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Published by Cornell University at Ithaca, New York, every two weeks throughout the year. Volume 40. March 24, 1949. Number 20. Entered as second-class matter, December 14, 1916, at the post office at Ithaca, New York, under the act of August 24, 1912.

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## ADMINISTRATION

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

CHARLES WILLIAMS JONES, A.B., A.M., Ph.D., Dean of the Graduate School.

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

## GENERAL COMMITTEE

- Professor DAMON BOYNTON, at large, term expires 1951.
- Professor C. M. McCAY, at large, 1949.

Professor H. H. DUKES, at large, 1950.

Professor L. S. COTTRELL, at large, 1950.

Professor H. A. WICHELNS, Group A (Languages and Literatures), 1951

Professor S. S. ATWOOD, Group D (Biological Sciences), 1949.

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

Professor B. F. WILLCOX, Group H (Law), 1950.

Professor A. L. WINSOR, Group I (Education), 1951.

- Professor J. W. McConnell, 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 the Administration Building, Room 125. The office hours are 8:30 to 12:00; 1:00 to 4:00.

Professor HENRY GUERLAC, Group B (History, Political Science, Philosophy, Psychology, Agricultural Economics, Farm Management, Rural Sociology), 1950.

Professor L. P. SMITH, Group C (Mathematics, Astronomy, Physics, Chemistry, Geology, Geography, Geodesy), 1950.

Professor C. O. MACKEY, Group E (Engineering, Architecture, Rural Engineering, Landscape Design), 1951.

Professor H. C. THOMPSON, Group G (Agricultural Sciences), 1949.

## GENERAL INFORMATION

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<sup>1</sup> (M.S. in Agr.)

Master of Fine Arts<sup>2</sup> (M.F.A.)

Master of Architecture<sup>2</sup> (M.Arch.)

Master of Landscape Architecture<sup>2</sup> (M.L.A.)

Master of Regional Planning<sup>2</sup> (M.R.P.)

Master of Metallurgical Engineering<sup>3</sup> (M.Met.E.)

Master of Chemical Engineering<sup>3</sup> (M.Chem.E.)

Master of Civil Engineering<sup>3</sup> (M.C.E.)

Master of Electrical Engineering<sup>3</sup> (M.E.E.)

Master of Engineering Physics<sup>3</sup> (M.E.P.)

Master of Mechanical Engineering<sup>3</sup> (M.M.E.)

Master of Laws<sup>4</sup> (L.L.M.)

Master of Education<sup>5</sup> (M.Ed.)

Master of Science in Education<sup>5</sup> (M.S. in Ed.)

Master of Science in Industrial and Labor Relations<sup>6</sup> (M.S. in I.L.R.)

Doctor of Education (Ed.D.)

Doctor of the Science of Law<sup>4</sup> (J.S.D.)

<sup>3</sup>Under the special jurisdiction of the Division of Engineering.

<sup>4</sup>Under the special jurisdiction of the Division of Law.

<sup>5</sup>Under the special jurisdiction of the School of Education.

<sup>6</sup>Under the special jurisdiction of the Division of Industrial and Labor Relations.

Doctor of Philosophy (Ph.D.)

<sup>&</sup>lt;sup>1</sup>Open only to students who have had a four-year course in Agriculture or the equivalent.

<sup>&</sup>lt;sup>2</sup>Under the special jurisdiction of the Division of Architecture and Fine Arts.

## GENERAL INFORMATION

## ADMISSION

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.

Inquiries about admission should be addressed to *The Graduate School, Cornell University, Ithaca, New York.* Inquires about assistantships and 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.

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 examination 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 Educational Testing Service, P.O. Box 592, 20 Nassau Street, Princeton, New Jersey.

For admission in the fall term, file application between January 1 and March 1; for Summer Session between March 15 and May 1. Though applications may be filed at any other time, the office cannot give assurance that the application will receive the same consideration that it would receive if filed during those periods.

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; (4) an honorary fellow.

*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.

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.

#### ADMISSION

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 non-candidate is expected to pursue a coordinated program of graduate work approved by his adviser. The student selects his adviser from members of the faculty of the Graduate School and must file with the Dean within two weeks of first registration a statement of the field in which he wishes to work, together with the adviser's signature indicating assent. Each term he must file a statement of the courses which he means to pursue, approved by his adviser.

Students who register as non-candidates and who afterward wish to become candidates may so change their registration and obtain credit for work already done only if they were able to meet the language requirements at the time of their first registration.

*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.

Honorary Fellows. 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.

MEDICAL REQUIREMENTS... In order to avoid reactions, often serious when tetanus (lockjaw) antitoxin is administered at the time of an injury, the University has adopted a rule requiring entering students to have two injections of tetanus toxoid. This offers the advantage of protection without the risk of antitoxin reaction. The injections may be given by a private physician before the student enters the University, or by staff doctors during the first two months of residence. If the injections are given before entrance, a physician's certificate must be presented by the student. The University requires students to have a booster injection at the end of the first year in order to preserve immunity.

As a requirement for acceptance, every candidate for admission to the University must submit to the Office of the Graduate School a certificate of vaccination against smallpox. It will be accepted as satisfactory if it shows that a successful vaccination has been made within the past five years, or that three unsuccessful attempts at vaccination have been made.

An entering student must have a chest radiograph on permanent file at the Infirmary. This chest radiograph may be made by a private physician and presented to the Clinical Director when the student matriculates, provided it is not more than a month old, or for a fee of two dollars it may be made at the Infirmary within a month after matriculation.

## 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." This registration takes place in Barton Hall on registration day. A fee of \$5 is required for late registration by matriculated students.

Candidates for advanced degrees granted under special jurisdiction (see p. 7) 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.

*Registration of Courses.* At the beginning of each term a candidate shall make out in triplicate a list of all the courses and other work which he plans to take during the term and shall have this list signed

#### RESIDENCE CREDIT

by the chairman of his Committee as an indication of approval. The research or essay-writing required by the Special Committee for candidates for the master's degree under Plan B should be entered with semester-hour equivalents. The three copies must be filed in the office of the Graduate School within two weeks after registration. Any subsequent change in this list of courses must be recorded on forms to be obtained at the office.

*Grades.* Grade reports are made available each term to all students. Information concerning grade reports is published by the Registrar's office. Formal transcripts of Cornell records are issued from the Registrar's office, and all requests for transcripts should be made to that office.

## **RESIDENCE CREDIT**

All advanced degrees require a minimum period of residence at the University, calculated as residence credit according to the following regulations:

1. One term of residence credit is predicated upon one academic term of full-time work satisfactorily completed.

2. If in any term a candidate's work is unsatisfactory in either the major or a minor subject, he may not receive the full residence credit for which he is otherwise eligible, and the amount he may receive will be determined by his Special Committee.

3. Candidates holding appointments in the University as instructors, assistants, teaching fellows, teaching assistants, or research assistants will be eligible for residence credit in accordance with the following formula:

- (a) A maximum of one term of residence credit if appointment requires not more than six clock-hours a week.
- (b) A maximum of three-fourths of a term of residence credit if appointment requires more than six but not more than twenty clock-hours a week.
- (c) A maximum of five-eighths of a term of residence credit, if appointment requires more than twenty but not more than twenty-five clock-hours a week.
- (d) A maximum of one-half term of residence credit if appointment requires more than twenty-five but not more than thirty clock-hours a week.

4. A candidate engaged in non-academic work, or part-time academic work not indicated above, which in the judgment of his Special Committees interferes with his academic program will be eligible for only partial residence, as determined by his Special Committee within the provisions of the preceding formula.

5. Students registered for a normal program of study at the graduate level in the Summer Session are eligible to receive residence credit providing the study is properly a part of the program for the degree for which they are candidates. Such residence may be counted at the rate of three Summer Sessions for one term of credit, and five sessions for two terms. To obtain such credit the candidate must register both in the Summer Session and in the Graduate School.

Students in the Graduate School who hold appointments as assistants while registered in the Summer Session cannot receive residence credit for the period of the Summer Session.

## 6. Extramural Students

(a) A candidate registered extramurally for *fewer than six* semester hours a term in courses given on the campus during the regular academic year may accumulate residence credit by such work, on recommendation of his Special Committee, up to a maximum of one term (or three Summer Sessions). For such work in the amount of *six or more* semester-hours a term, maximum residence credit will be allowed as for work done in Summer Sessions.

(b) A candidate registered extramurally in courses given at offcampus centers authorized by the University may accumulate residence credit on recommendation of his Special Committee, up to a maximum of two Summer Sessions.

(c) Residence credit earned by extramural work will be recorded only in blocks of six semester hours, each such block being regarded as the equivalent of one Summer Session of residence credit.

7. A candidate for an advanced degree is expected to complete his residence with reasonable continuity. Under any circumstances, a candidate who fails to register during a period of four or more years before he has completed minimum residence requirements may continue only after the General Committee has stipulated the amount of additional residence to be required. The Committee will be guided in its decision by a written estimate made by the candidate's Special Committee of the period of study needed by the candidate to recover ground lost. 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.

## **REQUIREMENTS FOR MASTERS' DEGREES**

#### 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. However, a student who before matriculation successfully completed a course of study at the graduate level in one Summer Session at Cornell may petition for transfer of this work, on approval of his Special Committee, after he has matriculated in the Graduate School.

The satisfactory completion of the candidate's work term by term, must be attested by the members of his Special Committee.

Work Under Personal Direction<sup>1</sup>. A candidate who lacks not more than one-half of a term's residence credit for completion of the residence requirement may, on recommendation of his Special Committee and with approval of the Dean, be permitted to register under Personal Direction for completion of the requirement during the summer. Registration must be made *in advance* at the office of the Graduate School, and satisfactory completion of the work must be certified by the professor supervising the work. There is no course credit for work under Personal Direction.

Additional requirements of residence for deficiency in foreign language. Candidates for the degree of A.M., M.S., M.Arch., M.L.A., M.F.A., or M.R.P., are subject to the following special requirements 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

<sup>&</sup>lt;sup>1</sup>While allotments are in force, this rule applies also to candidates for Masters' degrees who have one term of residence credit.

English approved by his Special Committee) by passing an examination given by a member of the Language Examination Board. The student must be enrolled in the Graduate School at the time such an examination is taken.

(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 demonstrating, before a member of the Language Examination Board not later than the beginning of the 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.Chem.E., M.C.E., M.Met.E., M.E.E., M.M.E., or M.E.P.

Plan A is intended for those candidates who wish to acquire competence in a restricted field of work.

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 field of instruction. Before selecting his Major and Minor Subjects the student should consult members of the Faculty regarding suitable combinations of subjects. The candidate will devote the major portion of his time 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 Committee. 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 candidate may change the membership of his Special Committee with the approval of all the members of the newly consituted 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 candidate and the members concerned.

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, with approval slip signed by all members of the Special Committee, must be on file in the office of the Graduate School. On the approval slip the name of the student and the title of the thesis must be identical with those inserted in the title-page of the thesis as indicated in the form below. Under no circumstances may the final examination be given before the thesis has been accepted and filed.

The thesis must be typewritten, double spaced, on a durable rag bond,  $8 \times 10\frac{1}{2}$  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:

#### GENERAL INFORMATION

#### [TITLE OF THESIS]

## A Thesis

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

#### By

1

#### [Author's Name in Full]

#### [Month and year in 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<sup>1</sup> 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 candidate's Special Committee and are open to all members of the Faculty. At the discretion of the Special Committee those under whom the candidate has worked may be invited to participate in the examination. But the

<sup>&</sup>lt;sup>1</sup>The candidate should consult the chairman of his Committee to ascertain if additional copies are required by the department.

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

A report on 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; 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 partial list of titles indicates the scope: American Culture, Agricultural Arts, Botanical Science, Education, Foreign Languages, General Science, History and Criticism of Art, Labor and Industry, Literature, Physical and Mathematical Sciences, Social Studies, Technical Agriculture, Zoological Science. This list is merely descriptive, and it is not the intention of the Faculty to confine selection to the fields named. The candidate will choose a title for his field of concentration in consultation with his Special Committee; that title is subject to the approval of the Dean.

Special Committees. The candidate 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

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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 candidate may change the membership of his Special Committee with the approval of both 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 candidate and the members concerned.

*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 in some other way, is left to the Special Committee in consultation with the candidate. The completed essay or report of research must be submitted to the members of the Special Committee, but not to the office of the Graduate School.

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 research or essay 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 candidate's Special Committee and are open to all members of the Faculty. At the discretion of the Special Committee those under whom the candidate 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 . . .

Additional requirements for professional degrees under special jurisdiction of divisions of the Graduate School will be found below in the announcements of the divisions concerned, as follows:

Master of Fine Arts (M.F.A.), Master of Architecture (M.Arch.), Master of Landscape Architecture (M.L.A.), Master of Regional Planning (M.R.P.) — in the Division of Architecture and Fine Arts, pp. 45–48.

Master of Metallurgical Engineering (M.Met.E.), Master of Chemical Engineering (M.Chem.E.), Master of Civil Engineering (M.C.E.), Master of Electrical Engineering (M.E.E.), Master of Engineering Physics (M.E.P.), Master of Mechanical Engineering (M.M.E.), in the Division of Engineering, pp. 160–166.

Master of Education (M.Ed.), Master of Science in Education (M.S. in Ed.)—in the Division of Education, pp. 152–153.

Master of Laws (LL.M.)-in the Division of Law, pp. 218-219.

Master of Science in Industrial and Labor Relations—in the Division of Industrial and Labor Relations, pp. 212–215.

## **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 below, 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.)

At least two of the last four terms 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 candidate'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 Session. Residence credit toward the Ph.D. degree earned in Summer Sessions or extramurally 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 summer under the personal direction of a member of the Faculty of the Graduate School. The privilege of working under Personal Direction will not ordinarily be granted to a student until he has completed at least one 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 candidate must apply 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. Candidates 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 candidate's program. 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, and except from the Cornell Aeronautical Laboratory at Buffalo, N. Y., such allowable compensation being in the form of a research assistantship or its equivalent.

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

(c) Permission to count such times 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 applicant'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 candidate acquire a total of more than two terms' residence under these provisions. (d) A candidate 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.

REQUIREMENTS IN FOREIGN LANGUAGES... A candidate for the Ph.D. degree whose native language is English must demonstrate while in residence 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. Assignment to an examiner is made 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.

