Related to Food Preparation.* Spring. Credit five hours.

225. *Food Preparation: Principles and Comparative Methods.* Fall and spring terms. Credit five hours.

230. *Nutrition, Advanced Course.* Spring. Credit three hours.

240. *Food Preparation, Advanced Course.* Fall and spring. Credit three hours.

250. *Food Preservation.* Summer Session only. Credit two hours.

260. *Meal Planning and Preparation.* Fall and spring. Credit three hours.

300. *SPECIAL PROBLEMS.* Fall and spring. Credit and hours to be arranged. Registration with permission of the head of the department and the instructor in charge.

Independent advanced work on a problem not dealt with by other courses in the department.

305. *FOOD DEMONSTRATIONS.* Fall and spring. Credit one hour. Prerequisites, Food and Nutrition 210, 215, or 225 and a course in elementary nutrition. Registration with permission. Assistant Professor FOSTER. T Th 2–3:30. Room 361.

Emphasis on the purposes and techniques of demonstrations in relation to food preparation and nutrition, with application to teaching, extension, business, and social service.

310. *SCIENCE RELATED TO FOOD, ADVANCED COURSE.* Fall. Credit three hours. Prerequisites, Food and Nutrition 210, 215 or 225, and 240 or 260, or the equivalent. Registration with permission. Professor PERSONIUS. M W F 8. Room 301.

The scientific principles necessary to the understanding of modern theory and practice in the field of food preparation.

320. *EXPERIMENTAL COOKERY.* Spring. Credit three hours. Prerequisites, Food and Nutrition 210, 215 or 225, and 240 or 260, or the equivalent. Registration with permission. Professors PERSONIUS and PFUND. T Th or W F 10–1. Room 426.

Independent laboratory work in the solving of practical problems in food preparation. Study of methods and techniques used in experimental work in food. Judging of food products.

330. *DIET THERAPY.* Fall. Credit two hours. Prerequisite, Food and Nutrition

230 or the equivalent. Registration with permission. Professor HAUCK. T Th 8. Room 426.

Diet in those diseases such as fevers, gastro-intestinal disturbances, and diabetes, in the treatment of which choice of food is important.

340. *FAMILY NUTRITION, WITH SPECIAL EMPHASIS ON CHILD FEEDING.* Fall and spring. 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. Prerequisite, Elementary Nutrition. Professor MONSCH and ———. Lecture, T 2–4. Room 339. Laboratories: (a) Infant Feeding, Th 2–4:20, Rooms 426, 432; (b, c) Child Feeding, F 2–4:20, Room 301.

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 in private homes, the well-baby clinic, the nursery school, and the public schools.

360. *SEMINARY IN FOOD AND NUTRITION.* Fall. Credit one hour. Primarily for seniors; open to graduate students. Prerequisites, Elementary Nutrition and Food and Nutrition 210, 215 or 225. Professor FENTON and Associate Professor STEININGER. Th 2. Room 301.

Study of historical and current literature.

400. *READINGS IN NUTRITION.* Spring. Credit two hours. Registration with permission of the instructor. Professor HAUCK. T Th 9. Room 301.

Emphasis on the experimental data on which the principles of human nutrition are based. Critical review of current literature in this field.

410. *RESEARCH IN FOOD AND NUTRITION.* Fall and spring. Credit and hours to be arranged. Registration with permission of the instructor. Professors PERSONIUS, MAYNARD, FENTON, HAUCK, MCCAY, MONSCH, and PFUND; Associate Professors LOOSLI and STEININGER; Assistant Professors BRIANT, JOHNSTON, and YOUNG.

Individual research in food, human nutrition, and animal nutrition.

420. *SEMINARY IN FOOD AND NUTRITION.* Fall and spring. Emphasis on nutrition in fall term, on food in spring term. Credit one hour each term. Department Staff. Time to be arranged. Room 301.

Note: The attention of advanced and graduate students is called to the courses listed in the Announcement of the School of Nutrition.

INSTITUTION MANAGEMENT

100. *Institution Food Service.* Fall and spring. Credit three hours. Primarily for freshmen.

220. *Food Selection and Purchase for the Institution.* Fall and spring. Credit three hours.

230. *Quantity Food Preparation: Principles and Methods.* Fall and spring. Credit five hours. For juniors and sophomores by permission.

Tea Room and Cafeteria Accounting. (Hotel Accounting 240.) Fall and spring. Credit three hours. For sophomores and juniors.

300. *SPECIAL PROBLEMS.* Fall and spring. Credit and hours to be arranged individually. For students approved by the head of the department and the in-

structor in charge for independent, advanced work on a problem not dealt with by other courses in the department.

320. *INSTITUTION ORGANIZATION AND ADMINISTRATION.* Spring. Credit four hours. Should be taken in the senior year. Advised for all students specializing in institution management or dietetics.

330. *QUANTITY FOOD PREPARATION AND CATERING, ADVANCED COURSE.* Fall and spring. Credit five hours. Open to seniors and a limited number of juniors majoring in institution or hotel management who have obtained the approval of the Department of Institution Management before registering.

RESTAURANT COST AND SALES ANALYSIS. (Hotel Accounting 340.) Spring. Credit two hours. Prerequisite, Institution Management 230.

350. *INSTITUTION PRACTICE.* Fall and spring. Credit four hours. Open to seniors majoring in institution management, with the permission of the instructor and the class counselor.

400. *RESEARCH IN INSTITUTION ORGANIZATION AND ADMINISTRATION.* Throughout the year. For graduate students with training and experience satisfactory to the instructor. Professor HARRIS and Associate Professor BURGOIN. Hours to be arranged. Fee determined by the problem.

Individual research in the area in which the student is particularly interested. Food-control procedure, job analyses and specifications, experimentation and development of standardized procedures in food preparation and merchandising as applied to quantity production, determination of factors underlying operation and maintenance costs are suggestive of the fields in which there is vital need for research.

410. *SEMINARY IN INSTITUTION ORGANIZATION AND ADMINISTRATION PROBLEMS.* Fall term, to be repeated in spring term. Credit one hour. For graduate students with adequate training in institution management. Professor HARRIS.

TEXTILES AND CLOTHING AND HOUSEHOLD ART

Textiles and Clothing: *Professor* BEULAH BLACKMORE; *Associate Professors* MURIEL BRASIE, ELSIE FROST, MARGARET HUMPHREY, and RUTH SCOTT.
Household Art: *Professor* NANCY M. ROMAN; *Associate Professor* DORA W. ERWAY; *Assistant Professors* VIRGINIA TRUE, MABEL WILKERSON, and HELEN J. CADY.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

Textiles and Clothing and Household Art 2, 3, 4

Graduate work for the Masters' degree is offered in Textiles and Clothing and Household Art. Emphasis may be placed upon either Textiles and Clothing or 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.

100. *Clothing Selection and Construction.* Fall and spring. Credit three hours.

101. *Selection, Purchase, Care.* Fall and spring. Credit three hours. *Not to be taken by students who have had course 100.*

110. *Clothing Construction.* Fall and spring. Credit two hours. Suggested for sophomores. Prerequisite, Textiles and Clothing 100, 101 or the equivalent.

130. *Textiles: Clothing Fabrics.* Fall and spring. Credit two hours.

200. *Fitting and Pattern Making, Flat Pattern Work, Modeling.* Fall and spring. Credit three hours. By permission of the department. Prerequisite, Textiles and Clothing 100, 101, 110, and 210.

205. *Clothing of the Family.* Fall and spring. Credit two hours. For upperclass students interested in child development and family relationships, teaching, or social work.

210. *Dress Selection and Design.* Fall and spring. Credit two hours. Prerequisite, Textiles and Clothing 100. For students intending to teach.

220. *Commercial Clothing and Advanced Problems in Construction.* Fall and spring. Credit three, four, or five hours. Prerequisite, Textiles and Clothing 200.

235. *SCIENCE RELATED TO TEXTILES.* Fall and spring. Credit two hours. Prerequisites, Food and Nutrition 215 or its equivalent, Textiles and Clothing 130 or 310. Mrs. NORTON. W F 8–10. Room 353.

A course concerned with the chemistry involved in the study of fabrics. Laboratory work includes the observation of the chemical properties of the major fibers used in clothing and household fabrics; analysis of anti-perspirants; stain removal by methods which can be adapted for home use; simple performance tests on fabrics and evaluation of these and standard tests.

300. *SPECIAL PROBLEMS.* Fall and spring. Credit and hours to be arranged individually. For students approved by the head of the department and the instructor in charge for independent, advanced work on a problem not dealt with by other courses in the department.

310. *HOUSEHOLD TEXTILES.* Spring term. Credit two hours. For juniors, seniors, and graduate students. (Graduate students please see Textiles and Clothing 410 and consult with instructor.) Professor BLACKMORE. T Th 9–11. Room 278.

A study of the range in quality in household textiles and the methods of selecting the quality best suited to specific needs. Buying problems in the area of household textiles.

Technical information necessary for efficient buying. Identification of fibers and physical testing of fabrics for properties which affect satisfactory use. Procedure and performance of standard and other physical tests will be evaluated. A study of specifications set up by various groups. Existing state laws governing the sale of certain household textiles.

A two-day trip to four or more manufacturing establishments to observe designing, weaving, making of certain household fabrics, and methods used in preparing fabrics for the retail market. (If trip is possible in 1946–47 students will be responsible for transportation and living expenses involved.) Estimated cost of materials, $2.

320. *PROBLEMS IN BUYING CLOTHING.* Fall and spring. Credit three hours. For juniors, seniors, and graduate students. Associate Professor BRASIE.

Fall: M W F 11 Room 278 *Spring:* M W F 11 Room 213

The course is planned to develop an appreciation of, and an alertness to the problems in buying clothing; an understanding of some of the problems involved in clothing production and marketing, consumer responsibility in this field, and skill in buying clothes.

Illustrated lectures and discussion of such topics as the relationship of such factors as labeling, design, construction, and fit, to the quality and the cost of similar types of wearing apparel; management problems met by people in choosing clothing best suited to their specific needs and desires; government regulations; trends toward simplification and standardization; services provided by various government and commercial agencies; trends in fashion growing out of current events.

Reference reading and a special problem supplement class discussion. (If trips are possible during 1946–47 students will be responsible for transportation and expenses involved.)

400. *DRESS DESIGN, ADVANCED COURSE.* Spring. Credit three hours. Prerequisites, Textiles and Clothing 200 and 220, or their equivalent. For upperclassmen and graduate students. Associate Professor FROST. T Th 2–4:45. Room 216.

A course in advanced dress design with emphasis on the development of originality and beauty of execution. Approaches in design problems are made through experimental manipulation of fabric combination; use of historic and contemporary design sources; draping; sketching.

The majority of the designs will be draped and fitted in muslin. The development of the designs into finished garments will depend on the needs and interests of the students. Estimated cost of material, $5 to $25.

410. *SEMINARY IN TEXTILES.* Fall and spring. Credit one hour. Parallel, Textiles and Clothing 310. For graduate students. Consult the instructor before registering. Professor BLACKMORE. Hours to be arranged.

430. *SEMINARY IN TEXTILES AND CLOTHING.* Spring. One hour by arrangement. For graduate students. Department Staff. Room 216.

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.* Fall and spring. Credit three hours.

116. *Applied Textile Design.* Spring term. Credit two hours.

[150. *Housing from the Standpoint of Home Economics.* Credit two hours. Not given in 1946–47.]

[160. *Contemporary Art.* Fall. Credit two hours. Not given in 1946–47.]

[170. *Growth and Development of Handicrafts.* Credit one hour. Given in alternate years. Not given in 1946–47.]

200. *Studio Course in Advanced Color and Design.* Fall, 1946. Credit two hours. Given in alternate years.

215. *Applied Design.* Fall and spring. Credit two hours. Prerequisite, Household Art 100.

220. *Home Furnishing.* Fall and spring. Credit three hours. Prerequisite, Household Art 100.

225. *Home Furnishings.* Fall and spring. Credit three hours. Prerequisites, Household Art 100 and 220.

235. *Home Furnishings.* Fall and spring. Credit three hours. Prerequisites, Household Art 100 and 220 or consent of the instructor.

[240. *House Planning.* Summer term, to be repeated in fall and spring terms. Credit three hours. Prerequisite, Household Art 220. Not given in 1946–47.]

300. *SPECIAL PROBLEMS.* Fall and spring terms. Credit and hours to be arranged individually. For students approved by the head of the department and the instructor in charge for independent, advanced work on a problem not dealt with by other courses in the department. Members of Household Art Staff.

305. *FASHION ILLUSTRATION.* Spring. Credit three hours. Prerequisites, Household Art 100 and life drawing. Clothing courses desirable. Assistant Professor TRUE. T Th 10–1. Room 327. Minimum cost of materials, $7.

A course planned to introduce the student to the requirements of knowledge and skills for the fashion illustrator. Study of layouts for fashion advertisements, techniques for reproduction processes used in newspaper and magazine fashion illustration, fashion styles, and presentation of work.

320. *HISTORIC FURNITURE AND INTERIOR DESIGN.* Fall. Credit two hours. Prerequisite, Household Art 220. Assistant Professor WILKERSON. T Th 11. Room 317.

A course concerned with the developments of furniture and interior design from early forms through the major historic periods to the present showing the recurrence of structural forms adapted and modified according to the taste of the period, which in turn reflects the economic, political, and social aspects of the time.

EDUCATIONAL LEADERSHIP IN HOMEMAKING

See offerings listed in *Announcement of the School of Education* — Rural Education 134b and 134c.

HOTEL ADMINISTRATION

Professors H. B. MEEK, F. H. RANDOLPH, LOUIS TOTH, A. L. WINSOR, JOHN COURTNEY, C. I. SAYLES, and C. E. CLADEL.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

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.

114. *Psychology for Students of Hotel Administration.* Fall term. Credit three hours.

181 and 182. *Hotel Accounting.* Throughout the year. Credit six hours.

183. *Auditing.* First term. Credit three hours.

184. *Food and Beverage Control.* Spring term. Credit three hours.

187. *Tax Computation.* Fall term. Credit two hours.

240. *Tea Room and Cafeteria Accounting.* Fall term, to be repeated in spring term. Credit three hours.

282. *Accounting Practice.* Fall term. Credit three hours.

283. *Advanced Accounting.* Spring term. Credit three hours.

284. *Problems in Food Control.* Spring term. Credit one hour.

288. *Accounting Machines in Hotels.* Fall term, to be repeated in the spring term. Credit one hour.

340. *Restaurant Cost and Sales Analysis.* Spring term. Credit two hours.

[151. *Hotel Operation.* Fall term. Credit two hours. Not given in 1946–47.]

Special Hotel Equipment (Hotel Engineering 261). Fall term. Credit three hours.

Water Systems (Hotel Engineering 262). Spring term. Credit three hours.

Steam Heating (Hotel Engineering 263). Fall term. Credit three hours.

Electrical Equipment (Hotel Engineering 264). Spring term. Credit three hours.

HOTEL PLANNING (Hotel Engineering 265). Spring term. Credit three hours. Open to seniors and graduate students. Discussion, T Th 9–10:30. East Roberts 223. Professor RANDOLPH.

Planning the layout for a proposed hotel, emphasizing floor plans and the selection and arrangement of the equipment in the various departments, including the kitchen and the laundry.

[*HOTEL STRUCTURES AND MAINTENANCE* (Hotel Engineering 266). Spring term. Credit three hours. Lectures, M W F 11. East Roberts 222. Laboratory sections as assigned in alternate weeks; computation period M 9 in alternate weeks. Associate Professor SAYLES. Not given in 1946–47.]

185. *HOTEL ACCOUNTING PROBLEMS.* Spring term. Credit two hours. Prerequisite, Hotel Accounting 183 or its equivalent. Assistant Professor TOTH.

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.* Spring term. Credit two hours. Prerequisite, Hotel Accounting 183 or its equivalent. Assistant Professor TOTH.

Study and discussion of hotel balance sheets and profit and loss statements. Typical balance sheets and operating ratios of representative hotels.

189. *PROBLEMS IN ANALYSIS AND INTERPRETATION.* Fall term, to be repeated in the spring term. Credit two or three hours, depending on work done. Registration limited. Assistant Professor COURTNEY. Martha Van Rensselaer G–1. Fee for materials, $3.