On recommendation of the Special Committee, English may be presented as a foreign language by a candidate whose native language is other than English. The examination will test the candidate's knowledge of the spoken as well as the written language, and the candidate's native language may not be presented as the second language. This examination will be given by the chairman of the candidate's Special Committee.

The examination in at least one foreign language must be passed immediately upon admission to candidacy; otherwise, a minimum of seven terms of residence credit is required. 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 candidate is not receiving residence credit.

The second language examination should be taken as soon as possible after admission to candidacy. Until it is passed no residence credit will be allowed after four terms of credit have been earned.

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.

Language examinations passed within one month after registration are considered as being passed at the time of registration. 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 field 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<sup>1</sup> 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 candidate and the members concerned.

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

<sup>&</sup>lt;sup>1</sup>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 will designate one of them as chairman.

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, with approval slip signed by all members of the Special Committee, shall be on file in the office of the Graduate School. On the approval slip the name of the student and the title of the thesis must be identical with those inserted on the title-page of the thesis as indicated in the form below. 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,  $8 \times 10\frac{1}{2}$  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

Doctor of Philosophy

#### By

[Author's Name in Full]

#### [Month and year in 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<sup>1</sup> 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

<sup>&</sup>lt;sup>1</sup>The candidate should consult the chairman of his Committee to ascertain if additional copies are required by the department.

copies, typewritten, double spaced, on bond paper,  $8 \ge 10\frac{1}{2}$  inches. 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, which may be oral or written or both. The primary purposes of this 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. In any event, until the examination is taken no residence credit will be allowed after the term in which the candidate is credited with four terms of residence. 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.

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 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. At the time of taking this examination, whether the two parts are given separately or in combination, the candidate must be registered in the Graduate School, either regularly or as a candidate for degree only.

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 may be both oral and written. The early completion of Examination A will leave the student free to devote his attention to the thesis and collateral studies during the remainder of his candidacy. Final Examination B, on the thesis and related topics and on such other work as the student may have done after completing Examination A, will be given after the residence requirement has been satisfied and the thesis has been completed and filed as provided above. This examination may be oral, or both oral and written, at the discretion of the Special Committee.

When the two parts of the final examination are given in combination, the combined examination, designated as Final Examination C, will be given after the residence requirement has been satisfied and the thesis has been completed and filed, as provided above. 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 candidate's Special Committee and are open to all members of the Faculty. At the discretion of the Special Committee those under whom the candidate 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 reexamination 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 requirement 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 applicant shall have met the general requirements for admission to the Graduate School as stated above on page 8; shall have received the degree of 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, Business and Public Administration, Industrial and Labor Relations, 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 23 above. *Final Examination.* After the thesis has been completed and filed in the office of the Graduate School, as provided on page 24 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 one 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 219 below in this Announcement and also the Announcement of the Cornell Law School.

## **REQUIREMENTS FOR THE ED.D. DEGREE**

The program for the degree of Doctor of Education is designed to prepare the candidate, within a broad cultural context, for professional proficiency in a selected field of education. Candidates for this degree must show evidence of competency in a field of educational activity and of ability to assume a position of leadership in education. The requirements for the degree include (1) a minimum of six terms of residence credit; (2) the satisfactory completion, under the direction of a Special Committee, of a major field of concentration and two minor fields of distribution; (3) competency in two foreign languages or in the use of statistics or educational law; (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:

A candidate for this degree is expected to complete his residence with reasonable continuity. All requirements, including the final examination, must be completed within four years after the minimum residence requirement for the degree has been satisfied. Two terms of residence must be consecutive, of which one may be secured under personal direction; ordinarily, these two terms should be the final terms of residence. All other requirements pertaining to residence are the same as those for the Ph.D.

#### Special Committees:

Regulations pertaining to the establishment and functions of Special Committees are the same as those for the Ph.D.

#### Major and Minor Fields:

A candidate for the Ed.D. degree must select a major field of concentration and two minor fields of distribution properly related to and supporting the field of concentration. Fields of concentration approved for this degree are the same as the major fields listed below for the Ph.D. in Education. Fields of distribution will be determined in consultation with the professor representing the major field.

The candidate should consult members of the faculty regarding his choice of a major field.

#### Special Requirements of Competency:

A candidate for the Ed.D. degree must demonstrate by examination competency in two of the following areas: (1) an approved foreign language; (2) a second foreign language; (3) statistics as applied in education; (4) law as applied in education; (5) accounting as applied in education; or (6) some other area recommended by the Special Committee and approved by the Dean of the Graduate School. Competency in each of these areas will be determined by examination by staff members appointed for the purpose. Preparation for these examinations must be made when the candidate is not receiving residence credit, and examinations must be passed within the time limits operative in the Ph.D. program.

#### Thesis:

The thesis required must meet the Ph.D. standard of scholarship and literary quality, but may emphasize the critical application of knowledge to a professional problem rather than attempt to contribute new knowledge. All regulations governing the preparation and publication of the thesis and abstracts are the same as those for the Ph.D.

#### Examinations:

A candidate for the Ed.D. degree must take a special written scholastic aptitude examination selected and administered by the School of Education in addition to the Qualifying Examination given by his Special Committee. The Committee shall decide the weight to be attached to the candidate's performance on this test in evaluating his fitness for candidacy. The aptitude test shall include ability to read and interpret educational literature, ability to analyze educational problems, proficiency in written English, and other aptitudes considered to be indicative of appropriate ability. Rules governing the qualifying and final examinations are the same as those for the Ph.D.

## 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 \$150 a term is to be paid by all students registered in the Graduate School with major concentration in subjects within the state-supported colleges of the University; all others must pay a fee of \$225 a term. This fee 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 and Honorary Fellows upon the recommendation.

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 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 \$1600, the tuition fee may be waived entirely;

(b) If the salary is greater than \$1600, but not greater than \$1700, 25% of the tuition will be charged and 75% waived;

(c) If the salary is greater than \$1700, but not greater than \$1800, 50% of the tuition will be charged and the balance waived;

(d) If the salary is greater than \$1800, but not greater than \$1900, 75% of the tuition will be charged and the balance waived;

(e) If the salary is greater than \$1900, 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 period under the above limitations. This waiver of tuition does not apply if the student registers in the Summer Session. 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

#### GENERAL INFORMATION

register as a "candidate for degree only" and shall pay only an administration fee of \$12.50.

A Matriculation and X-ray Fee of \$13 is required of every student upon his first entrance into the University. It must be paid at the time of admission and is not refundable.

A Health and Infirmary Fee of \$15 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 degrees of Doctor of Philosophy and Doctor of Education. 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, from the first day of registration to the date of withdrawal as certified by the College; provided, however, if withdrawal is made within six days of the date of registration, no charge is assessed. 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 \$80 for each Summer Session.

#### TUITION AND OTHER FEES

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 \$5. 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, within the immediate 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 \$2 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 from the insurance requirement 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, which includes obtaining a registration sticker and paying the fee, 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 \$2.

*Motorcycles* must be registered but may not be used anywhere 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 here indicated may be denied a student who is not in good standing.

Personal Direction. Students carrying on studies during the sum-

mer 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 \$15; provided, however, that one half of 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 Administration Building, Room 144. 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, and introduce them to other University officials and members of the faculty.

## LIVING FACILITIES

It is the responsibility of each graduate student to arrange for his own living quarters. Graduate men students are, upon application, assigned to space, when available, within the Men's Residential Halls. Graduate women students are, upon application, assigned to space, when available, within the Graduate Women's Residential Halls. Graduate women under 21 may apply for space in undergraduate dormitories and will be assigned if space is available. Undergraduate dormitory contracts entail room, board, and an allowance for personal laundry at the regular undergraduate residence charge.

University-operated rooms for men range in price from \$4.75 to \$10.00 a week. Similar housing for women includes a weekly allowance for personal laundry in addition to room, and the price range is from \$8.50 to \$10.50 a week. Unless specifically arranged in advance, contracts cover the full college year.

Off-campus rooms range in price from \$6.50 to \$10.00 a week, the average being from \$7.50 to \$8.00. It is usually impossible to arrange for room, board and laundry at the same place off-campus. There are, however, several restaurants and cafeterias on or near the campus which service the off-campus and university-housed student alike. The present estimated cost of board averages from \$2.00 to \$2.50 a day.

Upon assurance of admission to the University, graduate students should apply to the Office of Residential Halls, Administration Building, for specific information on both university and off-campus housing.

## 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 office of the Dean of Men and Dean of Women.

LOAN FUND FOR WOMEN GRADUATE STUDENTS... There are available loan funds for the use of women graduate students, provided by the Ithaca Branch of the Association of American University Women and Mu Chapter of Pi Lambda Theta. Applications should be made in writing to the office of the Dean of Women.

## THE BUREAU OF EDUCATIONAL RESEARCH AND SERVICE

The Bureau is designed to provide equipment and an organization whereby the various resources in the University can be utilized in the study of educational problems. These problems may arise in such areas as curriculum planning, testing and evaluation, administration and supervision, personnel management, youth adjustment, and psychological foundations of education. They may exist in any of the various colleges of the University, in the public schools, or in the communities of the State. In addition to the coordination of research, the Bureau offers statistical and clerical assistance to the staff and graduate students in their independent research studies.

The Bureau also maintains an educational and vocational testing and guidance service for students referred by the Dean of Men and the Dean of Women. Persons not enrolled in the University may obtain such service upon application to the Bureau and the payment of a fee.

Other forms of service include the maintenance of information concerning schools and colleges and related matters, teaching aids for use by the staff in the preparation of teachers, an extensive library of psychological and educational tests, and a small selected library of technical books and films dealing with research in education and psychology. There are numerous opportunities for graduate students in education to obtain practical experience in the various activities of the Bureau as part of their programs of study. Arrangements for such experience are made through the Director of the Bureau and the student's advisory committee.

# THE SCHOOL OF EDUCATION PLACEMENT OFFICE

The School of Education maintains a special service for the placement of teachers prepared at Cornell. Up-to-date files of credentials are kept for all potential teachers or former teachers who desire to register. Applicants are notified of any vacancies suitable to their qualifications and interests. The office will gladly send a registrant's papers to prospective employers upon request, and will make arrangements for interviews conducted on the campus. All inquiries should be addressed to the Director of the Educational Placement Bureau, 102 Stone Hall, Cornell University.

## FELLOWSHIPS; SCHOLARSHIPS, PRIZES

## HONORARY FELLOWSHIPS . . . See page 9 above.

AWARD AND TENURE... Appointments to fellowships and scholarships are made on April 1 of each year. Forms for making application may be obtained 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.<sup>1</sup>

<sup>&</sup>lt;sup>1</sup>For information concerning appointments to assistantships the applicant should write to the department concerned.
# FELLOWSHIPS AND SCHOLARSHIPS

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 must devote his whole time to his studies, except that he may be called upon to assist in instruction up to a maximum of six clock-hours a week and for such assistance may receive extra compensation from the University. He may not accept any other appointment.<sup>1</sup>

The stipends of fellowships and scholarships are payable at the office of the Treasurer of the University in eight or twelve equal installments, at the option of the holder thereof, with the first payment due October 15 and the other payments due on the fifteenth of each succeeding month.

*FELLOWSHIPS AND SCHOLARSHIPS*...All permanently endowed fellowships and scholarships carry exemption from tuition but not from other fees.

## GENERAL

#### 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, upon application, be exempted from the rule requiring scholarship-holders to accept no other appointment.

# Allen Seymour Olmstead Scholarships

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

#### 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 1949–1950 the stipend has been fixed at \$200.

#### 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.

<sup>1</sup>Holders of tuition scholarships may be granted exemption from this rule.

# GENERAL INFORMATION

## AGRICULTURE

Two Henry Strong Denison Fellowships in Agriculture. Stipend \$1,000 each. 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 \$600. 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.

#### BACTERIOLOGY

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

#### BOTANY

The Goldwin Smith Fellowship in Botany, Geology, or Physical Geography. Stipend \$400. Awarded in alternate years.

The Graduate Scholarship in Botany, Geology, or Physical Geography. Stipend \$200. Awarded in alternate years.

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 \$1200 if appointee is single, \$1800 if married.

The Carl G. Schluederberg Fellowship. Stipend \$200.

The John E. Teeple Fellowship. Stipend \$400.

#### FELLOWSHIPS AND SCHOLARSHIPS

## CLASSICS

Two Fellowships in Greek and Latin. Stipend \$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**

The President White Fellowship in Political and Social Science.<sup>1</sup> Stipend \$600. Awarded in alternate years in Government and Economics.

A Fellowship in Political Economy. Stipend \$700.

## 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 Aeronautical, Chemical, Civil, Electrical, or Mechanical Engineering. These scholarships were founded by a bequest of John McMullen, of Norwalk, Conn., to Cornell University "for the purpose of creating and maintaining free scholarship or scholarships for the education of young men as engineers, the details as to the amounts of said scholarships and the qualifications of the beneficiaries to be left to said institution to determine, said scholarships to be known as the John McMullen Scholarships." With the proceeds of this bequest the Board of Trustees has established fifteen scholarships of an annual value of \$1200 each. The scholarships have not been assigned to any particular School of the College, but will be awarded as conditions dictate. 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 for the year 1949–1950 is \$500. Applications should be sent to the Graduate School.

<sup>&</sup>lt;sup>1</sup>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.

#### 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

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

# GEOLOGY

The Goldwin Smith Fellowship in Botany, Geology, or Physical Geography. Stipend \$400. Awarded in alternate years.

The Graduate Scholarship in Botany, Geology, or Physical Geography. Stipend \$200. Awarded in alternate years.

The Eleanor Tatum Long Graduate Scholarship in structural Geology is open to graduate students who are majoring in this 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.

#### 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.

#### GERMAN

The University Fellowship in German Studies. Stipend \$400.

## GOVERNMENT

The President White Fellowship in Political and Social Science. 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.<sup>1</sup> Stipend \$500. In the discretion of the Faculty this fellowship may be made a traveling fellowship, with a stipend of \$800.

<sup>&</sup>lt;sup>1</sup>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.

### FELLOWSHIPS AND SCHOLARSHIPS

The Fellowship in American History. Stipend \$400. The George C. Boldt Fellowship in History. Stipend \$1,000. 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."

# 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.

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.

### 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.

# PSYCHOLOGY

The John Wallace Dallenbach Fellowship in Psychology. Stipend \$800. The Susan Linn Sage Fellowship in Psychology. Stipend \$400. The Susan Linn Sage Graduate Scholarship in Psychology. Stipend \$200.

#### ROMANCE STUDIES

The University Fellowship in Romance Studies. 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 accumulation it is sometimes possible to increase the amount available for this scholarship.

 $TEMPORARY\ FELLOWSHIPS\ldots$  There are regularly available a number of other fellowships, usually offered by industrial concerns to graduate students in Cornell University who are studying in a field of interest to the donor. Since these

# GENERAL INFORMATION

fellowships are established for a limited period or for a series of years, they are not listed here; but some of the appointees to such fellowships for the year 1948–49 are named below, pp. 232–233. All such fellowships are awarded by action of the Faculty of the Graduate School. Inquiries about those currently available will be referred by the office of the Graduate School to the department concerned.

THE GRADUATE PRIZE IN PHILOSOPHY... Open for competition to all students registered in the Graduate School. See below, pp. 67–68.

# THE UNIVERSITY LIBRARIES

STEPHEN A. MCCARTHY, Director; G. F. SHEPHERD, JR., Assistant Director; FELIX REICHMANN, Assistant Director; KRISTJAN KARLSON, Curator of the Icelandic Collection; —, Curator of the Dante and Petrarch Collection; MISS GUSSIE E. GAS-KILL, Curator of the Wason Chinese Collection; HENRY H. KING, Research Librarian; WHITON POWELL, Librarian of the College of Agriculture; MISS ELOISE R. SMITH, Librarian of the College of Architecture; ALBERT CROUTCH, Librarian of the School of Business and Public Administration; MISS JEANETTE POOR, Librarian of the College of Engineering; MISS VIVIEN N. WARTERS, Librarian of the College of Home Economics; J. G. MILLER, Librarian of the School of Industrial and Labor Relations; L. W. MORSE, Librarian of the Law Library; MISS ALICE PURINGTON, Librarian of the Veterinary College.

The University Libraries comprise the General Library of the University and the libraries of the following Colleges and Schools: The Library of the College of Agriculture, the Library of the Agricultural Experiment Station at Geneva, the Architecture Library, the Business and Public Administration Library, the Engineering Library, the Library of the College of Home Economics, the Library of the School of Industrial and Labor Relations, the Law Library and the Veterinary Library.

In addition there are the following special departmental libraries and laboratory collections: Agricultural Economics, Agronomy, Animal Husbandry, Apiculture, Barnes Hall, Botany, Browsing, Chemical Engineering, Chemistry, Dairy Industry, Entomology, Floriculture, Forestry, Geology, Goldwin Smith, Mathematics, Military, Music, Nature Study, Nutrition, Ornithology, Physics, Plant Breeding, Plant Pathology, Poultry, Regional History, and Zoology.

The general collection of reference books and documents, the chief bibliographical publications and the principal series of academy and learned society publications are located in the University library. Specialized reference materials will be found in the various college and departmental libraries. The Reference Department of the University Library and the librarians of the college, school, and departmental

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# LIBRARIES

libraries are prepared to assist students in the effective use of the libraries and in the location of research materials.

The total library resources on the Ithaca campus exceed 1,300,000 volumes. The number of periodicals, transactions, and other serials currently received is over five thousand.

In the course of their development the libraries have received and have built up some notable special collections. Likewise the program of acquisitions in certain subject fields has been exceptionally thorough. Some of the most significant of these collections and subjects are: Architecture, American History, Slavery, Reformation, English and French Revolutions, American Civil War, History of Superstition, Spinoza, Dante, Petrarch, Rhaeto-Romanic, Egyptology and Assyriology, China, Dramatic Literature, Freemasonry, Legal Trials, Entomology, Botany, Zoology, History of Science, Icelandic, and Regional History.

Cards of admission to the stacks and to the White Historical Library are issued to graduate students for the purpose of consultation and research. A limited number of stalls and study spaces are available to graduate students upon application. The privilege of borrowing books for home use is granted to all students who comply with the library regulations.

Several graduate assistantships, carrying stipends of \$750 plus free tuition, have been established in the University Library. Holders of these assistantships are required to give twenty hours of service a week during the academic year in various departments of the University Library. Candidates for assistantships are invited to apply to the Director of the Library.

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# 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. Far Eastern Studies. Languages and Literatures. Music. 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 the main, courses intended primarily for advanced undergraduate students, but often meeting the needs of graduates, are not listed or described in this catalogue. For all such courses, the student should refer to the announcement of the college in which the course is offered.

**PREREGISTRATION FOR COURSES...** In order to assure proper distribution of facilities, preregistration is required for all courses where staff and facilities are comparatively inflexible. In certain fields, a statement covering all courses is made at the beginning of the curriculum (e.g., PLANT SCIENCES, p. 104; HOME ECONOMICS, p. 198). In other fields the statement is made in the individual coursedescription (e.g., CHEMICAL ENGINEERING 5701, p. 170). The preregistration periods normally occur about six weeks before the end of the semester preceding, and registered students are informed. New students and those not on campus are advised to write to the department concerned or to the office of the Graduate School as soon as they know that they want a place reserved in courses.

# ARCHITECTURE AND THE FINE ARTS

The Division of Architecture and the Fine Arts has jurisdiction over work leading to the degrees of Master of Architecture, Master of Landscape Architecture, Master of Regional Planning, and Master of Fine Arts. These degrees are intended for those primarily interested in the practice of the various fields given below. Students primarily interested in the history and theory rather than the practice of these fields of study may become candidates for the Master of Arts degree.

# ARCHITECTURE

Professors S. M. BARNETTE, H. E. BAXTER, L. D. BROWN, T. H. CANFIELD, G. D. CLARKE, A. H. DETWEILER, F. W. EDMONDSON, J. A. HARTELL, T. W. MACKESEY, E. D. MONTILLON, A. D. SEYMOUR, J. N. TILTON, JR., F. M. WELLS.

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

Architectural Construction 2, 3, 4

Architectural Design 2, 3, 4

History of Architecture 2, 3, 4

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

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 welllighted drafting-rooms and studios are provided and a special architectural library, comprising 12,000 books, 20,000 mounted photographs, 45,000 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.

For specific courses offered see the Announcement of the College of Architecture.

# **REGIONAL AND CITY PLANNING**

Professors G. D. CLARKE, T. W. MACKESEY, F. W. EDMONDSON, MR. J. W. REPS, and other members of the University Faculty.

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

City Planning 1, 2, 3, 4 Regional Planning 1, 2, 3, 4

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.

700. HISTORY OF CITY PLANNING. Fall term. Credit three hours. Professors Detweiler and Mackesey.

The history of the planning of communities from ancient times to the present. 710. *PRINCIPLES OF REGIONAL AND CITY PLANNING*. Fall term. Credit three hours. Professor MACKESEY.

A review of the basic influences in the development of cities. A general view of the theory and accepted practice of city and regional planning.

711. CITY PLANNING PRACTICE. Spring term. Credit three hours. Prerequisite, Course 710. Professor 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.

713. HOUSING. Fall term. Credit two hours. Registration limited. Prerequisite, Course 710. Mr. REPS.

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.

717. ZONING PRINCIPLES AND PRACTICE. Spring term: Credit two hours. Prerequisite, Course 710. Mr. REPS.

Technical and legal aspects of drafting and administering zoning regulations. 718. *CITY PLANNING DESIGN*. Either term. Credit arranged. Professor EDMONDSON.

719. CITY AND REGIONAL PLANNING RESEARCH. Either term. Credit arranged. Professors Clarke, Mackesey, and Edmondson.

## LANDSCAPE ARCHITECTURE

Professors G. D. CLARKE, E. D. MONTILLON, F. W. EDMONDSON, and members of the Faculty in Architecture.

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

Landscape Architecture 2, 3, 4

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.

For specific courses offered see the Announcement of the College of Architecture.

# PAINTING AND SCULPTURE

Professors N. D. DALY, KENNETH EVETT, J. M. HANSON, J. A. HARTELL, R. P. LANG, J. O. MAHONEY, and K. L. WASHBURN.

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

Painting 2, 3, 4

Sculpture 2, 3, 4

The degree of Master of Fine Arts will be granted to candidates with a special aptitude for the practice of Painting or Sculpture, who have a basic general education and who have qualified themselves in the History and Theory of Art.

Entering students must present at least 30 hours of studio work in these fields, or its equivalent. Two years' residence will normally be required and candidates must supplement work in the practice of art with a related program in the history and theory of art. At the end of his third term of residence each candidate will present an exhibition of work done while in residence and take a comprehensive examination in the history and theory of the art of his special interest. A thesis, consisting of a creative project, will be presented at the end of the fourth term of residence. Instruction in Painting and Sculpture is given by the staff of the College of Architecture. For further information consult the Announcement of that College.

Either Painting or Sculpture may also be elected as minor fields of study for the degree of Master of Arts.

The degree of Master of Education, administered by the School of Education under the jurisdiction of the Graduate School, is offered for those students who wish to prepare themselves for the teaching of art in the secondary schools. credit. Open to qualified graduate students only.

For undergraduate courses which often meet the need of graduate students, see the Announcement of the College of Architecture, Department of Painting and Sculpture, Courses 320, 322–323, 326–327–328, 353, 356, 375, 370–371.

## STUDIO COURSES

The following courses constitute advanced work in the several fields they cover. They offer a study of the various artistic and technical problems inherent in the production of works of art in these fields through projects chosen by the student.

390. PAINTING AND COMPOSITION. Either term. Credit as assigned. May be repeated for credit. Open to qualified graduate students only.

396. SCULPTURE. Either term. Credit as assigned. May be repeated for credit. Open to qualified graduate students only.

#### SEMINARS

The following courses are for qualified graduate students only. They may be taken either term and may be repeated for credit.

392. SEMINAR IN THE THEORY OF PAINTING. Credit two hours.

Special topics in the theory and criticism of painting.

397. SEMINAR IN THE THEORY OF SCULPTURE. Credit two hours.

Similar to Course 392 but with sculpture as its subject matter.

398. SEMINAR IN ART CRITICISM. Credit two hours.

A study of critical opinions, historical and modern, and their relation to problems in the theory of art.

399. SEMINAR IN THE TEACHING OF ART. Credit two hours.

Investigation of the methods, past and present, of teaching art. Practice in conducting classes. Offered with the cooperation of the SCHOOL OF EDUCATION.

#### DRAMA AND THE THEATRE

Professors H. D. Albright, R. C. Bald, A. M. DRUMMOND, H. A. MYERS, Edwin NUNGEZER, W. H. STAINTON; Doctor H. H. Adams.

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

Dramatic Production 2, 3, 4 Dramatic Technique 2, 3, 4 Playwriting 2, 3, 4

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 opportunities for public presentation of the work of graduate students in Dramatic Interpretation and Acting and in Playwriting.

Students of Drama may become candidates for other advanced degrees. See page 61 of this *Announcement*.

# HISTORY OF ART AND ARCHAEOLOGY

Professors D. L. FINLAYSON, N. A. PATTILLO, and F. O. WAAGÉ.

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

Archaeology 1, 2, 3, 4

History of Art 2, 3, 4

Graduate work is offered in the general field of the history of the visual arts (architecture, painting, sculpture, and the minor arts). To elect this as a major subject the candidate must present undergraduate preparation comparable to the major course in Fine Arts, option 2 (Visual Arts Course) in the College of Arts and Sciences at Cornell. Instruction will be offered through advanced under-graduate courses (for which see the *Announcement of the College of Arts and Sciences* under FINE ARTS) and through independent study and research under individual direction.

The same conditions will usually apply in the election of work in the general field of Archaeology as a major subject; however, in undergraduate preparation relevant courses in such subjects as cultural anthropology may be substituted for some of those in art history and for graduate work in Classical Archaeology, courses in Latin and Greek may be so substituted.

History of Art and Archaeology are approved as major subjects for the Master of Arts, but not for the Master of Fine Arts, degree; candidates for the Master of Fine Arts degree may, however, elect History of Art as a minor subject.

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# FAR EASTERN STUDIES

Professors KNIGHT BIGGERSTAFF, H. W. BRIGGS, C. F. HOCKETT, N. A. PATTILLO, E. P. REUBENS, H. E. SHADICK, and LAURISTON SHARP; and Miss GUSSIE E. GASKILL.

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

Chinese Literature 2, 3, 4

Far Eastern Studies 4

For major or minor work in Chinese History, see under HISTORY. Students taking graduate work in Anthropology, Economics, and Government may also concentrate their research on the Far East.

In the Wason Collection Cornell University possesses one of the best Europeanlanguage libraries on China and the Chinese in the world. The Collection is also quite strong in books and periodicals dealing with Southeast Asia, Japan and other areas adjacent to China. The Chinese-language materials, amounting to some forty thousand volumes, cover the whole range of Chinese studies, being especially strong in bibliography, literature, Ch'ing history, and the various aspects of contemporary Chinese civilization.

INTRODUCTION TO LITERARY CHINESE. Throughout the year. M W F 11. Professor SHADICK. (Chinese 201–212)

INTERMEDIATE COLLOQUIAL CHINESE. Throughout the year. T Th S 11. Professor Hockett. (Chinese 203–214)

301. CHINESE LITERATURE IN TRANSLATION: PHILOSOPHICAL AND HISTORICAL LITERATURE. Fall term. M W F 10. Professor Shadick.

302. CHINESE LITERATURE IN TRANSLATION: IMAGINATIVE LIT-ERATURE. Spring term. Prerequisite: Far Eastern Studies 201 or 301, or History 161. M W F 10. Professor Shadick.

351-352. READINGS IN CHINESE LITERATURE: CLASSICAL AND MOD-ERN. Throughout the year. Prerequisite: Chinese 212 and 214. Professor SHADICK.

Texts selected to accord with the major interests of the students.

375–376. SEMINAR IN CHINESE LITERATURE. Throughout the year. Professor Shadick.

HISTORY OF CHINESE CIVILIZATION. Professor BIGGERSTAFF. (History 161–162).

THE MODERNIZATION OF CHINA. Professor BIGGERSTAFF. (History 811-812).

SEMINAR IN MODERN CHINESE HISTORY. Professor BIGGERSTAFF. (History 875–876).

INTRODUCTION TO FAR EASTERN ART. Dr. PATTILLO. (Fine Arts 601-602).

[SEMINAR: CONTEMPORARY CULTURE CHANGE IN SOUTHEAST ASIA. Professor SHARP. (Sociology and Anthropology 604) Not given in 1949–1950]

ECONOMICS OF THE FAR EAST. Professor REUBENS. (Economics 801-802).