A seminar course for graduate students or seniors in hotel administration. Application of statistical methods to problems in analysis and interpretation. Each student will solve one or more problems.

153. *SEMINARY IN HOTEL ADMINISTRATION.* Fall term, to be repeated in the spring term. Credit two hours. Prerequisite, Hotel Administration 151 or its equivalent. Registration limited. Professor MEEK.

A course devoted to the study of specific problems arising in the management of hotels.

119. *PERSONNEL ADMINISTRATION IN HOTELS.* Spring term. Credit three hours. Prerequisite, Rural Education 114 or its equivalent. Professor WINSOR.

Study of the problems of human relations in industry. Methods and problems of recruitment, selection, placement, maintenance, organization, and government of employees are analyzed with particular reference to the hotel industry.

219. *SEMINARY IN PERSONNEL ADMINISTRATION.* Spring term. Credit two hours. Prerequisite, 119. Professor WINSOR.

An analysis of current problems in personnel administration.

INDUSTRIAL AND LABOR RELATIONS

Professors IRVING M. IVES, PHILLIPS BRADLEY, MAURICE F. NEUFELD, DONALD J. SHANK; *Associate Professor* J. E. MORTON; *Assistant Professor* JEAN T. MCKELVEY; *Instructor* ROBERT H. FERGUSON.

The New York State School of Industrial and Labor Relations was established by legislation enacted in 1944. It admitted students at the beginning of the academic year 1945–46.

The School is intended to provide both general and intensive training for those who look forward to professional careers in industrial and labor relations. Advanced work is offered leading to the degrees, Master of Science in Industrial and Labor Relations and Doctor of Philosophy. A minimum of two terms of residence is required of candidates for the Master's degree; additional residence will be required of those students whose undergraduate courses combined with their work-experience do not conform substantially to the undergradaute curriculum of the School.

Special emphasis is placed on a thorough grounding at both the undergraduate and graduate levels in economics and the other social sciences. Close cooperation is maintained with these departments in the Graduate School. Courses in these and related departments of the University are included in the program of the School and may be utilized towards particular specializations within the field of industrial and labor relations.

The School of Business and Public Administration will offer a number of courses closely related to professional training in the School of Industrial and Labor Relations. It is anticipated that a number of courses offered by the former will be available to graduate students in the latter.

The *Division of Industrial and Labor Relations* consists of the Faculty of the School of Industrial and Labor Relations, who are also members of the Faculty of the Graduate School, and a representative from each of the departments of Agricultural Economics, Economics, Government, History, Sociology, and the School of Law.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

Collective-Bargaining, Mediation, and Arbitration 1, 2, 3, 4

Human Relations in Industry 1, 2, 3, 4

Industrial and Labor Legislation and Administration 1, 2, 3, 4

Labor Union Organization and Operation 1, 2, 3, 4

Personnel Management 1, 2, 3, 4

Social Security 1, 2, 3, 4

A student who proposes to take either a major or minor in Industrial and Labor Relations must select one of the above subjects.

As background for their independent research, candidates for the Ph.D. degree are expected to meet certain general requirements in these subjects as follows:*

Collective-Bargaining, Mediation, and Arbitration. For a major in this subject, the candidate must show knowledge of: (1) the history and current developments in collective-bargaining practices and procedures; (2) the content of trade agreements in different types of industry; (3) state and federal legislation in the field of collective-bargaining, mediation, and arbitration; (4) leading cases in this field of labor law; (5) administrative agencies and their functions.

For a minor, knowledge of (1), (3) and (5) is required.

Human Relations in Industry. For a major in this subject, the candidate must present: (1) comprehensive knowledge of industrial psychology as expressed in individual and group behavior; (2) familiarity with principles and practices of personnel administration; (3) knowledge of labor union organization and activity and collective bargaining techniques; (4) knowledge of community conditions affecting individual and social behavior and available community resources.

For a minor, (1), (2) and (3) are required.

Industrial and Labor Legislation and Administration. For a major in this subject, the candidate must show: (1) comprehensive knowledge of the origin and development of legislation in such fields as minimum wage, hours, protection of women and children, discrimination, and working conditions; (2) detailed knowledge of one special field of legislation, and the administrative and legal experience in that field; (3) knowledge of leading cases in each of the fields listed in (1).

For a minor, (1) and (3) are required. (This subject may not be offered for a minor, if the major subject is Social Security.)

Labor Union Organization and Operation. For a major in this subject, the candidate must present: (1) comprehensive knowledge of the history of the American labor movement and familiarity with the history of labor in other countries; (2) specific knowledge of the structure and operation of two labor unions in different types of industries; (3) understanding of the economic and social policies and practices of labor unions; (4) familiarity with types of union leadership and rank and file behavior; (5) detailed knowledge of the bibliography and sources of information in this field.

For a minor, (1), (2) and (3) are required.

Personnel Management. For a major in this subject, the candidate must present: (1) comprehensive knowledge of the general principles of personnel organization and operation; (2) intensive study of specialized fields of personnel management; (3) the application of principles of and practices in personnel management to industrial organizations and labor unions; (4) acquaintance with current methods and procedures in such fields as job evaluation and classification, wage classification and administration, time and motion study, industrial training and education, and union administration.

For a minor, (1), (2) and (4) are required.

Social Security. For a major in this subject, the candidate must present: (1) comprehensive knowledge of basic causes and types of social insecurity; (2) familiarity with efforts of labor, industry, and the community to meet these

* Field experience or internship may be included as part of the research program under the direction of the student's Special Committee.

problems on a voluntary basis; (3) knowledge of the origin and evolution of state and federal legislation in the field of social insurance; (4) familiarity with the administrative and legal aspects of one major field in social security; (5) knowledge of past and current proposals for improving and extending practices and legislation in the field.

For a minor, (1), (2), (3), and (5) are required. (This subject may not be offered as a minor, if Industrial and Labor Legislation and Administration is the major subject.)

The School will offer a number of Graduate Seminaries in the fields outlined above. For details of courses to be offered in the academic year 1946–47, consult the Graduate School.

A number of departments in the University offer related graduate courses which may be included in a program of concentration in Industrial and Labor Relations. These courses fall primarily in the departments of Agricultural Economics, Economics, Government, Hotel Administration, Industrial Engineering, Law, Psychology, and Sociology. Students should consult with their advisers in the School of Industrial and Labor Relations as to the inclusion of courses in these departments in their programs of study.

LAW

Professors of Law R. S. STEVENS, L. P. WILSON, G. J. THOMPSON, H. E. WHITESIDE, H. D. LAUBE, G. H. ROBINSON, W. H. FARNHAM, J. W. MACDONALD, A. J. KEEFFE, A. E. SUTHERLAND; *Associate Professors* B. F. WILLCOX, ARTHUR LARSON, HARROP FREEMAN, L. W. MORSE.

All members of the Law Faculty are expected to be in residence during the coming academic year.

The Division of Law consists of members of the Faculty of Law, representatives of the associate 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. 44)

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 the 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 in the purpose, administration, history, 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.

As each candidate for a graduate degree in Law is admitted and his program arranged on an individual basis, no courses, except Jurisprudence, are prescribed for all. The content of the program of any particular candidate will depend upon his individual needs. A description of Professor Laube's course in Jurisprudence will be found in the *Announcement of the Law School.*

Graduate students may pursue work in Administrative Law, Business Regulation, Commercial Law, Constitutional Law, International Law, Jurisprudence, Labor Law, Legal History, Procedure, Property, Taxation, or in any other field

of the Law in which they have an interest. Candidates who can not receive the instruction they require in the regular established courses listed in the *Law School Announcement* may study under the personal supervision of the appropriate members of the Faculty.

A number of furnished offices are provided in the Law School building, Myron Taylor Hall, for graduate students in Law.

Further information in regard to graduate work in Law can be found in the *Law School Announcement.*

For the procedure to be followed by a candidate for LL.M. see p. 16 of this *Announcement,* and for J.S.D. see page 26.

SPECIAL REQUIREMENTS FOR PROFESSIONAL DEGREES

The following special requirements apply in the case of the professional masters' degrees enumerated.

Master of Laws, LL.M. The degree of 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 6, the candidate must have received the degree of Bachelor of Laws from an approved law school and must have shown a high level 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 or more, 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 see page 16 of this *Announcement* and also the *Announcement of the Cornell Law School.*

REQUIREMENTS FOR THE J.S.D. DEGREE

Work leading to this degree is designed to train legal scholars and to stimulate original investigation in the purpose, administration, history, and progress of the law.

Admission. To be eligible for admission to candidacy for J.S.D. the candidate shall have met the general requirements for admission stated on page 6; 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 shown a high level 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 or more 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 other member or members may be chosen from the Graduate School Faculty in a field or fields appropriate to the 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 page 22.

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. A report on each final examination shall be filed by the Special Committee in the office of the Graduate School. By permission of his Special Committee, a candidate who has failed in his final examination may present himself for re-examination but only within a period of from six to twelve months after the failure.

For further information concerning J.S.D. see page 26 of this *Announcement* and also the *Announcement of the Cornell Law School.*

VETERINARY MEDICINE

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44)

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, above)

VETERINARY ANATOMY

Professor EARL SUNDERVILLE and *Assistant Professor* MALCOLM E. MILLER.

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.* Fall term. Three hours.

2. *Arthrology.* Fall term. One hour.

3. *Myology and Viscera.* Fall term. Three hours.

4. *Myology, Thoracic, and Abdominal Viscera, Lymphatic System, and Organs of Special Sense.* Fall term. Two hours.

5. *Blood Vessels and Nerves of the Arm, Leg, and Head.* Fall term. Five hours.

6. *Canine Anatomy.* Spring term. Two hours.

PHYSIOLOGY

Professors H. H. DUKES, C. E. HAYDEN, and *Associate Professor* J. A. DYE.

The laboratories of the department are well equipped for research work in physiology. Adequate facilities are available for work in both the experimental and the chemical field. 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 physiology must have had the basic courses of the department or their equivalents. Graduate students who plan to do minor work in 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*. Spring term. Three lectures a week. Primarily for undergraduates.

11. *Physiological Chemistry*. Spring term. Three lectures and three laboratory periods a week. Primarily for undergraduates.

12. *Physiology*. Spring term. Three lectures a week. For undergraduates and graduates.

13. *Physiology*. Fall term. Three lectures a week. For undergraduates and graduates.

14. *Experimental Physiology*. Fall term. Three laboratory periods a week. For undergraduates in veterinary medicine and graduates.

303. *Human Physiology*. Fall term, to be repeated in spring term. Three lectures a week. Primarily for undergraduates.

[16. *ADVANCED EXPERIMENTAL PHYSIOLOGY*. Spring term. One laboratory period (four hours) and one conference period (one hour). For graduates. Not given in 1946–47.]

17. *SPECIAL PROBLEMS IN CHEMICAL PHYSIOLOGY*. Either term. Credit hours and time to be arranged. Registration by permission. For graduates. Professor HAYDEN. James Law Hall.

This course will be adapted to the needs of students and will consist of laboratory work, conferences, collateral readings, and reports.

305. *ENDOCRINOLOGY AND METABOLISM*. Fall term. Credit three hours. Prerequisite, six or more hours each of biology and chemistry. Primarily for graduates. Associate Professor DYE. M W F 11. Moore Laboratory 101.

18. *RESEARCH*. Throughout the year. Professors DUKES and HAYDEN, and Associate Professor DYE.

ANIMAL PATHOLOGY, BACTERIOLOGY, AND IMMUNOLOGY

(See also BACTERIOLOGY, above)

Professors W. A. HAGAN, PETER OLAFSON, P. P. LEVINE; *Associate Professor* A. ZEISSIG; and *Assistant Professor* 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 subject, 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.* Two hours. Fall term.

40a. *General Pathology Laboratory.* Two hours. Fall term.

41. *Special Pathology.* Two hours. Spring term.

41a. *Special Pathology Laboratory.* Two hours. Spring term.

42. *Pathology of Infectious Diseases.* Two hours. Fall term.

46. *Diseases of Poultry.* Three hours. Spring term.

48. *Food Hygiene.* Two hours. Spring term.

149. *Pathogenic Bacteriology and Immunity.* Two hours. Spring term.

49a. *Pathogenic Bacteriology Laboratory.* Three hours. Spring term.

[151. *IMMUNOLOGICAL METHODS.* Prerequisites, 49, and 49a or 149. Associate Professor ZEISSIG. Class limited to twelve students. T Th 1:40–4. Laboratory fee, $10. Not given in 1946–47.]

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.* Spring term. One hour.

154. *SEMINARY.* Fall term, to be repeated in spring term. 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 AND VETERINARY PARASITOLOGY

Professors R. R. BIRCH, H. L. GILMAN, and *Associate Professor* 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.* Fall term. Two hours.

62a. *Parasites Laboratory.* Fall term. One hour.

63. *ADVANCED WORK IN ANIMAL PARASITOLOGY.* Either term. Associate 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 therapeutics 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. *Therapeutics.* Spring term. Five hours. (Not given in 1946.)

21. *Materia Medica and Pharmacy.* Spring term. One hour.

22. *Diseases of Small Animals.* Fall term. Three hours.

22a. *Diseases of Small Animals.* Fall term. Three hours.

23. *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 readings and reports.

24. *Small Animal Clinic.* Six actual hours a week.

25. Elective. Two hours.

VETERINARY MEDICINE, AMBULATORY CLINIC, AND OBSTETRICS INCLUDING DISEASES OF THE GENITAL ORGANS

Professor M. G. FINCHER; *Assistant Professors* W. J. GIBBONS, S. J. ROBERTS, and S. D. JOHNSON.

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 of the College.

VETERINARY SURGERY

Professor J. N. FROST and *Professor* A. G. DANKS.

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*. Summer term, to be repeated in spring 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 J. C. HINSEY, J. F. NONIDEZ, C. V. MORRILL, G. N. PAPANICOLAOU, C. L. YNTEMA, C. O. WARREN, W. HAMMOND, and W. A. GEOHEGAN.

Abundant material and sufficient apparatus are available for advanced study and work in the various branches of anatomy: embryology, histology, descriptive and experimental anatomy, neurohistology, and experimental neurology. 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.

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. In addition, the members of the staff offer work in the various phases of anatomy in which they are especially engaged. Technical and practical anatomical work are fully provided.

The requirements for either a major or a minor in anatomy will be determined for each individual case by the department of Anatomy, after consultation with

the authorized representative of the other departments involved. As a prerequisite for graduate work in anatomy, each student will be expected to have a thorough training in the fundamental sciences of physics, chemistry, and biology such as is required for admission to the Medical College.

BACTERIOLOGY AND IMMUNOLOGY

Professors JAMES M. NEILL, JOHN Y. SUGG, THOMAS P. MAGILL, and EDWARD J. HEHRE.

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.

Graduate 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, W. H. SUMMERSON, J. P. CHANDLER, JOHN L. WOOD, and JULIAN R. RACHELE.

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 JOHN G. KIDD, JACOB FURTH, CHARLES T. OLCOTT, and CURTIS M. FLORY.

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 selected collection of mounted museum specimens, in addition to an active file of preserved gross material for study. The histological collection is likewise 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 abundant opportunity for special work under the direct supervision of members of the department. Such work may include the investigation of some problem, and may be credited towards the applicant's graduate degree.

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 offered for the investigation of the action of drugs on the circulation, the autonomic nerves, and muscles. The department is well equipped with special apparatus, including electrocardiographs with amplifying system, and galvanometers with 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.

PHYSIOLOGY AND BIOPHYSICS

Professors Eugene F. Du Bois, Dayton J. Edwards, William H. Chambers, James D. Hardy, Robert F. Pitts, and Charles O. Warren.

Graduate and research training is provided for students who wish to prepare themselves for teaching and research in the physiology aspects of biological science, with special emphasis on the physical and chemical approach; those who desire to prepare themselves more adequately for clinical practice and research by advanced training in some phase of physiology; and those who are entering a career in human biology.

Instruction is at first provided through the medium of formal basic courses in this and other departments of the Medical School, and in the departments of physics and chemistry of neighboring universities. This work is paralleled by similar courses which deal with specialized subjects on a more advanced level. Finally, the student is associated with various members of the staff on a tutorial basis for instruction in special research problems.

The laboratories are equipped for research in most fields of physiology and biophysics with special facilities for investigations in neurophysiology and metabolism. There is an excellent library in the department.