FAR EASTERN POLICY OF THE UNITED STATES. Professor BRIGGS. (Government 417).

# FAR EASTERN STUDIES

951–952. SEMINAR IN FAR EASTERN STUDIES. Throughout the year. T 3–5. Far Eastern Studies staff.

Discussion of selected topics concerning contemporary China and other parts of Eastern Asia.

The attention of graduate students is also called to the following introductory courses, listed in the Announcement of the College of Arts and Sciences, which may be of interest to them: Chinese 101–102 (Elementary Colloquial Chinese); Far Eastern Studies 201 (Introduction to Contemporary China), 202 (Introduction to Contemporary Japan).

# LANGUAGES AND LITERATURES

# THE CLASSICS

Professors Edward L. Bassett, Harry Caplan, James Hutton, Gordon M. Kirkwood, 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 and Renaissance Latin Literature 1, 2, 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

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 seminar 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 seminar courses are ordinarily treated in courses of lectures.

A seminar room in the Library Building is 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 this room, 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 seminar room 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

For undergraduate courses, which often meet the needs of graduate students, see the *Announcement of the College of Arts and Sciences*, Department of CLASSICS.

301-302. ARISTOPHANES, CLOUDS; SOPHOCLES, OEDIPUS REX; HER-ODOTUS. Throughout the year. Credit three hours a term. Prerequisite, Greek 201 or the equivalent. M W F 3. Professor Solmsen.

305-306. LYRIC POETRY; AESCHYLUS, PROMETHEUS VINCTUS; THE-OCRITUS; DEMOSTHENES, PHILIPPICS. Throughout the year. Credit three hours a term. Prerequisite, Greek 301-302. M W F 9. Professor CAPLAN. 307-308. PLATO, THE REPUBLIC; PINDAR, SELECTED ODES; THUCY-DIDES. Throughout the year. Credit three hours a term. Prerequisite, Greek 301-302. Professor HUTTON.

309–310. ADVANCED GREEK COMPOSITION. Throughout the year. Credit one hour a term. T 2. Assistant Professor KIRKWOOD.

365-366. SEMINAR. HOMER. Throughout the year. Credit three hours a term. Library, Classical Seminar Room. W 2-4. Professor HUTTON.

[375-376. SEMINAR. PLATO. Throughout the year. Not given in 1949-1950.]

See also Ancient History (under HISTORY); and Greek Philosophy (under PHILOSOPHY).

#### LATIN

For undergraduate courses, which often meet the needs of graduate students, see the Announcement of the College of Arts and Sciences, Department of CLASSICS.

[315-316. THE GREATER REPUBLICAN WRITERS: PLAUTUS, CICERO, LUCRETIUS. Throughout the year. Credit three hours a term. Not given in 1949–1950.]

317-318. LITERATURE OF THE EARLY EMPIRE: TACITUS, ANNALS; JUVENAL; PLINY'S LETTERS; SENECA'S LETTERS. Throughout the year. Credit three hours a term. Prerequisite, Latin 205-206 or the equivalent. T Th S 9. Assistant Professor BASSETT.

321-322. LATIN COMPOSITION: ADVANCED COURSE. Throughout the year. Credit one hour a term. W 2. Professor Solmsen.

[381-382. SEMINAR: CLASSICAL RHETORIC.]

383–384. SEMINAR: PLAUTUS. Throughout the year. Credit three hours a term. Library, Classical Seminar Room. T 2–4. Professor CAPLAN.

#### GREEK AND LATIN LINGUISTICS

[347. HISTORY OF THE LATIN LANGUAGE. Credit two hours. Not given in 1949–1950.]

[348. VULGAR LATIN: PETRONIUS, CENA TRIMALCHIONIS; VULGAR LATIN INSCRIPTIONS. Credit two hours. Not given in 1949–1950.]

[350. COMPARATIVE GRAMMAR OF GREEK AND LATIN. Credit two hours. Not given in 1949–1950.]

389. GREEK DIALECTS. Fall term. Credit two hours. T Th 12. Assistant Professor BASSETT.

Italic Dialects; or topic to be chosen after consultation.

See also GENERAL LINGUISTICS.

#### CLASSICAL ARCHAEOLOGY

For undergraduate courses, which often meet the needs of graduate students, see the Announcement of the College of Arts and Sciences, Department of FINE ARTS.

[315. NUMISMATICS: ANCIENT COINAGE. Not given in 1949-1950.]

377. PAUSANIAS AND THE TOPOGRAPHY OF GREECE WITH SPECIAL REFERENCE TO ATHENS. First term. Hours to be arranged. Goldwin Smith 37. Professor WAAGÉ.

378. PROBLEMS IN CLASSICAL ARCHAEOLOGY. Second term. Hours to be arranged. Goldwin Smith 37. Professor WAAGÉ.

## ENGLISH

# ENGLISH LANGUAGE AND LITERATURE

Professors M. H. Abrams, R. C. Bald, David Daiches, F. Barron Freeman, W. H. FRENCH, BAXTER HATHAWAY, G. H. HEALEY, C. W. JONES, F. E. MINEKA, H. A. MYERS, EDWIN NUNGEZER, W. M. SALE, M. W. STEARNS, H. W. THOMPSON, and C. I. WEIR, JR.

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

Medieval Literature 1, 2, 3, 4

Old and Middle English 1, 2, 3, 4

The English Renaissance to 1660. 1, 2, 3, 4

The Restoration and the Eighteenth Century 1, 2, 3, 4

The Nineteenth Century and After 1, 2, 3, 4

American Literature 1, 2, 3, 4

English Poetry 1, 2, 3, 4

Dramatic Literature 1, 2, 3, 4

Prose Fiction 1, 2, 3, 4

Folk-Literature 3, 4

Creative Writing 2, 3 (for A.M.), 4 (for A.M.)

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 for advanced work in every division of English Literature; those in Old and Middle English, in Elizabethan and Nineteenth Century Literature, and in Folklore are especially rich. In addition, the Department has a separate collection, the Hart Memorial Library, with many reference books and ample 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-five 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 of the University.

In general, thirty 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. 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 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.

Successful study leading to the doctorate with the major in any one of the subjects listed above requires not only a balanced undergraduate training in the arts and sciences with a concentration in languages and literature, but also mature habits of reading and appreciation. Since entrance credentials cannot establish the presence of these habits, applicants intending to major in one of these subjects are admitted to the Graduate School as non-candidates and are required to pass an oral examination before admission to candidacy for the degree. This examination should be taken within one month of first registration if the student wishes to be admitted to candidacy and to receive residence credit for the term. A reading list useful in preparing for this examination may be obtained from the Graduate School. The examiners may require a composition to test students' ability to write critical prose. For those who pass the examination the usual qualifying examination of the Graduate School (see p. 25) may be waived.

The minimum residence requirement after admission to candidacy for the Ph.D. degree is, except in very unusual circumstances, four semesters. The other two semesters required by the Faculty of the Graduate School may, on recommendation of the candidate's Special Committee, be made up of study as a non-candidate, as a candidate for the Master's degree, or as a student in another accredited graduate school.

When a student has completed studies in his major and minor subjects, he will be given Final Examination A by his Special Committee. When his thesis has been accepted, he will be given Final Examination B by the same committee.

Rules in the three preceding paragraphs apply to those who enter in the fall term of 1949 or later.

A graduate student who expects to earn all his residence credit by attendance in summer sessions may be a candidate only for the degree of A.M., Plan B. Final examinations for the degree of A.M., Plan A, and for the degree of Ph.D. may be scheduled only during the fall and spring terms, preferably during the regular examination periods. Theses for the degrees of A.M., Plan A, or Ph.D., or parts thereof may be submitted for consideration by the student's Special Committee during the fall and spring terms only.

For further information on examinations, see pp. 16-17, 26-27.

The Martin Wright Sampson Teaching Fellowship, to 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 receive consideration, applicants must ordinarily have completed a year of graduate study. The Department also nominates deserving applicants for tuition scholarships. Furthermore, several 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 M.A. candidates under Plan B may be obtained from the secretary of the Department.

All graduate students in English must, on their arrival at Cornell, consult a member of the Committee on 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.

## ENGLISH

GROUP I. For undergraduate courses which often meet needs of graduate students, see the Announcement of the College of Arts and Sciences, Department of ENGLISH (courses numbered above 300) and also DIVISION OF LITERATURE (courses numbered above 200). Graduate students taking these courses are expected to do extra work in order to obtain graduate credit.

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, hours and a room for a course will be arranged. Candidates for the degree of A.M., Plan B, will receive three hours of credit a term for each course taken.

501. BIBLIOGRAPHY AND METHOD. Fall term. Professor BALD.

A survey of the principal sources of information and of the various techniques used in literary research. Recommended for all candidates for the doctorate.

503-504. *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.

507-508. *ELIZABETHAN LITERATURE*. Fall and spring terms. M W F 12. Associate Professor NUNGEZER.

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

[510. SEVENTEENTH CENTURY LITERATURE. Spring term. Professor BALD. Not given in 1949–1950.]

Donne and his age.

512. SHAKESPEARE. Spring term. Professor BALD.

513-514. *EIGHTEENTH CENTURY LITERATURE*. Fall and spring terms. Assistant Professor HEALEY.

The age of Pope, Swift, and Defoe; the age of Johnson.

535–536. VICTORIAN LITERATURE. Fall and spring terms. Associate Professor MINEKA.

Fall, studies in major prose writers; spring, subject to be announced.

541-542. AMERICAN LITERATURE. Fall term, Professor Myers; spring term, Professor Thompson.

Fall, a study of the histories and interpretations of American literature; spring, American criticism.

551-552. DRAMATIC LITERATURE. Fall and spring terms. Professor MYERS. Fall, tragedy; spring, comedy.

553. MODERN BRITISH LITERATURE. Fall term. Professor DAICHES.

Study of a selection of English satirical fiction from Samuel Butler to Evelyn Waugh. A different topic will be chosen each year.

GROUP III. Specialized study for Ph.D. candidates. The professors designated will supervise the work of advanced students.

601-602. OLD AND MIDDLE ENGLISH. Associate Professor FRENCH.

603-604. MIDDLE ENGLISH TEXTS. Associate Professor FRENCH.

605-606. MEDIEVAL LITERATURE. Professor JONES.

607-608. ELIZABETHAN LITERATURE. Associate Professor NUNGEZER.

609-610. THE ENGLISH DRAMA TO 1700. Professor BALD.

611-612. SEVENTEENTH CENTURY LITERATURE. Professor BALD.

613-614. EIGHTEENTH CENTURY LITERATURE. Professor SALE, Associate Professor Abrams, Assistant Professor Healey.

615-616. THE ROMANTIC PERIOD. Associate Professors MINEKA and ABRAMS.

635-636. VICTORIAN LITERATURE. Associate Professor MINEKA.

641-642. AMERICAN LITERATURE. Professors THOMPSON and MYERS.

645-646. PROSE FICTION. Professors SALE and DAICHES.

651-652. DRAMATIC LITERATURE. Professor MyERS.

653-654. CONTEMPORARY LITERATURE. Professors DAICHES and SALE. 657-658. FOLK-LITERATURE. Professor THOMPSON.

# GENERAL LINGUISTICS

Professors F. B. Agard, E. L. Bassett, J. M. Cowan, G. I. Dale, G. H. Fairbanks, W. H. French, R. A. Hall, Jr., C. F. Hockett, W. G. Moulton, and C. K. Thomas.

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

General Linguistics 1, 2, 3, 4

The following more specialized linguistic fields, listed elsewhere, are also available: Latin Language, Greek Language, (see The Classics); The English Language (see English Language and Literature); Germanic Linguistics (see German Studies); French, Spanish, and Romance Linguistics (see Romance Studies); and Slavic Linguistics (see Russian Studies). In any of these, emphasis is laid on (1) methodology, and (2) the body of results already attained in the field; but in General Linguistics the primary emphasis is on (1), in the linguistics of a specified language or group of languages the primary emphasis is on (2).

A student majoring in General Linguistics for the Ph.D. must choose at least one of his minors in a field other than those referred to above. Particularly desirable are literature, area studies, anthropology, and mathematics.

The Cornell Linguistics Club, open to all interested, meets monthly throughout the school year and affords an opportunity for the presentation and discussion of current developments of topics of research.

201, 202. See Announcement of the College of Arts and Sciences.

203–204. LINGUISTIC ANALYSIS. Throughout the year. Credit three hours a term. General Linguistics 201 is a prerequisite or concurrent for 203; 203 is a prerequisite for 204. M W F 9, and a fourth hour to be arranged. Assistant Professor Hockett.

A training course in the techniques of analysis of descriptive linguistics, and a survey of analytic theory. *Fall term:* phonetics and phonemics; *Spring term:* grammatical structure.

205. FIELD METHODS. Fall term. Credit three hours. Prerequisite, 204. Hours to be arranged; four class hours a week may be required. Assistant Professor Hockett.

A language with which the students have had no previous experience will be analyzed, on the basis of data gathered in class directly from an informant. The psychological, cultural, and linguistic problems of field method will be discussed as they arise.

211, 212. ACOUSTICAL PHONETICS. Throughout the year. Credit three hours a term. Hours to be arranged. Professor COWAN.

A rapid survey of the techniques of experimental articulatory phonetics; the speech mechanism as a sound generator; sound recording techniques, and the methods of general acoustics; application of acoustical analysis to the study of

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#### GERMAN

speech sounds. The course will require no mathematical training of the students beyond arithmetical computation; the necessary mathematical operations for acoustical analysis will be developed for the students by the instructor.

290. SEMINAR. Each term. Admission by permission of the instructor. Hours and credit to be arranged. Various members of the staff.

The topic chosen for a particular term will depend on student needs. Such topics as the following can be made available upon sufficient demand: Sanskrit; the linguistic interpretation of written records (philological method); analysis and classification of linguistic change; the comparative method; American Indian languages; mathematical procedures in linguistic analysis. Since the topic changes, the course may be repeated.

The following courses, described elsewhere, can be included in a program of work in General Linguistics with the permission of the student's Special Committee: Latin 347, 348, 350, 390 (see The Classics); English 305, 306, 601, 602 (see English Language and Literature); German 232, 241, 242, 281, 282, 290 (see German Studies); Speech and Drama 333, 334, 336 (see Speech and Drama); French 232, 241, 242, 290, Italian 290, Spanish 232, 241, 242, 290, Romance Linguistics 281, 282, 290 (see Romance Studies); Russian 232, 241, 290 (see Russian Studies).