The Russell Sage Institute of Pathology, which houses the calorimeter in the New York Hospital, is under the direction of the head of this department.

PUBLIC HEALTH AND PREVENTIVE MEDICINE

Professors WILSON G. SMILLIE and MORTON C. KAHN.

In this department candidates for the Ph.D. degree may elect Parasitology as a major subject. Members of this department have all carried on investigations in tropical countries, and an excellent collection of living and preserved parasitic material is available for study and research.

The medical school courses in both Public Health and Parasitology are acceptable as minor requirements for students who may desire to major in other departments of the University. 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 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. 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 AGRICULTURAL SCIENCES

AS PRESENTED IN THE NEW YORK STATE EXPERIMENT STATION AT GENEVA

A. J. HEINICKE, *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 eligible for membership on 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, 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 500 acres are available for work with fruits and vegetables.

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.

Students who plan to do part of their graduate work at Geneva should correspond with the Dean of the Graduate School concerning special regulations as to residence credit, special committees, etc.

FOOD SCIENCE AND TECHNOLOGY

Professors E. H. STOTZ, R. S. BREED, H. J. CONN, D. C. CARPENTER, G. J. HUCKER, C. S. PEDERSON, Z. I. KERTESZ, A. W. HOFER, G. L. MACK, G. W. PEARCE, F. A. LEE, J. C. MOYER, A. W. AVENS, W. B. ROBINSON, F. G. SMITH, J. C. HENING, and R. F. BROOKS.

Opportunities for graduate research in fundamental aspects of chemistry and bacteriology, particularly as applied to food problems, are offered: the chemistry and technology of food preservation; food bacteriology; the nutritive values of fruit and vegetable varieties; applied soil bacteriology; physiological and taxonomic studies of bacteria; insecticides and fungicides; protein chemistry; pectin and pectic enzymes; plant metabolism and enzymes.

THE CHEMISTRY OF FRUITS AND VEGETABLES. Professors KERTESZ and STOTZ.

THE PRESERVATION OF FRUITS AND VEGETABLES. Professors PEDERSON, STOTZ, LEE, MOYER, HENING, and BROOKS.

THE TECHNOLOGY OF THE PRESERVATION OF FRUIT JUICES. Professor PEDERSON.

NUTRITIVE VALUES OF FOODS. Professors STOTZ and ROBINSON.

FOOD POISONING. Professor HUCKER.

FOOD PACKAGING. Professor HUCKER.

FOOD AND FERMENTATION BACTERIOLOGY. Professor PEDERSON.

SOIL BACTERIOLOGY. Professors CONN and HOFER.

TAXONOMY OF BACTERIA. Professor BREED.

BIOLOGICAL STAINS. Professor CONN.

INSECTICIDES AND FUNGICIDES. Professors PEARCE, MACK, and AVENS.

PROTEIN CHEMISTRY. Professor CARPENTER.

THE CHEMISTRY OF PECTIN AND PECTIC ENZYMES. Professor KERTESZ.

PLANT METABOLISM AND ENZYMES. Professors STOTZ, SMITH, KERTESZ, and ROBINSON.

ENTOMOLOGY

Professors H. GLASGOW, F. Z. HARTZELL, S. W. HARMAN, P. J. CHAPMAN, E. H. WHEELER, D. M. DANIEL,* G. E. R. HERVEY, F. G. MUNDINGER, H. C. HUCKETT, F. L. GAMBRELL, L. A. CARRUTH, J. A. ADAMS, R. W. DEAN, and J. L. BRANN.

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 CHAPMAN, HARTZELL, HARMAN, MUNDINGER, DEAN, and BRANN.

VEGETABLE INSECTS. Professors GLASGOW, HERVEY, and CARRUTH.

INSECT PESTS OF NURSERY AND ORNAMENTAL PLANTS. Professor GAMBRELL.

APPLIED ECOLOGY. Professor HARTZELL.

APPLICATIONS OF BIOMETRY. Professor HARTZELL.

BIOLOGICAL CONTROL OF INSECTS. Professors WHEELER and ADAMS.

PLANT PATHOLOGY

Professors O. A. REINKING, J. M. HAMILTON, W. O. GLOYER, D. H. PALMITER, W. T. SCHROEDER, A. J. BRAUN, and R. E. FOSTER.

The Division offers opportunities for graduate research in diseases of fruits, vegetables, canning crops, and hops; fungicides; diseases caused by *Fusaria;* taxonomy of *Fusaria;* and ecology of plant diseases. Students may select problems as indicated below:

DISEASES OF FRUITS. Professors HAMILTON, REINKING, PALMITER, and BRAUN.

DISEASES OF VEGETABLES. Professors SCHROEDER, REINKING, and GLOYER.

* On leave for military service.

DISEASES OF CANNING CROPS. Professors SCHROEDER, REINKING, and FOSTER.

FUNGICIDES. Professors HAMILTON and SCHROEDER.

DISEASES CAUSED BY FUSARIA. Professor REINKING.

TAXONOMY OF FUSARIA. Professor REINKING.

ECOLOGY OF PLANT DISEASES. Professors SCHROEDER and REINKING.

POMOLOGY

Professors A. J. HEINICKE, R. WELLINGTON, G. D. OBERLE, JOHN EINSET, N. J. SHAULIS, R. W. BLEDSOE, and O. F. CURTIS, JR.

This Division is engaged in research in the following fields: genetics of fruit breeding; plant propagation and rootstocks including stock and scion relations; developmental morphology of deciduous fruits; orchard-soil management; orchard management; cytology, applied and theoretical. No formal courses are offered, but students may register for work on problems as indicated below:

FRUIT BREEDING PROBLEMS. Professors WELLINGTON and OBERLE.

ROOTSTOCK PROBLEMS, INCLUDING STOCK AND SCION RELATIONS. Professors CURTIS and BLEDSOE.

FERTILIZATION AND NUTRITIONAL STUDIES WITH TREES. Professor HEINICKE.

ORCHARD SOIL TECHNOLOGY. Professors HEINICKE and SHAULIS.

CYTOLOGY. Professor EINSET.

PHYSIOLOGY OF FRUIT PLANTS. Professors A. J. HEINICKE and CURTIS.

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, J. S. DAVIS, J. I. SHAFER, and W. T. TAPLEY.

Students may obtain, by arrangement, supervision of work on problems in the history and description of varieties, vegetable breeding, 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.

EFFECTS OF FERTILIZERS ON YIELD AND QUALITY OF VEGETABLES FOR MANUFACTURE. Professor SAYRE.

FERTILIZATION AND NUTRITIONAL STUDIES WITH VEGETABLES. Professors SAYRE and DAVIS.

VARIETY STUDIES OF VEGETABLES. Professor TAPLEY.

VEGETABLE BREEDING PROBLEMS. Professor SHAFER.

VEGETABLE CANNING CROP RESEARCH PROBLEMS. Professor SAYRE.

FELLOWS AND GRADUATE SCHOLARS IN 1943–1944 AND SUMMER TERM 1944

RESIDENT DOCTORS

Gertrude Aby Hanchett, Ph.B., University of Chicago, 1914; M.A., Syracuse University, 1934; Ph.D., Syracuse University, 1939.

Esther V. Hansen, A.B., Vassar College, 1921; A.M., Wisconsin University, 1922; Ph.D., Cornell University, 1930.

Cecil Su-sin Lee (Mr.), B.S., Madison College, 1940; M.S., Michigan University, 1941; Ph.D., Cornell University, 1943.

Ahmed Mohammed Mahrouki, M.S., University of California, 1939; Ph.D., Cornell University, 1943.

J. Maurice Richman, Ph.D., Fordham University, 1937.

ENDOWED AND UNIVERSITY FELLOWS

The Anna Cora Smith Fellowships in Home Economics: Dorothy J. Nagler, A.B., Albion College, 1938; Elizabeth Taylor Sheerer, B.S., Seton Hill College, 1938.

The Cornell Fellowship in English: Hope Bean, A.B., Swarthmore College, 1941.

Edgar J. Meyer Memorial Fellowship in Engineering Research: Bal D. Kalelkar, B.E. Mech.), University of Bombay, 1940; M.S., Massachusetts Institute of Tech., 1941.

The Erastus Brooks Fellowship in Mathematics: Mary P. Dolciani, A.B., Hunter College, 1944; A.M., Cornell University, 1945.

The Fellowship in American History: Harry Hubert Pierce, A.B., Syracuse University, 1940; M.A., Rutgers University, 1942.

The Fellowships in Greek and Latin: Mary Roberta Irwin, A.B., Indiana University, 1934; A.M., Indiana University, 1937; Stephanie Marie Jakimowitz, A.B., Hunter College, 1942; A.M., Cornell University, 1943; Helen Florence North, A.B., A.M., Cornell, 1942, 1943.

The Goldwin-Smith Fellowship in Botany: Jeanne LeCrenier, A.B., Radcliffe College, 1943.

The McGraw Fellowships in Civil Engineering: Mateo Lian Go, B.C.E., Cornell, 1942; M.E. in C.E., Massachusetts Institute of Technology, 1943; Richard Hsueh-Jui Pian, B.S., Tientsin University, 1941; M.S., Cornell, 1942.

The Schuyler Fellowships in Animal Biology: Robert Lee Livezey, B.S., Oregon State College, 1943; M.S., Oregon State College, 1944; Gunvantlal Amritlal Patel, B.S., Bombay University, 1938; M.S., Cornell, 1942.

The Susan Linn Sage Fellowships in Philosophy: Edward S. Spoerl, B.S., Wisconsin University, 1940; Anna Margaret Weber, A.B., Wilson College, 1942; A.M., Cornell, 1943.

The Susan Linn Sage Fellowship in Psychology: Jozef Bertram Cohen, S.B., Chicago University, 1942.

The University Fellowship in Agriculture: Henry Gabriel Elias Tabet, B.S., M.S.. Cornell, 1943, 1944.

The University Fellowship in Germanic Languages: Kaare R. Bergethon, A.B., DePauw University, 1938; A.M., Cornell, 1940.

SPECIAL TEMPORARY FELLOWSHIPS

Dow Chemical Company Fellowship: Bert Lear, B.S., Utah State Agriculture College, 1941.

Eli Lilly Company Fellowship: Luis A. Perez-Medina, Diplom-Chemiker, Georg-August University, 1938.

Frosted Foods Fellowship; Number 16: Doris Mae McWhorter, B.S., Oregon State College, 1943.

G.L.F. Poultry Fellowship: James McGinnis, B.S., North Carolina State, 1940.

Juice Clarification Fellowship: Robert Louis Messier, B.S., Worcester Polytechnic Institute, 1940; M.S., Massachusetts State College, 1941.

Merrell Fellowships: Lincoln Isaih Diuguid, B.S., West Virginia State, 1938; M.S., Cornell, 1939; Arthur S. Sucsy, B.S., Grove City College, 1942.

Nassau County Farm and Home Bureau Association Fellowship: Fred Morris Gordon, B.S., Massachusetts State College, 1942.

Near Eastern Foundation Greek Livestock Improvement Fellowship: Charalambos S. Stephanides, B.S., M.S., Cornell, 1932, 1941.

Near Eastern Homemaking Fellowship: Margaret J. Florea, B.S., Kansas State Teachers College, 1939.

Staten Island Growers' Fellowship: Aubrey Albert Foster, B.S., Cornell, 1939.

Texas Gulf Sulphur Company Livestock Insect Fellowship: John George Matthysse, B.S., Iowa State College, 1940.

Tobacco By-Products & Chemical Company Fellowship: Martin McRae Barnes, B.S., University of California, 1941.

W. Atlee Burpee Company Fellowship: Pao-Wah Ruby Lee, B.S., University of Hawaii, 1942.

Western Condensing Company Fellowship: Milton L. Scott, A.B., University of California, 1937.

SCHOLARS

The Graduate Scholarship in Architecture: David Zai-chen Chow, B.S., Saint Johns University, 1939.

The Graduate Scholarships in Civil Engineering: Chung J. Chu, B.S., Chiao-Tung University, 1936; D.I.C., Imperial College, 1939; Mateo Lian Go, B.C.E.,

Cornell, 1942; M.S. in C.E., Massachusetts Institute of Technology, 1943; Mei H. Loh, B.S., National Chiao-Tung University, 1941; M.C.E., Cornell, 1944.

The Graduate Scholarships in Greek and Latin: Rose Estelle Dubois, A.B., Hunter College, 1943; A.M., Cornell, 1944; Alice Sperduti, B.A., Ladycliff College, 1939; A.M., Cornell, 1943.

The Phi Kappa Phi Scholarship: Opal Gertrude Powell: B.S., M.S., Nebraska University, 1930, 1936.

The School of Education Scholarships: Dorothy Ellen Hammersley, B.A., Russell Sage College, 1943; Leah Audrey Strong, A.B., Allegheny College, 1943.

TUITION SCHOLARS

Charlotte C. Bernhardt, Doktor der Rechte, Hamburg University, 1932.

Fred W. Billmeyer, Jr., B.S., California Institute of Technology, 1941.

Samuel W. Blizzard, Jr., B.A., Maryville College, 1936; Th.B., Th.M., Princeton Theological Seminary, 1939, 1941; M.A., Hartford Seminary, 1944.

Yuan Stella Cheng, B.A., West China Union University, 1932; M.S., Yenching University, 1938.

Edith Mead Fox, A.B., A.M., Cornell, 1932, 1945.

Harrop A. Freeman, A.B., LL.B., Cornell, 1929, 1930.

Bruce L. Granger, A.B., A.M., Cornell, 1942, 1943.

Sarah Celia Harris, B.S., Russell Sage College, 1942.

Robert Leslie Hull, B.Mus., M.Mus., Eastman School of the University of Rochester, 1939, 1941.

Mary Jeanne Humphreys, B.A., Buffalo University, 1939; A.M., Cornell, 1944.

Mei Y. Li, B.A., Ginling College, 1931; M.Ed., Rochester University, 1943.

Mary Elizabeth Mies, S.B., Chicago University, 1935.

Mario Llarden Molina, Ingenieure Agriculteur, Ecole Superieur Libre D'Agr. de Purpan, 1930.

Luis Alberto Nazario, B.S., Puerto Rico University, 1935.

Hilah Foote Newton, A.B., New York State Teachers College, 1939.

Isidore Davis Passow, B.S., College of the City of New York, 1940.

Lisa Rauschenbusch, A.B., A.M., Cornell, 1940, 1945.

Mildred Rothblatt Ross, A.B., Cornell, 1943.

Gloria Edythe Rubin, B.A., Brooklyn College, 1943.

Joan of Arc Schmidt, A.B., Regis College, 1943.

Jane Elizabeth Sherrer, B.A., New Jersey College for Women, 1943.

Alice Sperduti, B.A., Ladycliff College, 1939; A.M., Cornell, 1943.

Ethel M. Takce, A.B., Brooklyn College, 1936.

Howard Elsworth Thomas, A.B., Wheaton College, 1934; B.D., Presbyterian Theological Seminary, 1937; A.M., Cornell, 1943.

Olive Branch Thomas, B.S., Oklahoma Agriculture and Mechanical College, 1916; M.A., Columbia University, 1927.

Ruth Margaret Thomas, Ph.B., Wheaton College, 1937; M.S., Cornell, 1943.

Forrest C. Travaille, B.S., Whitworth College, 1932; B.D., San Francisco Theological Seminary, 1935; M.S., Cornell, 1944.

Margaret Scoon Wilson, A.B., Cornell, 1938; A.M., Cornell, 1942.

CHINESE TUITION SCHOLARS

Pei L. Cheng, B.S., National Tsing Hua University, 1934; M.S., Cornell, 1945.

Y. S. Cheng, B.A., West China Union University, 1932; M.S., Yenching University, 1938.

Michael Chih-chi Chow, B.S., Nankai University, 1935.

Chung-Jui Chu, B.S., Chiao Tung University, 1936; D.I.C., Imperial College, 1939.

Fung Haan Fung, A.B., Radcliffe College, 1943.

Fung Ting Fung, B.S., Hawaii University, 1942.

Charlotte Kao, A.B., Lenoir Rhyne College, 1940; M.A., New York University, 1941.

Pao-wah Ruby Lee, B.S., Pennsylvania State College, 1942.

Mei Y. Li, B.A., Ginling College, 1931; M.Ed., Rochester University, 1943.

Shih-tsung Sang, B.M.E., National Hua Tsing University, 1938.

Jung-yi Tung Sung, B.S., National Szechuen University, 1939.

Samuel Hsuan Wang, A.B., National University of Peking, 1936.

LATIN-AMERICAN TUITION SCHOLARS

Taygoara F. Amorim, Chemico Industrial Agricola, Escola Superior de Agricultura e Medicina Veterinaria, 1925.

Josefina M. deMiller, B.A., North Carolina University, 1943.

Victor Lionel Guzman, Ingeriero Agronomo, National School of Agriculture and Veterinary Medicine, Lima, Peru, 1940.

Ricardo E. Jahn, Ingeniero Agronomo, Universidad Central de Venezuela, 1942.

Jefferson Firth Rangel, Engenheiros Agronomos, Escola Superior de Agricultura e Medicina Veterinaria, 1932.

Manuel Alberto Navarrette Rico, Ingeniero Agronomo, Facultad Nacionalde Agronomici de Me dellin, 1940.

Sebastian Anibal Romero, Ingeniero Agronomo, Universidad Central de Vene zuela, 1942.

Juan Antonio Villamil, D.V.M., National University of Bogota, 1942.

Jose Antonio Zelaya-Sotomayor, Graduated, Agricultural & Veterinary Medicine National School of Peru, 1941; M.S., North Carolina State College of Agriculture and Engineering, 1942.

FELLOWS AND GRADUATE SCHOLARS IN 1944–1945 AND SUMMER TERM 1945

RESIDENT DOCTOR

Cecil Su-sin Lee (Mr.), B.S., Madison College, 1940; M.S., Michigan University, 1941; Ph.D., Cornell, 1943.

ENDOWED AND UNIVERSITY FELLOWS

The Anna Cora Smith Fellowship in Home Economics: Marjorie E. Rankin, B.S., Russell Sage College, 1939.

The Charles Bull Earl Memorial Fellowship in Mechanical Engineering & Electrical Engineering: Raj P. Misra, B.S. in E.E., M.I.T., 1941.

The Clinton DeWitt Smith Fellowship in Agriculture: Ernest Mercier, B.A., B.S., University of Laval, 1939, 1943; M.S., Cornell, 1944.

The Erastus Brooks Fellowships in Mathematics: Mary P. Dolciani, A.B., Hunter College, 1944; A.M., Cornell, 1945; Irma Shocken, A.B., Barnard College, 1944.

The Fellowship in American History: Irene D. Neu, B.A., Marietta College, 1944.

The Goldwin Smith Fellowship in Botany: Gordon Ellsworth Hunt, A.B., Cornell, 1944.

The McGraw Fellowships in Civil Engineering: Mateo Lian Go, B.C.E., Cornell, 1942; M.S. in C.E., Massachusetts Institute of Technology, 1943; Mei-Hung Loh, M.C.E., Cornell, 1944; B.S., National Chia Tung University, 1941.

The Sage Fellowship in Chemistry: Jean Shu-chen Cheng, B.S., Monmouth College, 1944.

The Simon Henry Gage Fellowships in Animal Biology: Barbara Brooks, A.B., Radcliffe College, 1944; Margaret Chapman Ward, A.B., Mt. Holyoke College, 1937.

The Susan Linn Sage Fellowships in Philosophy: Alice Janette Bacon, A.B., Wells College, 1944; Anna Margaret Weber, A.B., Wilson College, 1942; A.M., Cornell, 1943.

The Susan Linn Sage Fellowship in Psychology: Jozef Bertram Cohen, S.B., University of Chicago, 1942.

The University Fellowship in Agriculture: Pei Lieu Cheng, B.S., National Tsing-Hua University, 1934; M.S., Cornell, 1945.

The University Fellowship in English: William C. Stokoe, Jr., A.B., Cornell, 1942.

The University Fellowship in Germanic Languages: Kaare R. Bergethon, A.B., De Pauw University, 1938; A.M., Cornell, 1940.

The University Fellowships in Greek and Latin: Stephanie Marie Jakimowitz, A.B., Hunter College, 1942; A.M., Cornell, 1943; Helen Florence North, A.B., A.M., Cornell, 1942, 1943.

The University Fellowship in History: Harry Hubert Pierce, A.B., Syracuse University, 1940; M.A., Rutgers University, 1942.

The University Fellowship in Romance Languages: Lewis Hall Gordon, A.B., A.M., Princeton University, 1927, 1928.

SPECIAL TEMPORARY FELLOWSHIPS

Allied Chemical and Dye Corporation Fellowship: Alfred J. Canale, A.B., Colgate University, 1942.

Birds-Eye Snider, Inc. Fellowship: Priscilla Shaw, B.S., University of Maine, 1944.

Cerophyl Fellowship: Louise Jane Daniel, B.S., University of Pennsylvania, 1935; M.S., Pennsylvania State College, 1936.

Dow Chemical Company Fellowship: Bert Lear, B.S., Utah State Agriculture College, 1941.

Innis, Speiden & Company Fellowship: Frank L. Stark, B.S., M.S., Rhode Island State College, 1937, 1939.

Merrell Fellowships: Lincoln T. Duiguid, B.S., West Virginia State College, 1938; M.S., Cornell, 1939; Aubrey Arnold Larsen, B.S., Antioch College, 1943; M.S., Michigan State College, 1944.

Nassau County Farm Bureau Association Fellowship: Fred Morris Gordon, B.S., Massachusetts State College, 1942.

Tobacco By-Products and Chemical Company Insecticide Fellowship: Martin McRae Barnes, B.S., University of California, 1941.

Western Condensing Company Fellowship: Milton L. Scott, A.B., University of California, 1937.

SCHOLARS

The Comstock Graduate Scholarship: David B. Turner, B.S.A., B.A., M.A., University of British Columbia, 1933, 1934, 1944.

The Graduate Scholarships in Animal Biology: Jung-yi T. Sun, B.S., National Szechuen University, 1939; Barbara Anna Woodward, B.A., Wooster College, 1944.

The Graduate Scholarship in Architecture: David Zai-chen Chow, B.S., St. Johns University, 1939.

The Graduate Scholarship in Botany: Mary Hickox Mandels, B.S., Cornell, 1939.

The Graduate Scholarships in Civil Engineering: Francis C. S. Hung, B.S. in C.E., Chiao Tung University, 1938; M.C.E., Cornell, 1945; Mei H. Loh, B.S., National Chiao Tung University, 1941; M.C.E., Cornell, 1944.

The Graduate Scholarship in Greek and Latin: Alice Sperduti, B.A., Ladycliff College, 1939; A.M., Cornell, 1943.

The Graduate Scholarships in History: Edith Mead Fox, A.B., A.M., Cornell, 1932, 1945; Eleanor Jane Goltz, B.A., University of Minnesota, 1943; A.M., Cornell, 1945; James E. Seaver, A.B., Stanford University, 1940; Betty Weigel, A.B., Stanford University, 1942.

The Graduate Scholarship in Psychology: Norma Wegner, A.B., Hunter College, 1944.

The Phi Kappa Phi Scholarship: Charlotte Susan Kaizer, B.S., Massachusetts State College, 1944.

TUITION SCHOLARS

Ruby Helen Adams, B.S., Miner Teachers College, 1944.

Priscilla S. Allen, A.B., West Virginia University, 1944.

Samuel W. Blizzard, Jr., B.A., Maryville College, 1936; Th.B., Th.M., Princeton Theological Seminary, 1939, 1941; M.A., Hartford Seminary, 1944.

Stella B. Brookes, A.B., Wiley College, 1923; A.M., Michigan University, 1930.

Wayne Burns, A.B., Miami University, 1938; A.M., Harvard University, 1940.

Nai Wei Chang, A.B., Central Political Institute of China, 1940.

Michael Chih-chi Chow, B.S. in E.E., Nankai University, 1935.

Li Chow, B.S., Chiao-Tung University, 1938.

Virginia Farrer Cutler, B.S., University of Utah, 1926; A.M. Stanford University, 1937.

Dsai Chewen Dju, B.S., National Central University, 1942.

Rose Estelle Dubois, A.B., Hunter College, 1943; A.M., Cornell, 1944.

Fung Haan Fung, A.B., Radcliffe College, 1943.

Catherine Hazel Grady, A.B., Cornell, 1939.

Bruce I. Granger, A.B., A.M., Cornell, 1942, 1943.

William Dunn Hackett, A.B., Drury College, 1936; A.M., Hartford Theological Seminary, 1941.

Irma Highbaugh, A.B., Baker University, 1915; A.M., Boston University, 1924.

David Kuang-tse Ho, B.S., National Tsing Hua University, 1940.

Edward Rih-hwa Ho, B.S., University of Nanking, 1942.

Pei Tung Hsu, B.S., Chiao-tung University, 1940.

Robert Leslie Hull, B.Mus., University of Rochester, 1939, 1941.

Mary Jeanne Humphreys, B.A., University of Buffalo, 1939; A.M., Cornell, 1944.

Tania Leshinsky, A.M., Radcliffe College, 1943.

Louise Allen McBee, B.A., M.S., University of Tennessee, 1938, 1939.

Geraldine McDonald McKee, B.A., Mills College, 1942.

Robert Jean Mangones, B.C.E., Cornell, 1943.

Lisa Rauschenbusch, A.B., A.M., Cornell, 1940, 1945.

Resat Ali Saribas, B.M.E., M.M.E., Cornell, 1943, 1944.

Carl W. Scheerer.

Joan of Arc Schmidt, A.B., Regis College, 1943.

Marcia Mae Schrump, B.S., Oregon State College, 1944.

Leon Seligman, B.A., Brooklyn College, 1944.

Lucille Gloria Stein, B.A., Queens College, 1944.

Jung-Yi Tung Sun, B.S., National Szechuen University, 1939.

Scott Alexander Swinehart, A.B., Heidelberg College, 1933; B.D., Colgate-Rochester Divinity School, 1936.

Howard Elsworth Thomas, A.B., Wheaton College, 1934; B.D., Presbyterian Theological Seminary, 1937; A.M., Cornell, 1943.

Ruth Margaret Thomas, Ph.B., Wheaton College, 1937; M.S., Cornell, 1943.

Olive Branch Thomas, B.S., Oklahoma Agriculture & Mechanical College, 1916; M.A., Columbia University, 1927.

Forrest C. Travaille, B.S., Whitworth College, 1932; B.D., San Francisco Theological Seminary, 1935; M.S., Cornell, 1944.

James Ella Turnley, B.S., Tuskegee Institute, 1944.

Samuel Hsuan Wang, A.B., National University of Peking, 1936.

Dorothy Campbell Williamson, B.A., Phillips University, 1939; A.M., University of Nebraska, 1941.

CHINESE TUITION SCHOLARS

Pei Wen Chao, B.S., University of Nanking, 1941.

Fung T. Fung, B.S., University of Hawaii, 1942.

Hai-Chang Benjamin Koo, B.S. in C.E., St. Johns University, 1941; M.S. in Eng., Cornell, 1942.

LATIN-AMERICAN TUITION SCHOLARS

Marta Coll-Camalez, B.S., University of Puerto Rico, 1944.

David de Aquino, D.V.M., Superior School of Agriculture & Veterinary Medicine, 1930.

Carlos Freire Gonzenbach, Ingeniero Agronomo, Universidad Central Ecuador, 1939; M.S., University of Florida, 1944.

Martin Hernandez-Ramirez, Jr., B.S. in Agr., University of Puerto Rico, 1938; M.S. in Agr., Cornell, 1945.

Miguel Angel Lugo-Lopez, B.S., University of Puerto Rico, 1943; M.S., Cornell, 1945.

Mario Molina-Llarden, Ingenieur Agriculteur, Ecole Superieure D'Agriculture du Sud-ouest, 1930.

Pierre Nadal, Ingenieur Civil, Ecole des Sciences Appliquees, 1934.

Jefferson F. Rangel, Engenheiros Agronomos, Escola Superior de Agricultura e medicina veterinaria, 1932.

Jose Santivanez-Morales, D.V.M., Cornell, 1944.

Juan A. Villamil, D.V.M., National University of Bogota, 1942.

Jose Antonio Zelaya, Graduated, Agricultural & Veterinary Medicine National School of Peru, 1941; M.S., North Carolina State College of Agriculture and Engineering, 1942; Ph.D., Cornell, 1945.

ADVANCED DEGREES CONFERRED IN 1943–1944

MASTERS OF ARTS

CONFERRED OCTOBER 23, 1943

Richard Morris Alexander, A.B.; Psychobiology, Neuro-Anatomy. Thesis: The Effects of Extract of Adrenal Cortex upon the Experimental Neurosis in Dogs.

Grace Antikajian, A.B.; Plant Physiology, Plant Pathology. Thesis: A Study of Certain Factors Influencing Solarization of Bean Plants.

Rinda May Bartlett, A.B.; English. Essay: The Lore of Warren County, New York.

Bertha Guttman Brenner, B.A.; Education.

Helen Maron Brown, A.B., B.S. in Ed.; Biological Sciences.

Lucille Elizabeth Clunk, A.B.; Social Studies.

Bruce Ingham Granger, A.B.; American Literature, Old and Middle English. Thesis: A Study of Herman Melville's Short Prose Works.

Lloyd Wilcox Hartman, B.S.; Speech and Drama.

Ralph Norman Helverson, A.B., B.D.; Philosophy of Religion, History of Philosophy. Thesis: Self-Transcendence of the Self in the Thought of Reinhold Niebuhr.

Florence Sarepta Holmes, A.B.; Social Studies.

Zelie Eleanor Horn, A.B., Latin Language and Literature, French Literature. Essay: A Rhetorical Study of Cicero's Catilinarian Orations.

Louise Gertrude Isfort, A.B.; Vertebrate Zoology, Science Education. Thesis: A Partial Bibliography of the Natural History of the Chicago Region.

Ruth Kenyon, B.A.; Speech and Drama.

Dorothy Wilson McCartney, B.A.; English Literature, Theory of Music. Thesis: Yeats and His Sources.

Kathleen Elizabeth McNiven, B.A., B.L.S.; Dramatic Literature, The English Drama. Thesis: Idealism in the Plays of Maxwell Anderson.

Elisabeth Walcott Oleson, A.B.; Family Life, Educational Psychology. Thesis: The Adjustment of a Group of Children to Life on a Refugee Boat.

Charlie Mae Otis, B.S., English.

Paul Bruce Pettit, A.B.; Dramatic Production, Dramatic Literature. Thesis: The Showboat Theatre — The Development of the Showboat on the Mississippi River and on the Eastern Waterways.

James Roy Phillippe, A.B.; Speech and Drama.

Sydney John Risk, B.A.; Dramatic Production, Speech and Phonetics. Thesis: The Proscenium and the Forestage.

Barbara Tupper Sullivan, A.B.; Social Studies.

Howard Elsworth Thomas, A.B., B.D.; Rural Sociology, Rural Education. Thesis: A Study of Leper Colony Policies.

Ruth Dixon Turner, B.S. in Ed.; Biological Sciences.

CONFERRED FEBRUARY 29, 1944

Ruth Helen Cook, B.A.; Home Economics.

Grace Elizabeth Miller, A.B.; English. Thesis: The Narrative Art of Sarah Orne Jewett.

Irma Ruth Moses, A.B.; Algebra, Geometry. Thesis: On a Certain Diophantine Equation.

Elizabeth Greenfield Wilson, A.B.; English. Essay: Thomas Wolfe: His Life and Personality.

CONFERRED JUNE 24, 1944

Carolyn Evans Finneran, A.B.; Social Studies.

Anne Ruth King, A.B.; English.

Jane Elinor Pritchard, A.B.; Foreign Languages.

Adelaide Nora Vagnarelli, A.B.; Social Studies. Essay: A History of Lumbering in the Ausable Valley (1800–1900).

Eira Morgan Williams, B.S.; English. Thesis: Shakespeare's Welshmen: Whence Do They Derive?

Evangeline Freda Zackey, A.B.; Social Studies.

MASTERS OF SCIENCE

CONFERRED OCTOBER 23, 1943

Edith Mildred Abbott, A.B., B.S.; Biological Sciences.

Barbara Bond, B.S.; Home Economics.

John Leo Curtin, B.S.; Experimental Physics, Theoretical Physics. Thesis: The Influence of a Transverse Magnetic Field on the Plasma Potential of a Glow Discharge.