### GERMAN STUDIES

Professors E. KAHLER, V. LANGE, W. G. MOULTON, W. OECHLER.

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

German Literature 1, 2, 3, 4

Germanic Linguistics 1, 2, 3, 4

For undergraduate courses which may meet the needs of graduate students, see the Announcement of the College of Arts and Sciences, Department of GERMAN LITERATURE.

In the advanced courses in this field the work is two-fold, literary and linguistic. 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 linguistics include the study of Gothic and of Old and Middle High German. They also afford an introduction to the historical and descriptive methods of language study. The seminar in German literature aims to impart the principles and methods of investigation.

Work in German studies is greatly facilitated by an exceptional library equipment, whose nucleus is the Zarncke library, one of the largest collections of rare books for the study of German literature and philosophy ever brought to America. With constant enlargements the library has become one of the most serviceable in the country.

Candidates for advanced degrees in German are expected to have an adequate knowledge of French and Latin. Inquiries concerning advanced work in German studies and fellowships available should be addressed to the chairman, Professor Victor Lange.

[232. LINGUISTIC STRUCTURE OF GERMAN. Spring term 1951 and alternate years. Credit three hours. Prerequisites, proficiency in German and Linguistics 201. Associate Professor MOULTON. T Th S 10.] A study of the sounds, forms, and structure of modern standard German, using phonograph records, and a selected text.

241. HISTORY OF THE GERMAN LANGUAGE. Fall term 1949 and alternate years. Credit three hours. Prerequisite, proficiency in German. Associate Professor MOULTON. T Th S 9.

The relationship of German to other Germanic and Indo-European languages. The development of High German from the earliest texts to modern times. The rise of the standard language; dialects. Analysis of changes in sounds and forms. Lectures, discussion, reading and analysis of texts.

242. MIDDLE HIGH GERMAN. Spring term 1950 and alternate years. Credit three hours. Prerequisite, German 241 or German 281, 282. Associate Professor MOULTON. T Th S 9.

Reading, discussion, and analysis of the language in Middle High German texts.

[281, 282. GOTHIC AND COMPARATIVE GERMANIC LINGUISTICS. Throughout the year, 1950–1951 and alternate years. Credit three hours. Associate Professor MOULTON. T Th S 9.]

Reading, discussion, and analysis of the language of the Gothic Bible. The relationship of Gothic to other Germanic and Indo-European languages. The reconstruction of Primitive Germanic and Primitive Indo-European. Analysis of changes in sounds and forms.

290. SEMINAR IN GERMANIC LINGUISTICS. Offered every term. Credit three hours. Prerequisite, German 241 or German 281, 282, or concurrent registration in one of these. Associate Professor Moulton. Hours to be arranged.

One of the following will be offered, according to student needs: Old Norse (selected Old Icelandic texts); Old Saxon (the Heliand); Old High German (selected texts); Modern German Dialects.

311. GERMAN LITERATURE OF THE BAROQUE AND REFORMATION PERIOD. Fall term. Credit three hours. Assistant Professor Oechler. M W F 10.

316. GERMAN PROSE FICTION FROM GOETHE TO THOMAS MANN. Fall term. Credit three hours. Assistant Professor Oechler. T Th S 11.

325. THE GERMAN DRAMA OF THE NINETEENTH CENTURY. Spring term. Credit three hours. Assistant Professor Oechler. M W F 11.

332. MODERN GERMAN LITERATURE, 1870–1940. Fall term. Credit three hours. Visiting Professor KAHLER. M W F 2.

An introduction to the history of ideas and values of the past seventy years and a specific discussion of the representative figures of the period: Nietzsche, Hauptmann, Thomas Mann, Rilke, Hofmannsthal, George, etc.

345. LESSING AND THE PERIOD OF ENLIGHTENMENT. Spring term. Credit three hours. Assistant Professor OECHLER. T Th S 11.

An introduction to German literature between Gotsched and Herder with special emphasis upon the works of Lessing.

[350. SCHILLER. Fall term 1950 and alternate years. Credit three hours. Visiting Professor KAHLER. M W F 12.]

365, 366. GOETHE. Throughout the year. Credit three hours a term. Professor LANGE. M W F 9.

A detailed study of Goethe's work with special emphasis upon his poetry, his prose, and Faust I and II. The intellectual background of Goethe's Europe will be established, and some of his contemporaries will be discussed.

420. GERMAN ROMANTICISM. Spring term. Credit three hours. Professor -----. M W F 12.

#### ROMANCE STUDIES

[470. *PROSEMINAR IN GERMAN LITERATURE*. Spring term 1950 and alternate years. Credit two hours. Professor LANGE. One meeting a week at a time to be arranged.]

An introduction to the sources and methods of German literary studies.

475, 476. SEMINAR IN GERMAN LITERATURE. Throughout the year. Credit three hours a term. Fall term: Der George Kreis. Visiting Professor KAHLER. Spring term: Sturm und Drang. Professor LANGE. One meeting a week at a time to be arranged.

# ROMANCE STUDIES

Professors F. B. Agard, Morris Bishop, G. I. Dale, R. A. Hall, Jr., and B. L. RIDEOUT.

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

French Linguistics 1, 2, 3, 4

French Literature 1, 2, 3, 4

Italian 1, 2, 4

Romance Linguistics 1, 3, 4

Spanish Linguistics 1, 2, 3, 4

Spanish Literature 1, 2, 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 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. 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 Graduate Committee on Romance Studies consists of the professors listed above, with Professor MORRIS BISHOP as chairman. Inquiries pertaining to advanced study in this field should be addressed to the chairman.

A working knowledge of Latin is especially desirable for all candidates for advanced degrees in this field. 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 studies 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.

#### FRENCH

For undergraduate courses which often meet needs of graduate students, see the Announcement of the College of Arts and Sciences, courses 232, 241, 242, 301, 302, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 361, 362, 375, 376.

290. SEMINAR IN FRENCH LINGUISTICS. Offered in accordance with student needs. Credit three hours a term. Hours to be arranged. Associate Professor HALL.

A topic such as one of the following will be studied: Old French or Old Provençal texts, historical grammar of French or Provençal, French dialectology.

375, 376. MODERN FRENCH SEMINAR. Throughout the year. Credit two hours a term. Professor BISHOP.

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

#### ITALIAN

For undergraduate courses which often meet needs of graduate students, see the Announcement of the College of Arts and Sciences, courses 401, 402, 407, 408.

290. SEMINAR IN ITALIAN LINGUISTICS. Offered in accordance with student needs. Credit three hours a term. Hours to be arranged. Associate Professor HALL.

A topic in Italian linguistics such as one of the following will be studied: old texts, historical grammar, dialectology.

#### SPANISH

For undergraduate courses which often meet needs of graduate students, see the Announcement of the College of Arts and Sciences, courses 232, 241, 242, 501, 502, 503, 504, 511, 512, 521, 522.

290. SEMINAR IN IBERO-ROMANCE LINGUISTICS. Offered in accordance with student needs. Credit three hours a term. Hours to be arranged. Associate Professor Agard.

A topic in Ibero-Romance linguistics such as one of the following will be studied: old texts, historical grammar, dialectology.

[575, 576. OLD SPANISH. Not given in 1949-1950.]

581, 582. CALDERON AND ALARCON. Throughout the year. Credit two hours a term. M 2:15. Professor DALE.

[585, 586. THE PICARESQUE NOVEL. Not given in 1949-1950.]

[591, 592. SEMINAR IN SPANISH-AMERICAN LITERATURE. Not given in 1949–1950.]

# ROMANCE LINGUISTICS

281, 282. THE COMPARATIVE STUDY OF THE ROMANCE LANGUAGES. Throughout the year. Credit three hours a term. Hours to be arranged. Associate Professor HALL.

The family of Romance languages; the application of the comparative method and the reconstruction of Proto-Romance speech. The relation between Proto-Romance and Old and Classical Latin. The history of the Romance languages as a whole from Latin time to the present, and their interrelationships. A survey of the accomplishments and approaches of recent work in Romance linguistics. Lectures, discussion, and exercises.

290. SEMINAR IN ROMANCE LINGUISTICS. Offered in accordance with student needs. Credit three hours a term. Hours to be arranged. Associate Professor HALL.

A topic in comparative Romance linguistics such as one of the following will be studied: the reconstruction of Proto-Romance, the relation of the Romance languages to Latin, problems of Romance linguistic geography.

# **RUSSIAN STUDIES**

Professors G. H. FAIRBANKS, VLADIMIR NABOKOV.

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

Russian Literature 1, 2, 3, 4

Slavic Linguistics 1, 2, 3, 4

232. THE LINGUISTIC STRUCTURE OF RUSSIAN. Spring term. Credit three semester hours. Prerequisite, proficiency in Russian and Linguistics 201. M W F 2. Assistant Professor FAIRBANKS.

A descriptive study and analysis of Russian linguistic structure. Russian phonetics, phonemics, morphology, and syntax.

241. HISTORY OF THE RUSSIAN LANGUAGE. Fall term. Credit three semester hours. Prerequisite, proficiency in Russian. M W F 2. Assistant Professor FAIRBANKS.

The study of the divisions of the Russian language chronologically and geographically; the relationships of the Russian language, the Slavic group, the Indo-European group; the changes in the sounds and forms of the Russian language; vocabulary borrowings from Eastern and Western languages.

290. SEMINAR IN SLAVIC LINGUISTICS. Offered in accordance with student needs. Credit three semester hours a term. Hours to be arranged. Assistant Professor FAIRBANKS.

A topic such as one of the following will be studied: Old Church Slavic texts, historical grammar of Russian, comparative Slavic linguistics, Polish, Czech, Bulgarian, Serbo-Croatian.

301, 302. SURVEY OF RUSSIAN LITERATURE. Throughout the year. Credit three semester hours a term. M W F 12. Associate Professor NABOKOV.

Lectures in Russian and classroom discussions on Russian literature from the beginnings to the present day, with emphasis on the nineteenth century.

311, 312. RENAISSANCE OF RUSSIAN POETRY. Throughout the year. Credit three semester hours a term. Prerequisite, Russian 302 or consent of the instructor. Hours to be arranged. Associate Professor NABOKOV.

A study of Russian poetry from 1890 to 1925, neo-romanticism and neoclassicism from Blok to Pasternak and Khodassevich.

# SPEECH AND DRAMA

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

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 Phonetics

Speech and Phonetics 2, 3, 4

Dramatic Production 2, 3, 4 Playwriting 2, 3, 4 Theatre Techniques 3, 4

Drama and the Theatre 1

Division of Dramatic Production

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.

For undergraduate courses which often meet needs of graduate students, see the Announcement of the College of Arts and Sciences, Department of SPEECH AND DRAMA, Courses 101, 102, 111, 131, 141, 175, 205, 209, 213. For courses 101, 102, 131, 141, 205, 421 preregistration is required.

214. ARGUMENT. Spring term. Credit three hours. Professor WICHELNS. M W F 12. Preregistration required.

Advanced study of methods and types of argumentation; practice in crossexamination, and in forensic and parliamentary debate.

221. FORMS OF PUBLIC ADDRESS. Fall term. Credit three hours. Professor WICHELNS. M W F 10. Preregistration required.

Types of public address employed in modern democracies.

241. PUBLIC OPINION AND THE METHOD OF ARGUMENT. Spring term. Credit three hours. Professor WICHELNS. M W F 10.

A critical study of the discussion of public affairs, oral and written, as a social force in various ages of democracy.

[275. HISTORY OF PUBLIC ADDRESS. Not offered in 1949-1950.

A survey of ancient oratory in the Greek and the Roman republics.]

276. HISTORY OF PUBLIC ADDRESS. Fall term. Credit three hours. Professor WICHELNS. W 2-4:30.

A survey of ancient and modern oratory from the time of the Roman Empire. [281,2. BRITISH RHETORIC AND ORATORY. Fall and spring terms. As-

sistant Professor ARNOLD. Not offered in 1949-1950.]

283. AMERICAN RHETORIC AND ORATORY. Spring term. Assistant Professor Arnold. T 2-4:30.

A survey from colonial times to the period of the Civil War.

[284. AMERICAN RHETORIC AND ORATORY: Post Civil War. Assistant Professor Arnold. Not offered in 1949–1950.]

[287,8. THEORIES OF PUBLIC ADDRESS. Fall and spring terms. Assistant Professor ARNOLD. Not offered in 1949–1950.]

[291,2. RHETORICAL CRITICISM. Fall and spring terms. Not offered in 1949–1950.]

[295,6. PHILOSOPHY OF RHETORIC. Fall and spring terms. Professor WICHELNS. Not offered in 1949–1950.]

[SEMINAR IN CLASSICAL RHETORIC. Professor CAPLAN.]

333. ENGLISH PHONETICS. Fall term. Credit three hours. Professor THOMAS. T Th S 11.

Principles of phonetics; study of English pronounciation, based chiefly on contemporary American usage; practice in phonetic analysis and, where necessary, drill for the improvement of individual speech.

334. PRINCIPLES OF PHONETICS. Spring term. Professor THOMAS. T Th S 11.

A study of the phoneme, the aspirate, assimilation, and other aspects of sound change and sounds in combination.

[336. REGIONAL AND HISTORICAL PHONETICS. Spring term. Credit three hours. Professor THOMAS. T Th S 11. Not offered in 1949–1950.]

[341,2. STRUCTURE AND FUNCTIONING OF THE SPEECH MECHA-NISM. Fall and spring term. Credit three hours. M W F 12. Not offered in 1949– 1950.]

351,2. PRINCIPLES OF SPEECH CORRECTION. Fall and spring terms. Credit three hours. Professor THOMAS. T Th S 9.

Study of principles and methods, correlated with supervised practice in the Speech Clinic.

353,4. *PRINCIPLES OF SPEECH CORRECTION*. Fall and spring terms. Prerequisite course 352. Credit three hours. Professor THOMAS. Hours to be arranged.

381,2. SPEECH TRAINING. Throughout the year. Credit two hours. Professor THOMAS. Hours to be arranged.

A seminar in general phonetics, methods of speech improvement, and theory of voice and speech.

401. DRAMATIC PRODUCTION: DIRECTION. Fall term. Credit three hours. Associate Professor STAINTON. M W F 11.

Theory of stage direction; fundamentals of theatrical mounting; survey of practical phases of production. Lectures, exercises, and reports. Prerequisite for further work in Dramatic Production.