Helen Louise Diehl, B.Sc. in H.E.; Home Economics.

Mary Louise Fagley, A.B.; Ornithology, Vertebrate Zoology. Thesis: Birds of the Lower Rio Grande Valley of Texas.

Ruth Constance Hastie, B.S.; Home Economics.

Marietta Claiborne Henderson, B.S.; Home Economics.

Betty Louise Hill, B.S. in H.E.; Home Economics.

Conrad Edmund Hoffmann, B.S.; Bacteriology, Animal Nutrition. Thesis: The Bactericidal and Bacteriostatic Action of Crystal Violet.

Alberta Mebane Levingston, B.S.; Education.

Reva Madeline Lincoln, B.S.; Animal Nutrition, Biochemistry. Thesis: A Study of Citrus Peel and Its Use for Marmalades of a High Vitamin C Content.

Grace Lillian Melchor, B.S.; Home Economics.

E. Jane Miller, B.S. in H.E.; Home Economics.

Lillian Lee Pieper, A.B.; Plant Morphology, Cytology. Thesis: A Comparison of the Floral Anatomy of Certain Members of the Ericaceae, the Diapensiaceae, and the Epacridaceae.

Mabel Annie Potter, B.S. in Ed.; Botany, Nature Study. Thesis: A Study of the Distribution of the Woody Plants of Adams Mountain and Vicinity, Franklin County, Massachusetts.

Charles Frederick Reeder, B.S.; Zoology, Animal Physiology. Thesis: Effect of Adrenalectomy on Mammary Gland Structure in the Immature Male Rat.

Eleanor Lorena Schrader, A.B.; Biological Sciences.

Muriel Ellsworth Starr, B.S.; Home Economics.

Daniel Augustus Swope, Jr., B.S.; Marketing, Prices and Statistics. Thesis: An Analysis of Milk Delivery in Jamestown, New York, as a Basis for Planning a Unified Delivery System.

Emily Jackson Woodruff, A.B.; Biological Sciences.

CONFERRED FEBRUARY 29, 1944

Katharine Stoneman Duroe, A.B., B.S.; Home Economics.

Eleanor Harriet Holmwood, B.S. in H.E.; Home Economics.

Margaret Goldie Phillips, B.S.; Foods and Nutrition, Family Life. Thesis: The Effect of Several Household and Quantity Cooking Procedures and of Home Freezing on the Ascorbic Acid, Thiamine, and Riboflavin Retention in Certain Vegetables.

Ethel Harriet Saxton, A.B., B.S. in H.E.; Home Economics.

CONFERRED JUNE 25, 1944

De Graff Everett Bliss, A.B.; Education, Entomology. Thesis: A Critical Evaluation of a Reading Program in a Central School.

Clayton Thomas Bridges, B.S.; Agricultural Education, Agricultural Economics. Thesis: Certain Factors That Influence the Continuation of Pupils in School — A Study of the Area of Clymer Central School, New York.

Phoebe Betty Butwenig, B.A.; Bacteriology, Biochemistry. Thesis: A Study of Some of the Factors that Affect the Stability of Carotene in Solution.

Georg Frostenson, B.S. in Agr.; Business Management, Marketing. Thesis: Some Structural and Functional Characteristics of Various Types of Egg Marketing Associations in the United States.

Carlos Garcés Orejuela, Ingeniero Agronomo; Plant Pathology, Plant Physiology. Thesis: New or Heretofore Unreported Species of the Higher Ascomycetes from Colombia and Venezuela.

Helen Hager Gifft, B.S. in H.E.; Nutrition, Foods. Thesis: Urinary Excretion of Thiamine of Normal Adults at the Level of Intake Recommended by the National Research Council.

Ella Gertrude Gleim, B.S.; Foods and Nutrition, Biochemistry. Thesis: The Ascorbic Acid, Thiamin, Riboflavin, and Carotene Content of Asparagus and Spinach in the Fresh, Stored, and Frozen State Both Before and After Cooking.

Marie Lax Hailperin, A.B.; Foods and Nutrition, Family Life. Thesis: The Thiamin Content of Potatoes.

Sarah Celia Harris, B.S.; Animal Nutrition, Biochemistry. Thesis: Carotene and Ascorbic Acid in Fresh and Salted Vegetables.

Dorothy Elizabeth Lyon, B.A.; Foods, Nutrition. Thesis: The Ascorbic-acid Content of Home-canned Tomatoes.

Ansel Robert Martin, D.V.M.; Veterinary Parasitology, Endocrinology. Thesis: Comparative Studies of the Effects of Anthelmintics against the Sheep Nematodes.

Gennard Matrone, B.S.; Animal Nutrition, Biochemistry. Thesis: A Study of Lignin and Cellulose Methods for the Chemical Evaluation of Feeds.

Ann Carolyn Moore, B.S.; Nutrition, Animal Nutrition. Thesis: Vitamin C Metabolism in Adult Subjects on the Recommended Daily Allowance; A Comparison of Several Criteria for Judging the State of Nutrition with Respect to Vitamin C.

Edward Randolph Moser, A.B.; Ornithology, Vertebrate Zoology. Thesis: A Preliminary Check-List of the Birds of Idaho.

Joseph William Motz, B.S. (Ed.); Physics, Mathematics. Thesis: Temperature and Frequency Dependence of the Elastic Properties of Some Plastics.

Arthur Jerome Newman, A.B.; Organic Chemistry, Biochemistry. Thesis: (Title withheld for military reasons).

Shirley Jane Smith, B.S. in Ed.; Education.

MASTER OF EDUCATION

CONFERRED OCTOBER 23, 1943

Nancy Jessup Underwood, A.B.

CONFERRED JUNE 25, 1944

Dorothy Ellen Hammersley, B.A.

MASTERS OF SCIENCE IN EDUCATION

CONFERRED OCTOBER 23, 1943

John Milo Avery.

Lilla Frances Cortright, B.S. in H.E.

Eloise Hannah Daly, B.S.

Lillian Rushmeyer Desoe, B.S. Thesis: An Experimental Study of the Integration of Shorthand and Typewriting Instruction in One Course, Transcription

Charlotte Alice Duncan, B.S. in H.E.

Ruth Elizabeth Goldsmith, B.S. in H.E.

Walfred John Johnson, E.E.

Theodore Peter Judway, B.S.

Clio Sharpe Reinwald, B.S. in H.E.

William Wollard Rogers, M.E. Thesis: A Study of the Development of a Mathematics Achievement Test for Use in the Selection of Entrants to the Ninth Year of a Technical and Industrial High School.

Agnes Ruth Shaw, B.S. in H.E.

Margaret Thorp, A.B. Thesis: Adaptation and Simplification of "Aida" by Giuseppe Verdi, for Use in the Sixth Grade.

Kenneth David Wells, B.S.

CONFERRED JUNE 25, 1944

James Davison Rupert, A.B. Thesis: A Critical Study of Researches on the Motion Picture and its Effects upon Adolescents with Application to the Teaching of English.

MASTERS OF SCIENCE IN AGRICULTURE

CONFERRED OCTOBER 23, 1943

Fausto Eduardo Calderon-Gené, Ingeniero Agronomo; Soils, Analytical Chemistry. Thesis: The Rapid Determination of Soluble Mineral Nutrients in Plant Tissues.

Walter Leonard Fields, Jr., B.S.; Agricultural Economics. Thesis: A Study of the Trends in Size of Farms in Selected Areas of the United States.

Earle Wayne Klosterman, B.S.; Animal Husbandry, Animal Nutrition. Thesis: A Study of Three Levels of Protein, Quality of Protein as Supplied by Various Supplements, and the Effect of Shearing with Fattening Lambs.

Julio Oscar Morales, B.S. in Agr.; Farm Management, Marketing. Thesis: A Credit Study of 167 Tobacco Farms, Puerto Rico, 1939–40.

Andrew Vanvig, B.S.; Agricultural Economics, Marketing. Thesis: Wartime Adjustments in the Rural Economy of the Elmira-Corning Region.

George Edwin Webster, B.S. in Agr.; Agricultural Education, Agricultural Engineering. Thesis: The Discovery of Factors Involved in the Conduct of Courses for the Repair or Construction of Farm Machinery and Equipment — A Study of Vermont's Experience.

CONFERRED FEBRUARY 29, 1944

Franklin Sankoh Anthony, B.S.; Technical Agriculture.

David Baxter Fales, B.S.; Rural Sociology, Agricultural Economics. Thesis: Social Participation and Membership Characteristics of Farm Youth in Cortland County, New York.

CONFERRED JUNE 25, 1944

John Lawrence Goheen, B.A.; Rural Sociology.

Ernest Mercier, B.A., B.S. Agr.; Animal Breeding, Genetics. Thesis: The Relationship between the Proportion of Morphologically Abnormal Spermatozoa and Other Criteria of Bull Semen Quality.

MASTER OF REGIONAL PLANNING

CONFERRED OCTOBER 23, 1943

Leslie Tse-chiu Kuo, B.Comm., A.M., Ph.D.; Regional and City Planning, Land Economics and Farm Finance. Thesis: Planning Chinese Cities.

MASTERS OF SCIENCE IN ENGINEERING

CONFERRED OCTOBER 23, 1943

Wing Ching Lam, B.S. (M.E.); Heat-Power Engineering, Automotive Engineering. Thesis: Heat and Power Supply for a Hotel in China.

Kenneth Eugene Rose, Metallurgical Engineer; Materials of Engineering, Metallography. Thesis: The Heat Treatment and Hardenability of Cast Iron.

Edwin Ben Watson, B.S.; Heat-Power Engineering, Administrative Engineering. Thesis: Summer Weather Data in Relation to Cooling Loads.

CONFERRED FEBRUARY 29, 1944

Andrew Peter Boehmer, B.S.; Heat-Power Engineering, Materials of Engineering. Thesis: The Hardness Testing of Plastics.

Heliodore Aimé Marcoux, B.S.; Experimental Mechanical Engineering, Administrative Engineering. Thesis: An Investigation of the Microstructure of Alloyed and Unalloyed Cast Iron Liners.

Charles Ralph Scott, Jr., B.S. in A.E.; Industrial Accounting, Industrial Engineering. Thesis: Taxes and Accounting As Presented To Students of Management Engineering.

CONFERRED JUNE 25, 1944

Salvatore Russell Allu, B.S. in Ch.E.; Chemical Engineering, Physical Chemistry. Thesis: (Requirement waived).

Carl Adolph Hering, B.S.; Chemical Engineering, Physical Chemistry. Thesis: (Requirement waived).

William Amos Hiatt, B.S. in Chem. E.; Chemical Engineering, Physical Chemistry. Thesis: (Requirement waived).

Robert Ernest Odening, B.S.; Chemical Engineering, Physical Chemistry. Thesis; (Requirement waived).

Charles Wesley Shinnamon, Jr., B.S.; Chemical Engineering, Physical Chemistry. Thesis: (Requirement waived).

Richard Nicholas Work, A.B.; Applied Physics, Electrical Communications. Thesis: Elastic Losses and Their Frequency Dependence in Natural and Synthetic Rubbers.

MASTER OF CHEMICAL ENGINEERING

CONFERRED JUNE 25, 1944

Theodore Strait Williams, B.S. in Eng.; Chemical Engineering, Physical Chemistry. Thesis: Wet Grinding Studies.

MASTERS OF CIVIL ENGINEERING

CONFERRED OCTOBER 23, 1943

Edward August Miller, C.E.; Structural Engineering, Mechanics. Thesis: A Study of the Strength of Short, Thin Walled Steel Studs.

CONFERRED FEBRUARY 29, 1944

Francis William Montanari, B.C.E.; Sanitary Engineering, Structural Engineering. Thesis: Digestion Studies Using Cloroben.

MASTERS OF MECHANICAL ENGINEERING

CONFERRED FEBRUARY 29, 1944

Israel Katz, B.S. in M.E.; Experimental Mechanical Engineering, Automotive Engineering. Thesis: 1. The Design and Construction of a Direct Reading Mean Effective Pressure Indicator for Testing and Balancing Two Stroke Cycle Diesel Engines. 2. A Survey of Engine Devices.

CONFERRED JUNE 25, 1944

Resat Saribas, B.M.E.; Industrial Engineering, Machine Design. Thesis: A Study of Specifications of a Factory to Manufacture Ten Thousand .50 Caliber Machine Gun Mountings Per Month.

DOCTORS OF PHILOSOPHY

CONFERRED OCTOBER 23, 1943

Thurston Madison Adams, B.S., M.S.; Prices and Statistics, Public Finance, Marketing. Thesis: Prices Paid by Vermont Farmers for Goods and Services and Received by Them for Farm Products, 1790–1940; Wages of Vermont Farm Labor 1780–1940.

George Napoleon Asai, B.S.; Plant Physiology and Floriculture (joint major), Plant Pathology, Vegetable Crops. Thesis: A Study of Frost Injury and Resistance in Garden Roses.

Benjamin Franklin Barrentine, B.S., M.S.; Animal Nutrition, Biochemistry, Animal Physiology. Thesis: The Availability of the Calcium and Phosphorus of Defluorinated Rock Phosphates to the Animal Organism.

Barnard Hinkle Bissinger, A.B., M.A.; Mathematical Analysis, Algebra, Aeronautical Engineering. Thesis: Generalizations of Continued Fractions.

Walden Philip Boyle, B.A., A.M.; Drama and the Theatre, Speech and Phonetics, Dramatic Literature. Thesis: Basic Elements of Art in the Theater.

John Chalmers, A.B.; Public Finance, Money, Banking, and International Finance, Economic Theory and Its History. Thesis: The New York State Personal Income Tax 1919–1943.

George Francis Condike, A.B.; Inorganic Chemistry, Chemical Microscopy, Organic Chemistry. Thesis: A Study of the System Ammonia-Boron Trifluoride.

Edmund Harold Crane, B.S. in Comm., M.A.; Rural Education, Rural Sociology, Economic Theory and Its History. Thesis: The Cost and Quality of School Bus Transportation and the Distribution of State Aid for Transportation in New York State.

Sala Dasananda, B.S.; Plant Breeding, Animal Breeding, Cytology. Thesis: Quantitative and Qualitative Inheritance in Barley.

William Hetherington Durfee, A.B., M.A.; Algebra, Geometry, Physics. Thesis: Congruence of Quadratic Forms over Valuation Rings.

Elaine Forsyth, B.E., M.A.; Social Studies Education, American History, American Literature. Thesis: An Experiment in the Teaching of Certain Map Reading Skills at the Junior High School Level.

Edith Jeffers Freeman, B.S., M.S.; Sociology, Family Life, Education. Thesis: Social Class as a Factor in the Family Group Relations of Certain New York Farm Families.

Barbara Samson Granger, A.B., A.M.; Histology and Embryology, Anatomy, Physiology. Thesis: Studies on the Hormonal Control of the Early Growth of the Mammary Gland in the Rat.

Alfred Harvey Grommon, A.B., A.M.; American Literature, Dramatic Literature, Education. Thesis: James Russell Lowell's Writings on Liberty, Abolition, and Public Affairs (1836–1861).

Franklin Albert Hamm, B.S., M.S.; Chemical Microscopy, Organic Chemistry, Physical Chemistry. Thesis: (title withheld for military reasons).

James Francis Hartmann, A.B.; Histology and Embryology, Invertebrate Zoology, Anatomy and Physiology. Thesis: Seasonal Cytological Changes in the Hypophysis of *Thamnophis sirtalis sirtalis* (Linné).

Margaret Riis Hasenpflug, B.S.S., M.A.; Drama and the Theatre, Dramatic Literature, Speech Training and Phonetics. Thesis: The Development of A Danish-Scandinavian Dramatist, 1880–1904 and A Translation of *Under the Law* by Edvard Brandes.

Gerald Thomas Hudson, B.S., M.S.; Rural Sociology, Sociology, Agricultural Economics. Thesis: The Social Status of Rural Households Living in Three Selected Low-Income Areas of New York State, 1940.

Frank Rogers Hunter, B.S.; Economic Geology, Structural Geology, Stratigraphy. Thesis: Geology of the Alabama Tin Belt.

Arthur Valdemar Jensen, A.B., A.M.; Psychobiology, Physiology, Neurology. Thesis: A Study of the Experimental Neurosis in Dogs.

James Arthur Krumhansl, B.S. in E.E., M.S.; Experimental Physics, Theoretical Physics, Electrical Communications. Thesis: (Title withheld for military reasons).

Oliver Lilburn Lacey, A.B.; Experimental Psychology, Physiology and Neurology, Biochemistry. Thesis: The Dependence of Behavior Disorder in the Rat upon Blood Composition.

Cecil Su-sin Lee, B.S., M.S.; Economic Entomology, Plant Pathology, Insect Physiology. Thesis: Toxicity Studies of Some Chinese Insecticidal Plants.

Ahmed Mohammed Mahrouki, M.S.; Vegetable Crops, Plant Breeding, Plant Physiology. Thesis: The Effect of Certain Ecological Factors on the Growth of the Radish (Raphanus Sativus L.).

Charles Thomas Male, Jr., B.S., M.S.; Agricultural Engineering, Public Administration and Finance, Soils. Thesis: Some Problems of Town Highway Superintendents in New York State.

John George Matthysse, B.S.; Economic Entomology, Animal Husbandry, Insect Toxicology. Thesis: The Biology and Control of Cattle Lice.

Frieda Louise Meyer, B.S., M.S.; Nutrition, Biochemistry, Animal Nutrition. Thesis: Ascorbic Acid Requirement and Metabolism of Preschool Children.

Norris George Nereson, B.A., S.M.; Experimental Physics, Theoretical Physics, Physical Chemistry. Thesis: (Title withheld for military reasons).

Gerald Oster, Sc.B. in Chem.; Physical Chemistry, Theoretical Physics, Mathematics. Thesis: Experimental and Theoretical Studies of Dielectrics.

Thomas Edward Poag, A.B., M.A.; Drama and the Theatre, Speech and Phonetics, Dramatic Literature. Thesis: The Negro in Drama and the Theatre.

Seth Alison Pope, A.B.; Plant Pathology, Plant Physiology, Biochemistry. Thesis: Some Studies on the Dutch Elm Disease and the Causal Organism.

Elmer Earl Puls, B.S., M.S.; Agricultural Education, Rural Secondary Education, Supervision. Thesis: District Supervision in Vocational Education in Agriculture in Certain States of the Southern Regions.

Daniel Scott Sears, B.S.; Inorganic Chemistry, Physical Chemistry, Organic Chemistry. Thesis: A Study of Some Addition Compounds of Boron Trichloride and Boron Trifluoride.

Mortimer Paul Starr, B.A., M.S.; Bacteriology, Biochemistry, Plant Pathology. Thesis: Studies of Phytopathogenic Bacteria.

Roland Stucki, B.S., M.S.; Money, Banking, and International Finance, Prices and Statistics, Economic Theory and Its History. Thesis: Stabilization of Consumption.

Harry John Sykes, A.B., M.S.; Organic Chemistry, Biochemistry, Inorganic Chemistry. Thesis. N-Nitrosoacylarylamines. Studies of Their Preparation and Catalysis in Addition Polymerization.

Paul Southworth Symonds, B.S., M.S.; Mechanics, Applied Physics, Fluid Mechanics. Thesis: Concentrated Force Problems in Plane Strain, Plane Stress, and Transverse Bending of Plates.

John Howard Thatcher, B.A., A.M.; Rhetoric and Public Speaking, Speech and Phonetics, Dramatic Literature. Thesis: Public Discussion of Civil Service Reform, 1864–1883.

Harlan Lloyd Tuthill, B.S.; Physical Chemistry, Organic Chemistry, Inorganic Chemistry. Thesis: Phase Equilibria in the Systems Cesium Bromide-Water, Cesium Bromide-Bromine, and Cesium Bromide-Iodine Monobromide.

Frederick Carl Gustav Von der Lage, B.S.; Theoretical Physics, Applied Physics, Mathematics. Thesis: A Method for Obtaining the Energy Levels and Wave Functions of Crystalline Solids and the Application of the Method to Sodium.

Walter W. Wainio, B.S., M.S.; Physiology, Biochemistry, Anatomy. Thesis: Concerning the *In Vitro* Destruction of Crystalline Insulin by Normal and Diabetic Human Blood.

Dwight Albert Webster, B.S.; Limnology and Fisheries, Vertebrate Zoology, Medical Entomology. Thesis: Fishery Management Studies of Connecticut Lakes.

Philip John Westgate, B.S. in Agr., M.S. in Agr.; Soils, Plant Physiology, Pomology. Thesis: Fluorine-Phosphorus Relationships in Some New York Soils.

Lillian Jaffin White-Stevens, A.B., A.M.; Latin, Greek, English Language and Literature. Thesis: The Myths of Homer's Iliad.

John Richard Wilmeth, B.A., M.A.; Social Studies Education, Modern European History, Sociology. Thesis: An Experiment in Teaching Time Relations in Junior High School American History.

William Abell Wimsatt, A.B.; Histology and Embryology, Animal Physiology, Ornithology. Thesis: A Study of Certain Aspects of the Reproductive Cycle and Development of Two American Vespertilionid Bats, Myotis L. lucifugus and Eptesicus F. fuscus.

Field Howard Winslow, B.S., M.S. in Chem.; Organic Chemistry, Physical Chemistry, Inorganic Chemistry. Thesis: The Reaction of 1,4-Dibromo-2-butene with Ammonia and Certain Related Compounds.

CONFERRED FEBRUARY 29, 1944

Fitzhugh Willets Boggs, B. ès S., B.S.; Physical Chemistry, Physics, Mathematics. Thesis: I. A Theory of the Ionization Constants of the Benzene-Dicarboxylic Acids. II. A Method for Measuring Dielectric Loss of Solids and Liquids at Low and Moderately High Frequencies.

Margaret Eggleston Brown, A.B., M.S.; Histology and Embryology, Neuro-Anatomy, Zoology. Thesis: The Histology of the Tadpole Tail During Metamorphosis, With Special Reference to the Nervous System.

Jack James Ramsay Campbell, B.S.A.; Bacteriology, Biochemistry, Organic Chemistry. Thesis: Citric Acid Metabolism of Homofermentative Lactic Acid Bacteria.

James Rolston Donnalley, B.S.; Chemical Engineering, Organic Chemistry, Physical Chemistry. Thesis: A Study of Home Freezer Design.

John Littell Eaton, A.B.; Physical Chemistry, Industrial Chemistry, Mathematics. Thesis: A Phase Study of the Condensed System: Soduim Iodide, Iodine, Water.

Fred Thomas Fiedorek, B.S. in Chem.; Organic Chemistry, Physical Chemistry, Inorganic Chemistry. Thesis: (Title withheld for military reasons).

James Foster Harrington, B.Sc. in Agr., M.Sc.; Vegetable Crops, Plant Physiology, Soils. Thesis: A Study of the Usefulness of Plant Tissue Tests in Determining the Fertilizer Requirements of Spinach and Snap Beans.

Frederic William Hill, B.S., M.S.; Animal Nutrition, Animal Physiology, Organic Chemistry. Thesis: Studies of Unidentified Vitamins Required by the Chick.

Rolland Theodore Hinkle, B.S. in M.E., M.S.; Machine Design, Mechanics, Automotive Engineering. Thesis: Theory and Generation of Elliptical Gears.

James McGinnis, B.S., Animal Nutrition, Organic Chemistry, Biochemistry. Thesis: Studies on the Utilization by the Chick of Phosphorus Supplied Entirely from Plant Sources.

Paul Bruce Marsh, A.B., M.S.; Plant Pathology, Plant Physiology, Biochemistry. Thesis: Salts as Antidotes to Copper in its Toxicity to the Conidia of *Sclerotinia fructicola.*

John Whipple Olmsted, A.B., B.A., M.A.; Modern European History, English History, Political Theory. Thesis: The Académie Royale des Sciences and the Origins of the First French Scientific Expeditions, 1662–1671.

Jesse Rodgers Delbert Otis, B.S., M.S. in Agr.; Agricultural Economics, Rural Sociology, Agricultural Education. Thesis: Changes in Characteristics of Type of Farming Areas in Alabama, 1880–1940.

Alfred Milton Peiser, A.B., A.M.; Applied Mathematics, Mathematical Analysis, Physics. Thesis: Some Applications of Fourier Analysis and Calculus of Probability to the Study of Real Roots of Algebraic Equations.

Bert Lorn Richards, Jr., B.S.; Plant Pathology, Plant Physiology, Physical Chemistry. Thesis: Studies on the Influence of the Apple Scab Fungus *Venturia inaequalis* (Cke.) Wint. on the Photosynthesis, Transpiration, and Respiration of McIntosh and Baldwin Leaves.

James Allen Robertson, A.B., M.A.; Inorganic Chemistry, Physical Chemistry, Chemical Microscopy. Thesis: The Heat of Combustion and Heat Capacity of Boron.

James Daniel Stroupe, A.B., M.S., Physical Chemistry, Organic Chemistry, Physics. Thesis: (Title withheld for military reasons).

Sien-moo Tsang, B.S., M.S.; Organic Chemistry, Chemical Engineering, Inorganic Chemistry. Thesis: (Title withheld for military reasons).

Jean Valerie Elizabeth Whitehead, B.A., M.A.; American Literature, Literary Theory and Criticism, Dramatic Literature. Thesis: The Art of Stephen Crane.

Ernest Herbert Wood, B.S.; Organic Chemistry, Physical Chemistry, Inorganic Chemistry. Thesis: (Title withheld for military reasons).

CONFERRED JUNE 25, 1944

William Parker Anslow, Jr., B.S. in Chem.; Biochemistry, Organic Chemistry, Physiology. Thesis: The Synthesis of the Isomers of Cystathionine and a Study of their Metabolism.

Norman John Bowman, A.B., M.S.; Organic Chemistry, Analytical Chemistry, Inorganic Chemistry. Thesis: Some New Derivatives of 6-Methoxy-8-Amino-Quinoline.

George Francis Carrier, M.E.; Mechanics, Mathematics, Physics. Thesis: Investi-

gations in the Field of Aeolotropic Elasticity and the Bending of the Sectorial Plate.

Chi-Cheng Chang, B.C.E., M.C.E.; Management Engineering, City and Regional Planning, Hydraulic Engineering. Thesis: Municipal Management.

Fred Carl Chromey, B.S., Experimental Physics, Theoretical Physics, Mathematics. Thesis: (Title withheld for military reasons).

Vincent Winner Cochrane, B.S.; Plant Pathology, Plant Physiology, Organic Chemistry. Thesis: Studies on the Common Leaf Rust of Cultivated Roses, Caused by *Phragmidium Mucronatum* (Fr.) Schlecht.

David Edwards Cook, B.S. in Chem. Eng.; Chemical Engineering, Physical Chemistry, Mechanics. Thesis: The Production of Toluene by Disproportionation Reactions.

Harry Wesley Coover, Jr., B.S., M.S.; Organic Chemistry, Analytical Chemistry, Inorganic Chemistry. Thesis: The Synthesis of Substituted Pyridines and Pyridones.

Peter Paul Rupprecht Debye, Experimental Physics, Theoretical Physics, Physical Chemistry. Thesis: (Title withheld for military reasons).

Karl Herman Dittmer, B.S., M.S.; Biochemistry, Physiology, Bacteriology. Thesis: A Microbiological Study of the Structural Specificity of Biotin.

Fred Irvine Elliott, B.S. in Agr.; Animal Husbandry, Animal Nutrition, Genetics. Thesis: Studies on Some Problems Related to the Successful Artificial Insemination of Dairy Cattle.

Ethel Elizabeth Ewing, B.A., A.M.; Social Studies Education, far Eastern History, Anthropology. Thesis: An Interpretation of Chinese Culture for American Secondary School Pupils.

Nicholas Gale, A.B., A.M.; The Classical Period, Dramatic Literature, Education. Thesis: The Work of William Shenstone.

Ernest Kenneth Gatcombe, B.S., M.S. in Eng.; Machine Design, Mechanics, Mathematics. Thesis: Lubrication Characteristics of Involute Spur Gears.

Charles Hatfield, Jr., A.B., M.A.; Mathematical Analysis, Algebra, Theoretical Physics. Thesis: On the Average Number of Roots of Certain Random Functions.

Oliver Harold Hewitt, B.A., M.S.; Ornithology, Vertebrate Zoology, Botany. Thesis: Waterfowl Food Plants and the Duck Population at the Head of Cayuga Lake.

Melvin Sidney Hofstad, D.V.M., M.S.; Poultry Diseases, Animal Pathology, Pathogenic Bacteriology. Thesis: A Study of Infectious Bronchitis in Chickens.

Frank Vincent Kosikowsky, B.S., M.S. in Agr.; Dairy Science, Bacteriology, Biochemistry. Thesis: The Effect of High Temperature and Various Chemical Agents upon the Heat Stability, Browning and Apparent Change in Lactose Concentration of Whole and Evaporated Milk.

Wilmer Leroy Kranich, B.S. in Che.E.; Chemical Engineering, Physical Chemistry, Organic Chemistry. Thesis: (Title withheld for military reasons).

James Francis Ryan, Jr., B.S. in Ch.E.; Organic Chemistry, Physical Chemistry, Biochemistry. Thesis: (Title withheld for military reasons).

Charalambos Stephoros Stephanides, B.S., M.S., Animal Husbandry, Animal

Breeding, Rural Sociology. Thesis: A Program of Livestock Rehabilitation and Improvement in Post War Greece.

Ulrich Paul Strauss, A.B.; Physical Chemistry, Physics, Mathematics. Thesis: The Depolarization of Light in High Polymer Solutions.

John William Strohecker, B.S.E., Chemical Engineering, Heat-Power Engineering, Physical Chemistry. Thesis: The Rate of Absorption of Carbon Dioxide by Solutions of Sodium Carbonate in a Hurdle Tower.

John Fanning Thompson, A.B., Biochemistry, Physics, Plant Physiology. Thesis: An Analytical Procedure for the Microdetermination of Cobalt and its Application to Physiological Experiments.

Harold Hamilton Williams, B.S., M.S. in Agr.; Ornamental Horticulture, Botany, Floriculture. Thesis: A Study of Landscaping in Negro Communities of the South Eastern States.

Michael Winesanker, B. Mus., A. M. Musicology, Eighteenth Century Literature, English History. Thesis: The Record of English Musical Drama, 1750–1800.

Eugene Clinton Winslow, A.B., M.S.; Organic Chemistry, Soils, Inorganic Chemistry. Thesis: The Addition of Dienophiles to Cyclopentadiene.

Herbert Fessenden Wright, A.B., M.S.; Organic Chemistry, Biochemistry, Analytical Chemistry. Thesis: (Title withheld for military reasons).

ADVANCED DEGREES CONFERRED IN 1944–1945

MASTERS OF ARTS

CONFERRED OCTOBER 24, 1944

Ernestine Baldridge Boorom, B.S. in Ed.; English. Essay: Speech-Rhythms in Modern American Poetry.

Genevieve Marguerite Carlson, B.A.; Dramatic Production, Dramatic Literature. Thesis: Modern Poetic Drama.

Rose Estelle Dubois, A.B.; Foreign Languages.

Mary Jeane Humphreys, B.A.; English. Essay: Four Critics of Milton: Dennis, Addison, Jonathan Richardson, Louder.

Lula White Johnson, B.S.; English.

Mary Susan MacDowell, B.A.; The Victorian Period, English History. Thesis: The Historical Background of Anthony Trollope's *Warden*.

Cassie Marsh, A.B.; English Literature, Education. Thesis: *The Wise-woman of Hogsdon,* by Thomas Heywood: Edited with Introduction and Notes.

Dorotha June Nagler, A.B.; Child Development and Child Guidance, Family Relationships and Marriage. Thesis: Techniques Used by Preschool Children to Enter Social Groups.

Hilah Foote Newton, A.B.; English. Essay: Four Interpretations of New York State's Indians.

Jeanette Mann Read, A.B.; Personnel Administration.

Doris Elizabeth Sanford, A.B.; Secondary Education, English Literature 1700–. Thesis: Thematic Units for Tenth Grade English.

Leah Audrey Strong, A.B.; English. Essay: Charles Dudley Warner.

CONFERRED FEBRUARY 22, 1945

Mary Patricia Dolciani, A.B.; Algebra, Mathematical Analysis. Thesis: The Semi-orthogonal Reduction of Second Order Matrices in K (p).

Lois Dorothea Odell, B.A.; Biological Sciences.