405. ADVANCED DRAMATIC PRODUCTION: DIRECTION. Fall term. Credit three hours. Associate Professor STAINTON. T 2–4 and hours to be arranged. Laboratory practice in the direction and production of plays.

421. ADVANCED DRAMATIC INTERPRETATION. Spring term. Credit three hours. Associate Professor ALBRIGHT. W 2-4:30. Preregistration required.

Practice in acting, directing, and group rehearsal, leading to public presentation in the University Theatre; individual drills, pantomimes, and reading exercises.

431. DRAMATIC PRODUCTION: STAGECRAFT. Spring term. Credit three hours. Associate Professor STAINTON. M W 11. Laboratory, T 2-4 or as arranged.

The theory and practice of stage production; planning of small theatres; stage arrangement; problems and practices in scene construction, design, and elements of lighting. Lectures, demonstrations, reports.

437. DRAMATIC PRODUCTION: STAGE LIGHTING. Spring term. Credit three hours. Associate Professor STAINTON. T Th 12. Laboratory, Th 2–4:30.

439,40. THEATRE PRACTICE. Fall and spring terms; may be entered either term. Associate Professor STAINTON and Associate Professor Albright. Hours and credits as arranged.

451. HISTORY OF THE THEATRE. Spring term. Credit three hours. Professor DRUMMOND. M W F 12.

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

455. AMERICAN DRAMA AND THEATRE. Fall term. Professor DRUMMOND. M W F 12.

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.

463,4. PLAYWRITING. Fall and spring terms. Credit three hours. Professor Drummond. F 2–4:30.

475. THEORIES OF DRAMATIC PRODUCTION. Fall term. Credit three hours. Professor DRUMMOND. W 2-4:30.

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

476. SEMINAR. Spring term. Credit three hours. Professor DRUMMOND. W 2-4:30, or hours to be arranged.

Special problems in the theory and practice of the theatre and drama.

481. DRAMATIC ART. Fall term. Credit three hours. Associate Professor ALBRIGHT. W 2-4:30.

A seminar: persistent questions in drama and theatre, viewed in the light of historical and critical materials.

485. MODERN THEORIES OF STAGE PRESENTATION. Spring term. Credit three hours. Associate Professor STAINTON. W 2-4:30.

A seminar in the work of Craig, Appia, Fuchs, and others who have influenced contemporary stage production.

DRAMATIC LITERATURE. See English 341-342, 369-370.

DRAMATIC STRUCTURE. See English 651-652.

DRAMA AND THE THEATRE. See Literature 301,2.

# MUSIC

Professors William W. Austin, William A. Campbell, Donald J. Grout, Robert L. Hull, Hunter Johnson, John Kirkpatrick, Robert Palmer.

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

History of Music 2, 3, 4	Musicology 1, 2, 3, 4
Musical Composition 2, 3, 4	Theory of Music 2, 3, 4

Students interested in applied music and the musical organizations are invited to consult wth the chairman of the Department. Graduate credit is not given for applied music.

For undergraduate courses which often meet needs of graduate students, see the *Announcement of the College of Arts and Sciences*, Department of Music, courses 101, 103 and 201. For courses 101 and 103, preregistration is required.

## MUSIC HISTORY

#### MUSIC THEORY

203, 204. *THEORY III. COUNTERPOINT*. Throughout the year. Credit three hours a term. Prerequisite, Music 201–202, or the equivalent. M W F 12. Associate Professor PALMER.

The general principles of counterpoint will be studied by examining the contrapuntal practice of the Baroque period as exemplified chiefly in the works of J. S. Bach. There will be analysis and composition in the polyphonic forms of the period.

205, 206. THEORY IV. ANALYTIC TECHNIQUE. Throughout the year. Credit three hours a term. Prerequisite, Music 203–204, or the equivalent. Hours to be arranged. Associate Professor PALMER.

This course is designed to develop a technique of analysis applicable to the music of any period. Examples from various periods in the history of music will be intensively studied, and the growth of the important structural principles underlying Western music will be traced.

207, 208. ORCHESTRATION AND CONDUCTING. Throughout the year. Credit three hours a term. Prerequisites, Music 101–102 and 103–104, or the equivalents. M W F 2. Messrs. CAMPBELL and JOHNSON.

A study of the instruments of the orchestra and their use in representative works from 1700 to the present. Scoring for various instrumental groups, including large orchestra. The fundamentals of score reading and conducting. Qualified students will be given opportunity to practice with university musical organizations.

209, 210. COMPOSITION IN TWENTIETH CENTURY STYLE. Throughout the year. Credit two hours a term. Hours to be arranged. Prerequisite, Music 203–204. (Music 203–204 may be taken concurrently with Music 209–210). Mr. JOHNSON.

The study of twentieth century harmonic and contrapuntal techniques and their application in original composition.

021-022. INFORMAL STUDY. Credit hours to be arranged. Associate Professor PALMER.

023–024. INFORMAL STUDY. Credit hours to be arranged. Associate Professor HULL.

#### MUSIC HISTORY

301, 302. *HISTORY OF MUSIC*. Throughout the year. Credit three hours a term. Prerequisites, Music 101–102 and Music 201–202 (the latter may be taken concurrently with Music 301, 302). M W F 9. Professor GROUT.

The development of the art of music from the Middle Ages to the present, with a study of compositions representative of the principal styles.

[305, 306. MUSIC OF THE BAROQUE PERIOD. Throughout the year. Credit three hours a term. Prerequisite, Music 301–302. M W F 10. Professor GROUT. Not offered in 1949–1950.]

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

311. CONTEMPORARY MUSIC. Fall term. Credit three hours. Prerequisites, Music 301–302 and Music 203–204. (The latter may be taken concurrently with Music 311). M W F 11. Associate Professor PALMER.

A study of the beginnings, development and current directions in the music of Europe from the mid-nineteenth century until the present. Representative works by significant composers will be examined through analyses and recordings. Considerable importance will be given to the relationships between music and developments in other fields.

312. CONTEMPORARY MUSIC. Spring term. Credit three hours. Prerequisite, Music 311. M W F 11. Associate Professor PALMER.

A study similar to Music 311 with particular reference to American music as an aspect of the wider development of the arts in North America. Representative composers' work will be examined and current trends discussed.

319, 320. COLLEGIUM MUSICUM. Throughout the year. Credit two hours a term. Prerequisites, Music 101–102 or Music 103–104, and consent of the instructor. T 2–4:40. Associate Professor Hull, assisted by members of the Department.

A study of selected works from all periods in the history of music through analysis, editing, conducting, and performing. Each member of the class will be assigned specific research problems which will be the basis of performances and discussions during the laboratory section of the regular class periods. The techniques and objectives will be the same each year, but the materials covered will not be the same in any two successive years.

031, 032. *INFORMAL STUDY*. Credit hours to be arranged. Assistant Professor Austin.

033, 034. *INFORMAL STUDY*. Credit hours to be arranged. Professor GROUT. 041, 042. *INFORMAL STUDY*. Credit hours to be arranged. Associate Profes-

SOT KIRKPATRICK.

#### ADVANCED SEMINARS

275, 276. SEMINAR IN COMPOSITION. Throughout the year. Credit two hours a term. Open to seniors by permission. Hours to be arranged. Associate Professor PALMER.

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

875, 376. *INTRODUCTION TO RESEARCH*. Throughout the year. Credit two hours a term. Prerequisites, a reading knowledge of French and German and an elementary knowledge of music theory and general music history. Hours to be arranged. Professor GROUT.

The basic materials and techniques of musicological research.

377, 378. SEMINAR IN MUSICOLOGY. Throughout the year. 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 applied music and score reading. The topic for the seminar in 1949–1950 is "Studies in the Mass and Motet of the Early Sixteenth Century."

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# SUSAN LINN SAGE SCHOOL OF PHILOSOPHY

# Professors Max Black, Stuart M. Brown, Jr., E. A. Burtt, Norman Malcolm, Arthur E. Murphy, Harold R. Smart, and Gregory Vlastos.

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* is 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 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 is 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. PHILOSOPHY

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 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

For undergraduate courses which often meet needs of graduate students, see the Announcement of the College of Arts and Sciences, Department of PHILOSO-PHY, Courses 301–302, 312, 313, 321, 322, 323, 324, 325–326, 327.

424. PHILOSOPHY OF SCIENCE. Spring term. Professor BLACK. T 2-4, Th 2. A critical analysis of scientific methodology with detailed study of such topics as causality, theories, fictions, measurement.

425. ETHICAL THEORY. Fall term. Assistant Professor BROWN. M W F 10. An intensive study of selected periods in the history of ethical theory. Topics for 1949–1950: Modern English ethics from Hobbes through F. H. Bradley.

427. RECENT PHILOSOPHY (1890–1940). Fall term. Professor MURPHY. M W F 12.

Topic for 1949-1950: The metaphysical theories of Bradley, Bergson, and Whitehead.

[481. AESTHETICS: ADVANCED COURSE. Fall term.

An intensive study of selected problems in the field. Not offered in 1949–1950.] 485. *PHILOSOPHY OF RELIGION: ADVANCED COURSE*. Spring term. Professor BURTT. F 2–4, or hours to be arranged.

An intensive study of selected problems in the field, with critical comparison of basic ideas in Judaism, Christianity, and Oriental religions.

SYMBOLIC LOGIC. (See MATHEMATICS.)

575-576. PLATO AND ARISTOTLE. Fall and spring terms. Professor VLASTOS. M 3-5.

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

579–580. MODERN PHILOSOPHERS. Fall and spring terms. Fall term: Hume. Professor BURTT. W 3–5. Spring term: Dewey and Mead. Professor MURPHY. W 3–5.

[581-582. SEMANTICS AND LOGIC. Fall and spring terms. Professor BLACK. Not given in 1949-1950.]

### PHILOSOPHY

[585-586. ADVANCED ETHICS AND VALUE THEORY. Fall and spring terms. First term prerequisite to the second. Assistant Professor BROWN and Professor VLASTOS.

An intensive study of some of the main problems in ethics and social philosophy. Not given in 1949-1950.]

[587-588. METAPHYSICS. Fall and spring terms.

An intensive study of some of the main theories and problems regarding reality and knowledge. Not given in 1949-1950.]

[590. SEMINAR IN GREEK PHILOSOPHY. Fall term. Professor VLASTOS. Not given in 1949–1950.]

[592. SEMINAR IN MODERN PHILOSOPHY. Spring term. Not given in 1949–1950.]

594. SEMINAR IN PHILOSOPHICAL ANALYSIS. Spring term. Assistant Professor MALCOLM. Th 3-5.

Topic for 1949-1950: Consciousness and thought.

595. SEMINAR IN SEMANTICS AND LOGIC. Fall term. Professor BLACK. T 2-4. Topic for 1949–1950: Philosophy of language.

039. INFORMAL STUDY. Professors BLACK, BURTT, MURPHY, VLASTOS.

049. INFORMAL STUDY. Assistant Professors Brown and MALCOLM, Associate Professor SMART.

# 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 G. P. Adams, Jr., Morris Copeland, J. G. B. Hutchins, A. E. Kahn, M. S. Kendrick, R. E. Montgomery, J. E. Morton, P. M. O'Leary, H. L. Reed, E. P. Reubens, and D. G. Tyndall.

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

International Economics 1, 2, 3, 4

Labor Economics 1, 2, 3, 4

Monetary Economics 1, 2, 3, 4

Organization and Control of Industry 1, 2, 3, 4

Public Finance 1, 2, 3, 4

1. All candidates for the Ph.D. degree will be required to demonstrate competence in Economic Theory, Economic History, Statistics, and in such other fields as their special committees prescribe. With the exception of Economic History, these requirements apply also to candidates for the A.M. degree.

2. All candidates for advanced degrees who elect a minor in economics will be held for work in economic theory.

3. Candidates for advanced degrees in economics may, with the approval of their special committees, elect one minor subject from some field outside economics.

4. Applications for fellowships and scholarships in economics should be filed with the Dean of the Graduate School prior to March 1. Applications for teaching fellowships, however, should be made directly to the Chairman of the Department of Economics.

5. The requirements for the Ph.D. degree in the approved major and minor fields in economics are listed below. Requirements for the A.M. degree correspond generally to the minor requirements for the Ph.D. degree.

ECONOMIC HISTORY. When offered as a major: (1) detailed familiarity with economic policies, practices and trends, economic structure and business organization from 1750 to the present: (2) general knowledge of the primary features of economic development before 1750, particularly since 1450; (3) detailed knowledge of at least one special field of economic history; (4) ability to apply sound

economic analysis to any problem of economic history; (5) critical knowledge of bibliography and source materials.

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

ECONOMIC THEORY AND ITS HISTORY: When offered as a major: (1) general knowledge of the history of economic thought and its historical and intellectual background, including the more important recent schools and principal contemporary theorists; (2) familiarity with methods of economic analysis and with controversial areas of thought; (3) detailed knowledge of some period or school and of the relevant historical and intellectual background.

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

INTERNATIONAL ECONOMICS. When offered as a major: (1) the theory of international trade and investment, and its history; (2) the organization and control of international trading and investing-cartels, commodity agreements and commercial policy; (3) the theory of balance of payments equilibrium and its history; (4) international financial organization and policy.

When offered as a minor the same subjects should be covered but less intensively.

LABOR ECONOMICS. When offered as a major: (1) labor organization, collective bargaining, and the employer's approach to industrial relations including labor management; (2) the economics of wage determination, the volume of employment and related matters; (3) history and interpretation of American and other labor movements; (4) government policy towards labor, labor legislation, social insurance, and legal and constitutional aspects of labor problems; (5) unorthodox or dissenting economic thought; (6) quantitative measurements of economic phenomena, with special reference to labor problems.

When offered as a minor: any two or more of the above requirements as prescribed by the candidate's special committee.

MONETARY ECONOMICS. When offered as a major: (1) a detailed understanding of the theory and history of money and currency; (2) the monetary system of the United States; (3) principles of foreign and domestic exchange; (4) monetary aspects of cyclical fluctuations; (5) an understanding of leading monetary systems of the world; (6) modern central banking theory and practice; (7) monetary policy in relation to output and to the distribution of the national income.

When offered as a minor: Parts 1, 2, 3, 4, 5 of the above requirement.

ORGANIZATION AND CONTROL OF INDUSTRY. When offered as a major: (1) a good general knowledge of the organization of industry under the price system; (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 or in one major American industry; (4) a knowledge of accounting and corporation finance; (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: An adequate knowledge of (1) the historical development of state and local, and federal, expenditures and revenues; (2) the existing pattern of expenditures and revenues; (3) the problems pertaining to individual items of expenditure and revenue; (4) the problems of intergovernmental fiscal relations; and (5) theories of taxation and expenditure, including the incidence of taxation, and fiscal policy. Some acquaintance with public finance in other countries is also required.

When offered as a minor: A less intensive knowledge of the same five areas.

#### HISTORY AND THE SOCIAL SCIENCES

6. Courses and seminars. Courses in the School of Business and Public Administration, in addition to those listed below, may be taken with the approval of the Dean of the School. For undergraduate courses which often meet the needs of graduate students, see the *Announcement of the College of Arts and Sciences*, Department of Economics. Preregistration is required for all of these.

[275. MONETARY AND BUSINESS CYCLE THEORY. Throughout the year. Prerequisite, consent of instructor. Professor REED. Not given in 1949–1950.]

BASIC ECONOMIC STATISTICS. (I.L.R. 103). Fall term. Credit three hours. Professor MORTON. Hours to be arranged.

For graduate students who have not taken a course in Statistics or who wish to take a refresher course. Emphasis will be placed on discussion of technical aspects of statistical analysis, and on initiative in selecting and applying statistical methods to individual research problems. The subjects ordinarily covered will include analysis of frequency distributions, of time series (including index numbers), correlation analysis, and analysis of variance.

SEMINAR IN ECONOMIC STATISTICS. (LL.R. 113). Spring term. Credit three hours. Professor Morron. Hours to be arranged.

A continuation of 103. Each seminar will be given over to the intensive study of a specific topic, such as: theory and analysis of index numbers (with emphasis on the measurement of the "cost of living" and of production and consumption); of time series (stressing the analysis of business cycle data and forecasting methods); of simple and multiple correlation and of confluence analysis; of sampling designs, etc.

375. PUBLIC CONTROL OF BUSINESS. Throughout the year. Credit three hours a term. Professor —————. Hours to be arranged.

A series of intensive investigations of individual areas and problems of public policy within the general framework of a private enterprise economy.

475. LABOR ECONOMICS. Throughout the year. Credit three hours a term. Professor MONTGOMERY. Hours to be arranged.

Topics selected for critical examination vary from year to year. In general, the first semester is devoted to a survey of some of the more general theoretical and quantitative data, and the second to investigation of special topics.

575. *PUBLIC FINANCE*. Spring term. Credit three hours. Professor KENDRICK. Hours to be arranged.

Readings and informal discussion of various problems in the field, each selected because of its current importance.

675. ECONOMIC HISTORY. Throughout the year. Credit three hours a term. Professor HUTCHINS. Hours to be arranged.

A study of the development of the modern economic system in Europe and the United States. Comparative study of technological change, institutional adaptations to these changes, and resulting economic structures in the leading countries.

775. *INTERNATIONAL ECONOMICS*. Throughout the year. Credit three hours a term. Professor —————. Hours to be arranged.

The subjects covered include the theory of international trade, international competition; cartels; commodity agreements; commercial policy and agreements; mechanism of adjustment of the balance of payments; foreign exchange; exchange stabilization; international capital movements.

975. *ECONOMIC THEORY*. Throughout the year. Credit three hours a term. Professor —————. Hours to be arranged.

The seminar involves broad reading in the contemporary literature of economic

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thought and analysis and reports by members on particular writers or topics. The content changes from year to year.

980. HISTORY OF ECONOMIC THOUGHT. Throughout the year. Credit three hours a term. Associate Professor ADAMS. Hours to be arranged.

The development of economic doctrine from Mercantilist thought to the present day, with primary emphasis on the Classical and Neo-Classical tradition.

## GOVERNMENT

Professors Herbert W. BRIGGS, ROBERT E. CUSHMAN, MARIO EINAUDI, ELIAS HUZAR, and CLINTON L. ROSSITER.

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

American Government and 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

Students undertaking graduate work in Government should possess a familiarity with the elements of political science and American and European political institutions, as well as some knowledge of international relations and American and European history. Facilities exist at Cornell for carrying on research in any of the fields listed above. It is recommended that candidates for the Ph.D. with a major in Government should take at least one minor outside the Department.

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.

## AMERICAN GOVERNMENT AND INSTITUTIONS

213. CONGRESS: ORGANIZATION AND METHODS OF WORK. Fall term. Credit three hours. M W F 2. Associate Professor HUZAR.

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

216. THE AMERICAN PRESIDENCY. Spring term. Credit three hours. M W F 11. Assistant Professor Rossiter.

A study of the presidential office; the constitutional, administrative, and political position of the President; relation to Congress; current problems and proposals.

218. AMERICAN POLITICAL PARTIES. Spring term. Credit three hours. Prerequisite, Government 101. M W F 8. Assistant Professor Rossiter.

The history, organization, functions, and significance of political parties in the United States.

231, 232. PUBLIC ADMINISTRATION. Throughout the year. Credit three hours a term. M W F 10. Associate Professor HUZAR.

The following topics will be emphasized: efficiency and responsibility in public

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

235. AMERICAN POLITICAL AND CONSTITUTIONAL THEORY. Fall term. Credit three hours. Prerequisite, Government 101, or the consent of the instructor, M W F 8. Assistant Professor Rossiter.

A survey of the development of American political thought with special reference to its influence on constitutional development.

241. CONSTITUTIONAL LAW: THE AMERICAN FEDERAL SYSTEM. Fall term. Credit three hours. Prerequisite, Government 101, or the consent of the instructor. T Th S 11. Professor CUSHMAN.

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

242. CONSTITUTIONAL LAW: FUNDAMENTAL RIGHTS AND IMMUNI-TIES. Spring term. Credit three hours. Prerequisite, Government 101, or the consent of the instructor. T Th S 11. Professor CUSHMAN.

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.

275. SEMINAR IN CONSTITUTIONAL PROBLEMS. Throughout the year. Credit two hours a term. Hours to be arranged. Professor CUSHMAN.

285. SEMINAR IN PUBLIC ADMINISTRATION. Spring term. Credit two hours. Hours to be arranged. Associate Professor HUZAR.

Problems of the American military establishment.

## COMPARATIVE GOVERNMENT AND POLITICAL THEORY

311. CONSTITUTIONAL GOVERNMENT OF EUROPE. Fall term. Credit three hours. T Th S 9. Professor EINAUDI.

The reconstruction of democratic and constitutional governments after the totalitarian crisis.

[331. PUBLIC CONTROL OF ECONOMIC LIFE. Fall term. Credit three hours. Professor EINAUDI. Not given in 1949–1950.]

321. DEVELOPMENT OF MODERN POLITICAL THOUGHT. Fall term. Credit three hours. T Th S 10. Professor EINAUDI.

Political thought from the sixteenth century to the French revolution: from Machiavelli to Rousseau.

322. CONTEMPORARY POLITICAL THOUGHT. Spring term. Credit three hours. T Th S 10. Professor EINAUDI.

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

[375-376. SEMINAR IN POLITICAL THEORY. Throughout the year. Credit three hours a term. Hours to be arranged. Preregistration required. Professor EINAUDI. Not given in 1949-1950.]

385–386. SEMINAR IN COMPARATIVE CONSTITUTIONAL LAW. Throughout the year. Credit three hours a term. Hours to be arranged. Preregistration required. Professor EINAUDI.

#### INTERNATIONAL RELATIONS

[411. INTERNATIONAL POLITICS. Fall term. Credit three hours. M W F 9. Professor BRIGGS. Not offered in 1949–1950.]

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#### HISTORY

414. INTERNATIONAL ORGANIZATION. Spring term. Credit three hours. M W F 9. Professor BRIGGS.

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 and specialized agencies; the judicial function and the International Court of Justice.

417. CONTEMPORARY AMERICAN FOREIGN POLICY: THE FAR EAST-ERN POLICY OF THE UNITED STATES. Fall term. Credit three hours. M W F 9. Professor Briggs.

An analysis of the relations of the United States with China, Japan, and the European powers with Far Eastern interests, primarily since 1898.

[418. CONTEMPORARY AMERICAN FOREIGN POLICY: THE LATIN AMERICAN POLICY OF THE UNITED STATES. Spring term. Credit three hours. Professor BRIGGS. Not offered in 1949–1950.]

441, 442. *INTERNATIONAL LAW*. Throughout the year. Credit three hours a term. M W F 12. Professor BRIGGS.

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

475. SEMINAR IN INTERNATIONAL LAW AND INTERNATIONAL OR-GANIZATION. Throughout the year. Credit two hours a term. Hours to be arranged. Professor BRIGGS.

## HISTORY

Professors KNIGHT BIGGERSTAFF, C. W. DE KIEWIET, E. W. FOX, P. W. GATES, H. E. GUERLAC, M. L. LAISTNER, F. G. MARCHAM, C. P. NETTELS, CARL STEPHENSON, and MARC SZEFTEL.

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

History of Science 1, 2, 3, 4
Medieval History 1, 2, 3, 4
Modern European History 1, 2, 3, 4
Slavic History 1, 2, 3, 4

For graduate work in history a student should have a general knowledge of history, government, and other social studies. He should be able to speak and write good English; to read French, German, and any other foreign language required for work in his special field. For major work in Ancient History the student needs a reading knowledge of both Greek and Latin; for major work in Medieval History a reading knowledge of Latin; for major work in Chinese History a reading knowledge of Chinese; for major work in Slavic History a reading knowledge of Russian. Such linguistic training should preferably be obtained by the student during his undergraduate years, but deficiencies can be made up after admission to the Graduate School.

The University Library contains a number of special collections that are notably strong. Among these are the President White Library of European History with its emphasis upon the French Revolution and science and warfare, the Eisenlohr collection on the history of Egypt, the Anthon collection on the Graeco-Roman world, the Fiske Collections on Dante, Petrarch, and Iceland, the Goldwin Smith collection on English history, and the Wason collection on China and the Chinese. The Collection of Regional History has brought together rich manuscript and newspaper materials for the study of American economic and social history. Mention should also be made of the libraries of the College of Agriculture and the Law School which include much additional material relating to American and English History.

Three fellowships and a scholarship are available to graduate students in history. The President White Fellowship in Modern History has a value of \$500; the Fellowship in American History has a value of \$400; the stipend of the George C. Boldt Fellowship is \$1,000; and the Graduate Scholarship amounts to \$200. All fellowships and scholarships carry exemption from tuition.

There are several assistantships in History which are generally awarded to advanced graduate students. Competition for the Moses Coit Tyler prize for an outstanding original study in American history and literature is open to graduate students.

For undergraduate courses at the beginning level which may be useful to graduate students see Announcement of the College of Arts and Sciences, Department of HISTORY, courses 101-2, 103-4, 105-6, 107-8, 147-8, 151-2.

## AMERICAN HISTORY

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

[711. AMERICAN COLONIAL HISTORY TO 1763. Fall term. M W F 1. Professor NETTELS. Not offered in 1949–1950.]

712. THE AGE OF WASHINGTON. 1763-1800. Spring term. M W F 1. Professor NETTELS.

717. AMERICAN BIOGRAPHY. Fall term. M W F 1. Professor NETTELS.

[721–2. AMERICAN HISTORY: HISTORY OF THE WEST. Fall and spring term. M W F 12. Professor GATES. Not offered in 1949–1950.]

726. RECENT AMERICAN HISTORY. Spring term. M W F 12. Professor GATES.

[728. ECONOMIC HISTORY OF THE UNITED STATES. Spring term. M W F 12. Professor GATES. Not offered in 1949–1950.]

775-6. SEMINAR IN AMERICAN HISTORY. One or two terms during the year. Hours to be arranged. Professor NETTELS.

782. SEMINAR IN AMERICAN HISTORY. Spring term. Hours to be arranged. Professor GATES.

## ANCIENT HISTORY

Professor M. L. W. LAISTNER.

211. GREEK HISTORY, 500-323 B.C. Fall term. M W F 11.

[212. THE HELLENISTIC AGE. Spring term. M W F 11. Not given in 1949–1950.]

[213. THE ROMAN REPUBLIC, 133-30 B.C. Fall term. M W F 11. Not given in 1949–1950.]

214. THE ROMAN EMPIRE, 30 B.C.-180 A.D. Spring term. M W F 11.

[275–6. SEMINAR IN GREEK AND ROMAN HISTORIOGRAPHY. Throughout the year. Not offered in 1949–1950.]

277-8. SEMINAR IN ROMAN HISTORICAL INSCRIPTIONS. Fall and spring terms. M 2-4. A reading knowledge of Latin is essential.

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#### HISTORY

## CHINESE HISTORY

#### Professor KNIGHT BIGGERSTAFF.

161. HISTORY OF CHINESE CIVILIZATION: TO 1842. Fall term. M W F 12. Credit three hours.

A rapid survey of the more significant Chinese cultural developments from earliest times until the establishment of formal relations with the West.

162. HISTORY OF CHINESE CIVILIZATION: SINCE 1842. Spring terms M W F 12. Credit three hours.

A detailed survey of Chinese history since the beginning of significant Western influence.

811. MODERNIZATION OF CHINA: 1842-1911. Fall term. M 2-4. Credit two hours. Prerequisite History 162 or consent of the instructor.

Topical study of the impact of Western civilization upon traditional China.

812. MODERNIZATION OF CHINA: SINCE 1911. Spring term. M 2-4. Credit two hours. Prerequisite History 162 or consent of the instructor.

Topical study of changes in China since the Revolution of 1911.

875-6. SEMINAR IN MODERN CHINESE HISTORY. Throughout the year. Hours to be arranged.

See related courses under FAR EASTERN STUDIES.

#### ENGLISH HISTORY

### Professor F. G. MARCHAM.

512. ENGLISH CONSTITUTIONAL HISTORY SINCE 1485. Spring term. T Th S 11.

[515. HISTORY OF ENGLAND UNDER THE TUDORS. Fall term. T Th S 11. Not offered in 1949–1950.]

[516. HISTORY OF ENGLAND UNDER THE STUARTS. Spring term. T Th S 11. Not offered in 1949–1950.]

[517. HISTORY OF ENGLAND IN THE 19th CENTURY. Fall term. T Th S 11. Not offered in 1949–1950.]