Lisa Rauschenbusch, A.B.; Drama and the Theatre, Dramatic Literature. Thesis: *Critique of the Theatre: Essay in Systematic Dramaturgy.* A Translation of *Kritik Der Bühne.* Versuch zu Systematischer Dramaturgie, by Julius Bab. (Oesterheld and Co. Verlag, Berlin. 1908).

Irving Reiner, B.A.; Algebra, Mathematical Analysis. Thesis: On the Number of Classes in Genera of Quaternary Quadratic Forms.

Ingeborg Rogel, A.B.; Animal Physiology, Endocrinology. Thesis: The Effect of Various Concentrations of Pregnant Mare Serum (Gonadin) on the Reproductive Tract of the Mature Female Guinea Pig.

Mildred Schulman Ross, A.B.; English.

Hans Karl Weiss, A.B.; Organic Chemistry, Physical Chemistry. (Title withheld for military reasons).

Ann Carolyn White, A.B.; Sociology, Regional and City Planning. Thesis: A Delineation of Rural-Farm Housing Regions in New York State.

CONFERRED JUNE 24, 1945

Ruby Helen Adams, B.S.; Education.

Priscilla Schermerhorn Allen, A.B.; English.

Ruth Frank Brinkley, Licencé-ès-Lettres; Organic Chemistry, Inorganic Chemistry. Thesis: Transformations of Substituted 2-Pyridones.

Margaret Ellin Firestone, A.B.; Social Studies.

Edith Mead Fox, A.B.; American History, English History. Thesis: William Johnson's Early Career As A Frontier Landlord and Trader.

Feb Grobman, B.A.; English Literature from 1700, Prose Fiction. Thesis: George Meredith: A Study in the Development of a Technique of the Novel.

Betty Carol Kelly, A.B.; Biological Sciences.

Cletus Paul Kohake, B.A.; Education.

Patricia Ann Lassalle, A.B.; Foreign Languages.

Jeanne Le Crenier, A.B.; Plant Morphology, Nature Study. Thesis: The Morphology of the Inflorescence and Flowers of *Mitchella repens* L.

William Judson Le Veque, B.A.; Algebra, Mathematical Analysis. Thesis: On Transcendental Numbers.

James Hirsch Lorie, A.B.; Prices and Statistics, Land Economics and Farm Finance. Thesis: Relationship of Monthly Fluctuations in Industrial Production and Commodity Prices to Monthly Fluctuations in the Prices of Industrial Common Stocks, 1921–1941.

Ellen Mary McTiernan, A.B.; English. Thesis: Irish Ballads and Songs in America.

Josefina Morales de Miller, B.A.; Rural Sociology, Educational Psychology. Thesis: The Discriminative Value of Selected Opinion Statements for a Rural Life Attitude Scale.

Irene Dorothy Neu, B.A.; American History, English History. Thesis: Land Credit in Frontier Wisconsin.

Mildred Jeannette Pangburn, A.B.; Biological Sciences.

MASTERS OF SCIENCE

CONFERRED OCTOBER 24, 1944

Mildred Louise Babcock, B.S. in H.E.; Home Economics.

Florence Louise Bailey, B.S. in H.E.; Home Economics.

Paul Boulanger, D.V.S.; Pathogenic Bacteriology, Animal Physiology and Biochemistry. Thesis: Comparative Studies of Listeria monocytogenes, Erysipelothrix rhusiopathiae, Corynebacterium pyogenes and Corynebacterium renale.

Lucille Eleanor Frech, B.S.; Nutrition, Animal Nutrition. Thesis: A Dietary Study of Cornell University Women.

Jesus Freire Eiras, Contador Publico Nacional; Prices and Statistics, Marketing. Thesis: Economic Aspects of the Production of Cotton in Argentina.

Ruth Leah Highberger, A.B.; Family Life, Educational Psychology. Thesis: The Relationship Between Certain Personality Needs of Two Preschool Children and the Principles Operating in their Guidance.

Ethel Turner Johnson, B.S.; Education.

Frederic Cutter Merriam, B.S.; Organic Chemistry, Inorganic Chemistry. Thesis: Substituted Benzyl Thiuronium Chlorides for the Identification of Organic Acids.

Mary Elizabeth Mies, S.B.; Home Economics.

Eliot Deming Pratt, S.B.; Agricultural Economics. Thesis: Professional Farm Management Services in the United States.

Ethan James Randall, B.S.; Agricultural Education, Farm Management. Thesis: The Study Sheet as a Device in Meeting the Requirements of Good Method in Teaching Vocational Agriculture.

Jefferson Firth Rangel, Engenheiros Agronomos. Plant Pathology, Economic Entomology. Thesis: Two Alternaria Diseases of Cruciferous Plants.

Clyde Newton Rogers, B.A.; Rural Sociology, Agricultural Economics. Thesis: The Social Development of Reading Community.

Sebastian Anibal Romero, Ingeniero Agronomo; Soils, Statistical Methods of Analysis. Thesis: A Study of Soil Variability at Mount Pleasant.

Elizabeth Taylor Sheerer, B.S. in H.E.; Home Economics.

Joseph Henry Stevenson, B.S.; Farm Management, Marketing. Thesis: Variations in Business Factors on New York Farms of Different Types.

Henry Gabriel Elias Tabet, B.S.; Animal Husbandry, Agricultural Economics. Thesis: Comparison of Methods of Feeding and Management in Fattening Yearling Steers and Steer Calves.

Forrest Clifford Travaille, B.S., B.D.; Agricultural Engineering.

Douglas C. Williams, B.S.; Materials of Engineering, Experimental Mechanical Engineering. Thesis: A New Furnace for Testing Foundry Sands at Elevated Temperatures and Some Factors Involved in Testing Technique.

CONFERRED FEBRUARY 22, 1945

Kermit Molyneaux Bird, B.S.; Business Management, Marketing. Thesis: An Analysis of the Cooperative Assessment Fire Insurance Companies of New York State.

Pei-Lieu Cheng, B.S.; Animal Breeding, Animal Husbandry. Thesis: Some Problems of Livestock Production in China.

Frank Victor Dunderman, B.S.; Physical Chemistry, Organic Chemistry. Thesis: A Study of the Absorption and Raman Spectra of Dimethyl Ether Boron Trifluoride.

Lucius Roscoe Fancher, B.S., A.B.; Physics, Applied Mathematics. Thesis: The Electrical Resistance of Thin Lead Films.

Ricardo Enrique Jahn-Adoue, Ingeniero Agronomo; Soils, Statistical Methods of Analysis. Thesis: A Study on the Valencia and Guataparo Soils of the Valencia Lake Basin of North Central Venezuela.

Mario Leon Juncosa, A.B.; Mathematics, Physics. Thesis: An Integral Equation Related to Bessel Functions.

John Kenneth McClennan, B.S.; Organic Chemistry, Inorganic Chemistry. Thesis: Polymerization of Styrene Employing N, N'-Dinitroso-4, 4'-Dibromosuccindianilide as Catalyst.

Abraham Morton Mark, B.A.; Mathematical Analysis, Algebra. Thesis: Multi-Dimensional Fourier Integrals.

Manuel Alberto Navarrete-Rico, Ingeniero Agronomo; Plant Breeding, Plant Pathology. Thesis: A Potato Improvement Program for Colombia.

Sarah Bent Ransom, A.B.; Science Education, Biology. Thesis: An Annotated List of Projects and Teaching Aids Related To High School Chemistry.

Arthur Charles Santora, B.S.; Physics, Physical Chemistry. Thesis: The Conductivity of Thin Metallic Films.

Nancy Lee Seger, B.S. in H.E.; Foods and Nutrition, Animal Nutrition. Thesis: A Study of Infant Feeding Practices As Used With Cornell's 45 "Practice House" Babies From 1920–44.

Elizabeth Catherine Selke, B.S.Ed.; Nutrition, Foods. Thesis: A Study of Soy Flour Products. The Calculated Nutritive Value of Selected Recipes; The Acceptability of A Soy Bread.

Robert James Tedeschi, A.B.; Organic Chemistry, Analytical Chemistry. Thesis: Substituted Carbobenzoxy Chlorides, and the Conversion of Cephaeline to Emetine.

Jeannette Swenson Tolhurst, A.B.; Biological Sciences.

CONFERRED JUNE 24, 1945

Catherine Adelle Behnke, A.B.; Home Economics.

Elizabeth Schmeck Brown, B.S. in H.E.; Textiles and Clothing, Economics of the Household and Household Management. Thesis: American Women's Dress as Seen in a Fashion Publication, 1870–1890 (The Bustle Era).

Fung Haan Fung, A.B.; Nutrition, Foods. Thesis: The Availability of the Indigestible Residue in Chinese Celery Cabbage.

Edward Rih-Hwa Ho, B.S.; Prices and Statistics, Money, Banking and International Finance. Thesis: Foreign Trade of Agricultural Products of China.

William Ralph Le Grow, B.S.A.; Diseases of Large Animals, Animal Nutrition. Thesis: The Relation of the Opsonic Index to Brucella Infection and Immunity in Cattle.

Stanley Harold Logan, B.S.; Limnology and Fisheries, Vertebrate Zoology. Thesis: The Literature of Stream Improvement Work and Suggestions for Increasing the Carrying Capacity of Six-Mile Creek.

Leslie Haverton Lord, D.I.C.T.A.; Animal Husbandry, Diseases of Large Animals. Thesis: A Program for the Improvement of Livestock in St. Vincent, B.W.I. with Special Reference to the Development of a Dairy Industry.

Victoria Evelyn MacKenzie, B.S.; Foods and Nutrition, Institutional Management. Thesis: Ascorbic Acid Retention in One Market-Fresh Vegetable and Three Frozen Ones in Large-Scale Food Service.

Mavis Carlotta Nymon, B.S.; Animal Nutrition, Biochemistry. Thesis: Niacin, Riboflavin, and Thiamine Studies on Dehydrated Pork.

Marjorie Eunice Rankin, B.S.; Textiles and Clothing and Household Art, Education. Thesis: A Study of Alterations Made in Ready-To-Wear Clothing in Two Women's Specialty Stores.

Jose Santivanez-Morales, D.V.M.; Diseases of Large Animals, Animal Pathology. Thesis: The In Vivo and In Vitro Activity of Streptothricin Against Brucella Abortus.

Donald Scochman, B.S.; Bacteriology.

Arlene Rebecca Seaman, B.S. in Ed.; Biological Sciences.

Betty Winans Sharp, A.B.; Social Studies.

Veronica Mary Stodola, B.S.(H.E.); Institution Foods, Nutrition. Thesis: Ascorbic Acid Retention in Two Vegetables in Institution Food Service: Preliminary Preparation and Holding of Raw Potatoes and Cabbage; Holding of Cooked Cabbage for Serving.

Paul Sink Thompson, B.S.; Marketing, Farm Management. Thesis: An Analysis of Relative Sales of Late-Crop Potatoes Sold at Retail, Buffalo, Rochester, and Syracuse, 1939–40 Season.

Juan Antonio Villamil, D.V.M.; Biological Sciences.

Frances Elizabeth Volz, B.Sc. in Agr.; Animal Nutrition, Animal Physiology. Thesis: The Role of Various Fats in the Lactation Performance of the Albino Rat.

Alga Dorothy Weaver, B.Sc. in H.E.; Economics of the Household and Household Management, Family Life. Thesis: The Use of Carpentry Tools As A Resource In Home Management.

MASTERS OF SCIENCE IN EDUCATION

CONFERRED OCTOBER 24, 1944

Ethelwyn Gibson Cornelius, B.S.

Emma Rose Elliott, B.S.

John Cameron Fraser, B.S.

Peter Philip King, B.S.

CONFERRED FEBRUARY 22, 1945

Mary Angela Couch, B.S.

Glenn May Ungerer, A.B.; Thesis: A Survey of the Status of the High School Graduates of Schoharie County from the Year 1930 to 1939.

CONFERRED JUNE 24, 1945

Abelard Joseph Desenclos.

Blanche B. Nechanicky, B.S.; Thesis: The Status of Private Trade School Education for Girls and Women in New York State.

MASTERS OF SCIENCE IN AGRICULTURE

CONFERRED OCTOBER 24, 1944

Luis Alberto Nazario, B.S. in Agr.; Farm Management, Marketing. Thesis: A Credit Study of the Lajas Valley, Puerto Rico 1942–43.

CONFERRED FEBRUARY 22, 1945

Chester Higby Freeman, B.S.; Farm Management, Business Management. Thesis: A Study of the Distribution of Labor Incomes and Other Related Factors on New York Farms During the Period 1907–1936.

CONFERRED JUNE 24, 1945

Dwight Livingstone Foster, D.I.C.T.A.; Prices and Statistics, Soils. Thesis: A Study of Sampling as Applied to Marketing Research Based on Factual Information on Retailer and Consumer Demand for Apples and Other Fruits in New York City, November 1939.

MASTER OF ARCHITECTURE

CONFERRED FEBRUARY 22, 1945

David Zai-chen Chow, B.S.; Architectural Design, Regional and City Planning. Thesis: A Modern Chinese Opera House.

MASTERS OF SCIENCE IN ENGINEERING

CONFERRED OCTOBER 24, 1944

Paul Denzil Ankrum, B.S.E.E., A.B.; Electrical Communications, Electric Power Generation, Transmission, and Distribution. Thesis: Electronic Voltage Regulator for a Direct-Current Generator.

CONFERRED JUNE 24, 1945

Morris Nathan Blaine, B.S. in Ch.E.; Chemical Engineering, Organic Chemistry. Thesis: A Discussion of the Stability of Nitrocellulose Base Smokeless Powder.

Sandford Lee Carter, B.S. in Chem. E.; Chemical Engineering, Mathematics. Thesis: Petroleum Products as Raw Materials for Explosives.

Hugh Wyman Howard, B.S.; Chemical Engineering, Theoretical Hydraulics. Thesis: (Title withheld for military reasons).

Clarence Bernard Mansky, B.S. (Mech.E.); Mechanics, Mathematics. Thesis: The Application of Finite Difference Equations to the Shear Lag Problem.

Harold Reuben, B.Ch.E.; Chemical Engineering, Organic Chemistry. Thesis: Theory of the Ignition of a Propellant Powder.

Charles Atherton Richardson, B.S. in Chem. Eng., M.S.; Chemical Engineering, Fluid Mechanics. Thesis: Wood Pulp for Nitration.

Harold W. Ritchey, B.S. in Ch.E., M.S., Ph.D.; Chemical Engineering, Fluid Mechanics. Thesis: Mechanics and Thermodynamics of Propulsion by Jets.

Martin Wright Sampson, Jr., B.S. in A.E.; Administrative Engineering, Applied Psychology. Thesis: A Study of Industrial Absenteeism.

Si-Chin Shao, B.S.; Heat-Power Engineering, Industrial Engineering. Thesis: The Combustion Gas Turbine, Its Development, Thermodynamics, Applications and Prospects.

Howard Edward Somers, B.S. in Ch.E.; Chemical Engineering, Physical Chemistry. Thesis: The Advantages of Nitroguanidine as an Explosive.

Walton Herschel Welch, B.S., M.S.; Chemical Engineering, Physical Chemistry. Thesis: Explosives Waste Treatment.

Robert Paul Theodore Young, B.Ch.E.; Chemical Engineering, Mathematics. Thesis: Some Considerations in the Design of Tracers.

MASTERS OF CIVIL ENGINEERING

CONFERRED OCTOBER 24, 1944

Mei-hung Loh, B.S.; Structural Engineering, Regional and City Planning. Thesis: Deflection of Truss.

CONFERRED FEBRUARY 22, 1945

Francis Chung Siu Hung, B.S. in C.E.; Structural Engineering, Regional and City Planning. Thesis: Analyses of Prestressed Reinforced Concrete.

MASTERS OF MECHANICAL ENGINEERING

CONFERRED OCTOBER 24, 1944

Kuo-Jen Kang, B.S.E.E., M.E.E.; Heat-Power Engineering, Industrial Engineering. Thesis: A Study of the Theory and Practice of the Application of Pulverized Coal Firing in the Modern Steam-Generating Stations.

CONFERRED FEBRUARY 22, 1945

Mehmet Sami Gonul, B.S. in M.E., Machine Design, Materials of Engineering. Thesis: A Study of Methods of Production and Stress Analysis in Gun Barrels.

Mehmet Ali Oksal, B.S. in M.E., Machine Design, Industrial Engineering. Thesis: Design and Manufacturing of a Rifle Barrel.

DOCTORS OF PHILOSOPHY

CONFERRED OCTOBER 24, 1944

Albert Carl Beer, A.B.; Physics, Physical Chemistry, Mathematics. Thesis: (Title withheld for military reasons).

Grant Etherington Blanch, B.S., M.S.; Marketing, Land Economics and Farm Finance, Economic Theory and Its History. Thesis: Apple Quality and Its Effect on Price and Rate of Sale.

James Lewis Brann, Jr., B.S.; Economic Entomology, Plant Pathology, Insect Toxicology. Thesis: The Biology and Control of the Scurfy Scale, *Chionaspis furfura* Fitch.

Alice Mary Briant, B.Sc., M.S.; Foods and Nutrition, Biochemistry, Animal Physiology. Thesis: Thiamine and Riboflavin Retention in Three Frozen and One Market-Fresh Vegetable Prepared in the Navy Mess-Hall and Similar Studies Under Controlled Conditions on Two of the Frozen Vegetables.

Yuan Ying Stella Cheng, M.S.; Nutrition, Foods, Biochemistry. Thesis: The Effect of Sprouting on the Nutritive Value of Soybeans: The Ascorbic Acid Content and the Protein Quality.

Pradisth Cheosakul, B.Sc., M.S. in Chem.; Organic Chemistry, Biochemistry, Physical Chemistry. Thesis: The Structure of Anacardol.

Chung-jui Chu, B.S. in C.E., D.I.C.; Geodetic Surveying, Mathematics, Physics. Thesis: Another Method of Determining the Tilt of an Aerial Photograph and Some Suggestions on Improving the Stereocomparagraph Method of Mapping.

Martha Elizabeth Curtis, A.B., A.M.; Nature Study and Rural Education, Botany, Zoology. Thesis: A Study of the Relation of Some Science Materials Known to Certain Algonkian Indians to Present Elementary Science Teaching.

James Edwin Dewey, B.S., M.S.; Insect Toxicology, Vegetable Crops, Economic Entomology. Thesis: Toxicity Studies of Some Activators of Pyrethrum Dusts on the German Cockroach.

Leonea Barbour Dudley, A.B., A.M.; Drama and the Theatre, Dramatic Production, Dramatic Literature. Thesis: The Language of Comedy: An Introductory Analysis of the Verbal Forms of the Comic Spirit in Drama.

Richard Roy Dunham, A.B., A.M.; Drama and the Theatre, Dramatic Literature, Rhetoric and Public Speaking. Thesis: The Birth of the Modern Theatre.

Frieda Almira Gillette, A.B., A.M.; American History, English History, International Law and Relations. Thesis: The New York State Constitutional Convention of 1938.

Lois May Hutchins, B.A., A.M.; Invertebrate Zoology, Embryology, Science Education. Thesis: The Effect of Tetanizing and of Alternating Current upon the Division Rate of *Stylonychia pustulata* (Ehrenberg).

Richard Berndt Johnson, B.A., M.S.; Pathogenic Bacteriology, Biochemistry, Animal Pathology. Thesis: Studies on the Complement Fixation Reaction as Applied to Bovine Tuberculosis.

Bal Dattatrey Kalelkar, B.E.(Mech.), M.S.; Automotive Engineering, Machine Design, Mechanics. Thesis: A Study of Intake Manifold Design with Special Em-

phasis on the Distribution Characteristics of a Six-Cylinder Engine Equipped with a Twin-Carburetor Layout.

Margaret Philbrick Kellogg, B.A., M.S.; Histology and Embryology, Human Anatomy and Physiology, Zoology. Thesis: The Postnatal Development of the Oviduct of the Rat.

Eleanor Elaine Knowles, B.S., M.S.; Economics of the Household and Household Management, Family Life, Physiology-Psychology. Thesis: Posture and other Physiological Responses of the Worker in Relation to the Height of Working Surface Used in Household Ironing.

Julius John Krauklis, B.S. (Chem.Eng.), M.S.; Chemical Engineering, Fluid Mechanics, Mathematics. Thesis: Study of Sieve Plates with Air and Water.

Harold Levine, B.S.; Theoretical Physics, Experimental Physics, Mathematics. Thesis: (Title withheld for military reasons).

William Gilman McCollom, A.B., A.M.; Dramatic Literature, Dramatic Production, Elizabethan Literature. Thesis: Illusion and Formalism in Elizabethan Tragedy.

Joseph William Miller, A.B., A.M.; Drama and the Theatre, Rhetoric and Public Speaking, Dramatic Literature. Thesis: Working Methods of Modern Playwrights.

William Montagna, B.A.; Histology and Embryology, Entomology, Vertebrate Zoology. Thesis: A Re-investigation of the Development of the Wing of the Fowl.

Edward William Noland, A.B., A.M.; Sociology, Statistics, Rural Sociology. Thesis: Factors Associated with Absenteeism in a South Central New York State Industry.

Charles Lawrence Norton, B.S.; Animal Husbandry, Agricultural Economics, Animal Physiology. Thesis: The Value of Ground Whole Grains Versus By-Product Feeds, and the Value of Various Amounts of Corn Gluten Feed in Concentrate Mixtures for Dairy Cows.

Tarmo Abraham Pasto, B.S., A.M.; Educational Psychology, Education, Painting. Thesis: An Investigation of Three Systems of Teaching Drawing.

Luis Arcesio Perez-Medina, Diplom-Chemiker; Organic Chemistry, Animal Physiology, Analytical Chemistry. Thesis: Pyridine Derivatives Related to Pyridoxin.

John Theodor Reich, German Literature, German Philology, Dramatic Production. Thesis: The Actor in German Fiction from Goethe to Mörike (1776–1832).

George Philip Rice, Jr., B.S., A.M.; Educational Psychology, Rhetoric and Public Speaking, English History. Thesis: Speakers and Speeches in Tudor and Stuart History: A Study of Personalities in Politics.

John Mead Richardson, B.S.; Physical Chemistry, Physics, Mathematics. Thesis: Part I. (withheld for military reasons). Part II. The Canonical Distribution.

Lloyd Eugene Slater, B.S., M.S.; Farm Management, Marketing, Soils. Thesis: An Economic Study of Fruit Farming in Wayne County, New York, 1940–42.

George Horsley Smith, A.B., M.A.; Social Psychology, Psychology, Sociology. Thesis: A Quantitative and Qualitative Study of American Attitudes Toward Russia (the Soviet Union).

Irving Andruss Spaulding, B.S., M.S.; Rural Sociology, Social Psychology, Dramatic Production. Thesis: Farm Labor Camps for Youth in New York State.

John Benjamin Clark Watkins, B.A., M.A.; Old Norse Icelandic Language and Literature, Victorian Literature, Danish, Norwegian, Swedish Literature. Thesis: The Life and Works of Gustav Wied.

George Martin Weimann, A.B., M.S.; Organic Chemistry. Inorganic Chemistry, Physical Chemistry. Thesis: A Study of Some Trifluoroacetoacetic Esters.

James Carrick White, B.S.; Bacteriology, Dairy Industry, Biochemistry. Thesis: Streptococci From Subacute Bacterial Endocarditis.

John Mowll Wrightson, A.B., A.M.; Organic Chemistry, Physical Chemistry, Inorganic Chemistry. Thesis: The Relative Reactivities of Some Substituted Phenyl Fluorides.

CONFERRED FEBRUARY 22, 1945

John Hart Andreen, B.S.; Organic Chemistry, Biochemistry, Inorganic Chemistry. Thesis: (Title withheld for military reasons).

Morton Edward Bitterman, B.A., A.M.; Psychology, Animal Physiology, Experimental Psychology. Thesis: Studies in Visual Fatigue and Efficiency.

Jozef Bertram Cohen, S.B.; Experimental Psychology, Systematic Psychology, Educational and Mental Measurement (including statistics). Thesis: The Color Adaptation of the Human Eye.

Jorge de Alba, B.S., M.S. in Agr.; Animal Breeding, Animal Husbandry, Animal Diseases. Thesis: The Response of Ovariectomized Heifers to Injections of Estrogen and Progesterone.

Frank Willard Dittman, B.S. in Ch.E., M.Chem.E.; Chemical Engineering, Physical Chemistry, Inorganic Chemistry. Thesis: (Title withheld for military reasons).

Edna Drill, B.S. in Ed., M.S.; Nature Study, Botany, Zoology. Thesis: A Study of Science Interests of Certain Elementary School Children of New York State as Revealed in Their Free Discussion Periods.

Edward Fisher, B.S.; Theoretical Physics, Experimental Physics, Mathematics. Thesis: Quantum Theory of Photoconductivity and Photoelectric Effect in Sodium Chloride Crystals.

Jose Gomez-Ibanez, Lic. Cienciano Oceanografo, M.A.; Physical Chemistry, Inorganic Chemistry, Physics. Thesis: Determination of Activity Coefficients by the Cryoscopic Method.

Walter Richard Harrison, B.S., M.S.; Rural Sociology, Rural Education, Rural Economy. Thesis: The Attitudes of the Negro Towards the Church.

Julius Mitchell Hastings, B.A.; Physical Chemistry, Physics, Mathematics. Thesis: An Electron Diffraction Apparatus with a Sector: The Structure of Neo-Pentyl Chloride and Silico-Neo-Pentyl Chloride.

Mary Roberta Irwin, A.B., A.M.; Latin Language and Literature, Greek Literature, Ancient History. Thesis: Republicanism and Freedom of Speech in Rome in the First Century.

William Cary Kelly, B.S. in Agr., M.Sc.; Vegetable Crops, Plant Physiology, Soils. Thesis: The Effect of Rate and Time of Application of Nitrogen on the Growth and Yield of Potatoes. (Solanum tuberosum L.).

John Flaig Lingenfelter, B.S.; Biochemistry, Animal Nutrition, Organic Chemistry. Thesis: Studies on the Autoxidation of Pork Fat.

Neil Adams McNall, B.S. in Ed., M.A.; American History, Modern European History, English History. Thesis: An Agricultural History of the Genesee Valley, 1790–1860.

Gunvantlal Amritlal Patel, B.S., M.S.; Economic Entomology, Insect Physiology, Meteorology. Thesis: The Influence of Carbon Tetrachloride on Insecticidal Efficiency of Certain Fumigants.

Emil Frederick Taschenberg, A.B.; Economic Entomology, Biochemistry, Insect Physiology. Thesis: Studies on the Control of Grape Berry Moth, *Polychrosis viteana* (Clemens) in Chautauqua County.

Georgiana Josephine von Tornow, A.B., A.M.; Drama and the Theatre, Dramatic Literature, Speech and Phonetics. Thesis: The Heroine in American Drama and Theatre Down to the Civil War: And Her Relation to "Life" and the Novels of the Times.

George Frederick Warren, Jr., B.S.; Vegetable Crops, Soils, Plant Physiology. Thesis: Studies of a Rye Cover Crop in its Relation to Nitrogen, Soil Moisture, and the Yield of Certain Vegetable Crops.

José Antonio Zelaya-Sotomayor, M.S.; Animal Husbandry, Animal Nutrition, Dairy Industry. Thesis: A Suggested Program for the Development of Dairying in the Coastal Zone of Peru.

CONFERRED JUNE 24, 1945

Winthrop Dexter Bellamy, B.S.; Bacteriology, Biochemistry, Organic Chemistry. Thesis: A Function of Vitamin B_6.

Robert Thomas Beyer, B.A.; Physics, Mathematics, Physical Chemistry. Thesis: (Title withheld for military reasons).

Fred Wallace Billmeyer, Jr., B.S. in Sc.; Physical Chemistry, Inorganic Chemistry, Physics. Thesis: (Title withheld for military reasons).

Walter Charles Brandsma, B.S. in Chem.E.; Chemical Engineering, Physical Chemistry, Organic Chemistry. Thesis: The Cooling of Water Saturated Air in a Glass Heat Exchanger.

Lincoln Isaiah Diuguid, B.S., M.S.; Organic Chemistry, Inorganic Chemistry, Analytical Chemistry. Thesis: Benzothiazole Derivatives for Antimalarial Studies.

Dorothy Schaefer Genghof, A.B.; Bacteriology, Biochemistry, Anatomy. Thesis: Serological Studies on the Levans Synthesized From Sucrose by a Bacillus and by a Streptococcus.

Lewis Hall Gordon, A.B., A.M.; Italian, French Literature, French Philology. Thesis: The Critical Edition of the Authenticated Sonnets of Antonio Pucci (1309–1388) Found in Two Florentine Manuscripts Magliab. VII. 1145 and Laurentian-Rediano 184.

Lyle Everest Hagman, B.Sc. in Agr., M.S.; Economic Entomology, Insect Histology, Zoology. Thesis: Feeding Habits and Related Activities of the Two Elm Scolytids.

Alvin Bernard Hoerlein, D.V.M.; Pathogenic Bacteriology, Animal Pathology, Biochemistry. Thesis: Studies on Animal Dermatomycoses.

Joseph Emery Holand, B.S. in Agr., M.S.; Floriculture and Ornamental Horticulture, Plant Physiology, Agronomy. Thesis: Foliar dieback of the Greenhouse Snapdragon, *Antirrhinum majus,* and a Study of the Influence of Certain Environmental Factors Upon Flower Production and Quality.

Bjorn Johannesson, M.S. in Chem.E.; Soils, Physical Chemistry, Field Crop Production. Thesis: The Effect of Soil Volume on Plant Growth.

Robert Kunkel, B.S.; Vegetable Crops, Plant Physiology, Soils. Thesis: The Effect of Certain Mineral Nutrients on the Yield and Keeping Quality of Onions.

Mei Yun Li, B.A., M.Ed.; Rural Secondary Education, Family Life, Educational Psychology. Thesis: An Analysis of Social Economic Conditions in Peng-Shan Hsien, Szechwan, China, Looking Toward Improvement of Educational Program.

John Jay McKelvey, Jr., A.B., M.S.; Economic Entomology, Insect Ecology, Plant Pathology. Thesis: Seasonal History of the European Corn Borer in Relation to Corn Plant Development in Eastern New York During 1943 and 1944.

Herbert McKennis, Jr., S.B.; Biochemistry, Physiology, Pharmacology. Thesis: Metabolic Antagonists of Biotin and of Phenylalanine.

William Frederick Mai, B.S. in Agr.; Plant Pathology, Plant Breeding, Plant Physiology. Thesis: Studies of the X Virus of Potatoes.

Robert Louis Messier, B.S. in Chem., M.S.; Biochemistry, Dairy Science, Bacteriology. Thesis: An Investigation of the Action of Clarifying Enzymes on Apple Juice.

Lawrence Ernie Nielsen, A.B., M.S.; Physical Chemistry, Inorganic Chemistry, Physics. Thesis: Fractionation of Proteins by Electrophoresis Convection.

Louise Adele Raynor, A.B., Cytology, Plant Morphology, Plant Taxonomy. Thesis: A Cytotaxonomic Investigation of Geum.

Myron Arthur Rice, B.S., M.S. in Agr.; Economic Botany, Pomology, Ornamental Horticulture. Thesis: The Culinary Herbs.

Jerome Colbert Smith, B.A., M.A.; Mathematical Analysis, Geometry, Philosophy. Thesis: Asymptotic Distributions of Sums of Rademacher Functions and of Cosines with Big Gaps.

Mohamed Rasal Taraki, B.S. (Ed), M.A.; Supervision, Curriculum, Educational Psychology. Thesis: A Proposed Functional Training Program for Elementary School Teachers in Afghanistan.

Howard Elsworth Thomas, A.B., B.D., A.M.; Rural Sociology, Rural Education, Anthropology. Thesis: A Study of the Impact of the War Upon A Rural Community.

Ruth Hatcher Thomas, Ph.B., M.S. in Ed.; Rural Education, Anthropology, Family Life. Thesis: An Educational Program for Lepers.

Jeremiah James Wanderstock, B.S., M.S.; Animal Husbandry, Animal Breeding, Animal Physiology. Thesis: The Effect of Pasture and of Amount of Grain on the Quality and Palatability of Beef.

Roy Harold Wilcox, B.S., M.S.; Farm Management, Prices and Statistics, Marketing. Thesis: Farm Machinery and Crop Costs.

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