518. HISTORY OF ENGLAND IN THE 20th CENTURY. Fall term. T Th S 11.

576. SEMINAR IN TUDOR AND STUART HISTORY. Fall and spring terms.

#### MEDIEVAL HISTORY

## Professor CARL STEPHENSON.

511. ENGLISH CONSTITUTIONAL HISTORY TO 1485. Fall term. M W F 2. [309-310. ECONOMIC AND SOCIAL HISTORY OF EUROPE FROM THE FOURTH TO THE SIXTEENTH CENTURY. Fall and spring terms. Hours to be arranged. Not offered in 1949–1950.]

[312. INTELLECTUAL HISTORY OF EUROPE FROM THE FOURTH TO THE SIXTEENTH CENTURY. Spring term. Not offered in 1949–1950.]

375-6. SEMINAR IN MEDIEVAL HISTORY. Fall and spring terms. A reading knowledge of Latin is desirable. Hours to be arranged.

## MODERN EUROPEAN HISTORY

Professors C. W. DE KIEWIET, E. W. FOX, CARL STEPHENSON.

[411-2. FRANCE IN THE 17th AND 18th CENTURIES. Fall and spring terms. Professor DE KIEWIET. Not offered in 1949–1950.]

[421. THE EUROPEAN REVOLUTION, 1789–1848. Fall term. W F 2:00–3:30. Professor Fox. Not offered in 1949–1950.]

[423. MODERNIZATION OF EUROPE. Fall term. W F 2:00-3:30. Professor Fox. Not offered in 1949-1950.]

[424. EVOLUTION OF THE FOURTH FRENCH REPUBLIC. Spring term. W F 2:00-3:30. Professor Fox. Not offered in 1949–1950.]

426. ORIGINS OF THE THIRD REICH. Spring term. W F 2:00-3:30. Professor Fox.

427. EUROPE AND THE WORLD WARS. Fall term. W F 2:00-3:30. Professor Fox.

From the origins of the first war to the present.

481-2. SEMINAR IN MODERN EUROPEAN HISTORY. Hours to be arranged. Professor Fox.

[475-6. SEMINAR IN MODERN EUROPEAN HISTORY. Hours to be arranged. Professor de Kiewier. Not offered in 1949-1950.]

## SLAVIC HISTORY

## Professor MARC SZEFTEL.

[451. HISTORY OF POLAND AND CZECHOSLOVAKIA. Fall term. T Th 2–3:30. Not offered in 1949–1950.]

[452. HISTORY OF YUGOSLAVIA AND BULGARIA. Spring term. T Th 2-3:30. Not offered in 1949-1950.]

455-6. INTELLECTUAL HISTORY OF MODERN RUSSIA. Fall and spring terms. Credit three hours a term. Prerequisite, History 147-148, or consent of the instructor. T Th 2-3:30.

[457. RUSSIAN HISTORIOGRAPHY. Fall term. Credit three hours. Prerequisite, History 147–148, or consent of the instructor. T Th 2–3:30. Not offered in 1949–1950.]

[458. KIEV RUSSIA AND MUSCOVY. Spring term. Credit three hours. Prerequisite, History 147–148, or consent of the instructor. T Th 2–3:30. Not offered in 1949–1950.]

495-6. SEMINAR IN RUSSIAN STUDIES. Fall and spring terms. Credit and hours to be arranged. Prerequisite, consent of Mr. SZEFTEL and other members of the Committee on Russian Studies.

## HISTORY OF SCIENCE

Professor H. E. GUERLAC.

911. ORIGINS OF MODERN SCIENCE. Fall term. Prerequisite, History 165-166 or consent of the instructor. T Th 2-4.

The evolution of some fundamental physical concepts studied through representative writings.

[913. ORIGINS OF MODERN SCIENCE. Fall term. T Th 2-4. The development of biological thought. Not offered in 1949-1950.]

916. SCIENCE AND THE CENTURY OF THE ENLIGHTENMENT. Spring term. M W F 9.

The thought of the 18th century from Bayle and Fontenelle through the French Revolution, with special reference to the influence of scientific ideas.

975-6. SEMINAR IN THE HISTORY OF SCIENCE. Throughout the year. Hours to be arranged.

#### SOCIOLOGY

## SOCIOLOGY

Professors L. S. Cottrell, Jr., W. A. Anderson, M. E. Duthie, A. H. Leighton, M. E. Opler, R. A. Polson, R. L. Sharp, R. M. Williams, Jr.; Associate Professors R. C. Clark, Louis Guttman, Olaf Larson; Assistant Professors M. L. Barron, A. R. Holmberg, H. M. Leyendecker, W. W. Reeder, Edward A. Suchman, Philip Taietz, H. E. Thomas; Doctors John Adair and J. P. Dean.

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

Sociology 1, 2, 3, 4 Rural Sociology 1, 2, 3, 4 Cultural Anthropology 1,\*2, 3, 4 Statistics 2, 3, 4

## 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 sub-fields in sociology, such as: 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 subfields.

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 sub-fields in sociology, such as: 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 other sub-field 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 major for the Ph.D. degree: (1) a thorough knowledge of the history of anthropology and of anthropological theory and method; (2) familiarity with the major culture areas of the world and details of the ethnology of at least one such area; (3) a grasp of the principles of linguistics, of physical anthropology, and familiarity with the most important findings of archaeology.

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 Sociology 775–776; (2) completion of a research project which demonstrates that the candidate is able to select methods appropriate to the problems 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 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 Departments of Sociology and Anthropology (SA) and Rural Sociology (RS) as indicated.

## GENERAL SOCIOLOGY

For undergraduate courses which often meet needs of graduate students, see the *Announcement of the College of Arts and Sciences*, Department of Sociology AND ANTHROPOLOGY, courses SA 101, SA 102, SA 104.

SA 201. INTRODUCTION TO RESEARCH METHODS. Fall term. Credit three hours. Prerequisite Sociology and Anthropology 101 or equivalent. Assistant Professor SUCHMAN. M W F 10.

Problems of research design and techniques for gathering data in sociological research.

SA 202. ANALYSIS AND INTERPRETATION OF SOCIOLOGICAL DATA. Spring term. Credit three hours. Prerequisite, Statistics 101 or the equivalent. Assistant Professor SUCHMAN. M W F 10.

The application of simple statistical techniques to the analysis of sociological data. Interpretation of evidence and consideration of sources of error and of bias.

[SA 210. THE FAMILY. Spring term. Credit three hours. Prerequisite Sociology and Anthropology 101 or the equivalent. Not given in 1949–1950.]

SA 223. *DELINQUENCY AND CRIME*. Fall term. Credit three hours. Prerequisite, Sociology and Anthropology 101 or equivalent. Not open to freshmen. Assistant Professor BARRON. T Th S 10.

Comparison of juvenile delinquency and adult crime with special reference to the United States. Analysis of statistics on offenses and offenders; historical development of criminological theory; recent etiological trends; laws and court systems; police and penology; techniques of treatment and prevention.

SA 228. PROBLEMS IN MINORITY GROUP RELATIONS. Spring term. Credit three hours. Prerequisite, Sociology and Anthropology 101 or the equivalent. Not open to freshmen. Assistant Professor BARRON. T Th S 10.

The old world background of American minorities and patterns of immigration; critical analysis of minorities' contributions to American culture. Relations of ethnic institutions and American legislation to adjustment and assimilation. Problems of second generation Americans.

SA 301. SOCIAL PSYCHOLOGY: INTER-PERSONAL BEHAVIOR. Fall term.

### SOCIOLOGY

Credit three hours. Prerequisite, Sociology and Anthropology 101 and one course in psychology or the equivalent. Mr. Foote. M W F 11.

Social psychological analysis of the processes and products of personal interaction.

SA 302. SOCIAL PSYCHOLOGY: GROUP DYNAMICS. Spring term. Credit three hours. Prerequisite, Sociology and Anthropology 101 and one course in Psychology or the equivalent. Mr. Foote. M W F 11.

Social psychological analysis of the processes and products of intra- and intergroup behavior.

SA 311. PUBLIC OPINION. Fall term. Credit three hours. No prerequisites. Assistant Professor SUCHMAN. M W F 11.

The nature and control of public opinion, including opinion formation and change. A study of the methods and techniques of public opinion and attitude analysis.

[SA 312. MASS COMMUNICATION MEDIA. Spring term. Credit three hours. No prerequisites. Assistant Professor SUCHMAN. Given in alternate years. Not given in 1949–1950.]

A study of the media of mass communication in modern society. Special attention is given to the role of the radio, the press, and the motion pictures; their growth and distribution, content, audience, and effects. Course includes a study of the methods of communications research.

[SA 314. COLLECTIVE BEHAVIOR AND SOCIAL MOVEMENTS. Spring term. Credit three hours. Prerequisite Sociology and Anthropology 101 or equivalent. Not given in 1949–1950.]

SA 320. POLITICAL SOCIOLOGY. Fall term. Credit three hours. Prerequisite, Sociology and Anthropology 101 and consent of instructor. Mr. WHITE. M W F 9.

Analysis of political institutions with emphasis on the relationship between the political leaders of a community and the social and economic leadership on the county and state level.

HUMAN RELATIONS IN INDUSTRY. (See Industrial and Labor Relations 44.)

[SA 410. POPULATION PROBLEMS. Spring term. Credit three hours. Given in alternate years. Not given in 1949–1950.]

SA 431. STRUCTURE AND FUNCTIONING OF AMERICAN SOCIETY-I. Fall term. Credit three hours. Prerequisite Sociology and Anthropology 101 or equivalent. Professor WILLIAMS. T Th S 9.

Institutional structure and social organization of the United States.

SA 432. STRUCTURE AND FUNCTIONING OF AMERICAN SOCIETY-II. Spring term. Credit three hours. Prerequisite Sociology and Anthropology 101 or equivalent. Professor WILLIAMS. T Th S 9.

Analysis of the functional interrelations of groups and institutions in American society.

SA 433. THE SOCIOLOGY OF ECONOMIC CLASSES. Fall term. Credit three hours. Prerequisite Sociology and Anthropology 101 or the equivalent and consent of the instructor. Mr. FOOTE. T Th S 8.

A sociological analysis of the specific nature of American economic classes and their interrelations.

SA 434. SOCIAL PLANNING. Spring term. Credit three hours. Prerequisite Sociology and Anthropology 101 or the equivalent and consent of the instructor. Mr. FOOTE. T Th S 8.

A survey of objectives, methods, and problems in social planning with special attention to community participation in the planning process.

SA 575. THEORY OF CULTURE AND SOCIAL ORGANIZATION. Fall term. Credit three hours. Open to seniors and graduate students with the consent of the instructor. Professor WILLIAMS. T Th S 11.

Analysis of convergence in modern sociological thought. Includes consideration of sociological elements of major recent theories in related fields. The works of a number of the more important modern social scientists will be analyzed in developing a consistent theoretical framework.

SA 775–776. SEMINAR IN ADVANCED STATISTICAL METHODS. Throughout the year. Credit two hours a term. Prerequisite, consent of instructor. Hours to be arranged. Associate Professor GUTTMAN.

[RS 207. SOCIOLOGICAL THEORY. Throughout the year. Credit three hours a term. Alternates with course, RS 208. Open to seniors and graduate students. Prerequisite, permission of instructor. Professor ANDERSON. Not given in 1949– 1950.]

RS 208. SYSTEMATIC SOCIOLOGY. Fall and spring terms. Credit three hours a term. Alternates with course RS 207. Open to seniors and graduate students. Prerequisite, consent of instructor. Professor ANDERSON. T Th S 10.

This course presents a frame of reference for sociological thinking, with special emphasis on the interrelationships of the concepts in a system of sociology.

SA 020. *INFORMAL STUDY*. Throughout the year. Credit and hours to be arranged. Open to upperclass major and graduate students in Sociology and Anthropology. Members of the Department Staff.

SA 275–276. SEMINAR IN RESEARCH METHODS IN SOCIOLOGY AND ANTHROPOLOGY. Throughout the year. Credit two hours a term. Open to upperclass majors and graduate students in Sociology and Anthropology. Members of the Department Staff. W 3–5.

SA 375. SEMINAR IN SOCIAL PSYCHOLOGY. Spring term. Credit two hours. Prerequisite, Sociology and Anthropology 301 or 302. Professor Cottrell. W 2-4.

[SA 376. SEMINAR ON PRESSURE GROUPS AND PROPAGANDA. Fall term. Credit two hours. Assistant Professor SUCHMAN. Not given in 1949–1950.]

SA 377. SEMINAR ON MEDIA OF COMMUNICATION. Spring term. Credit two hours. Prerequisite, consent of instructor. Assistant Professor SUCHMAN. Th 2–4.

SA 475. SEMINAR IN GROUP RELATIONS. Spring term. Credit two hours. Prerequisite, consent of instructor. Professor WILLIAMS. T 2-4.

[SA 476. SEMINAR: SOCIAL CHANGE AND SOCIAL PLANNING. Spring term. Credit two hours. Not given in 1949–1950.]

SEMINAR IN HUMAN RELATIONS IN INDUSTRY. (See Industrial and Labor Relations 104.)

SA 577-578. SEMINAR ON THE URBAN COMMUNITY. Throughout the year. Credit two hours a term. Prerequisite, consent of instructor. Dr. DEAN. M 2-4.

#### STATISTICS

The following courses will be found listed in the Announcement of the College of Arts and Sciences.

STATISTICAL REASONING. Either term. Credit three hours.

## SOCIOLOGY

*INTRODUCTION TO STATISTICAL ANALYSIS.* Throughout the year. Credit three hours each term.

 $STATISTICAL\ TABULATION\ AND\ COMPUTING.$  Spring term. Credit two hours.

 $ADVANCED\ STATISTICAL\ ANALYSIS.$  Throughout the year. Credit three hours each term.

THEORY AND METHODS OF SAMPLING. Spring term. Credit three hours. PROBABILITY AND STATISTICS. Throughout the year. Credit three hours each term.

ADVANCED THEORY OF PROBABILITY. Fall term. Credit three hours.

SEMINAR ON CURRENT ADVANCES IN STATISTICAL RESEARCH. Throughout the year. Credit two hours each term.

SEMINAR IN ADVANCED STATISTICAL METHODS. Throughout the year. Credit two hours a term.

SEMINAR ON SOCIAL AND ECONOMIC STATISTICS. Spring term. Credit three hours.

## ANTHROPOLOGY

SA 341. NATIVE CULTURES OF THE NEW WORLD: NORTH AMERICA. Fall term. Credit three hours. Dr. Adair. M W F 2.

A survey of the culture areas from the Eskimo to Mexico. Topics include: the peopling of North America, linguistic classification, cultural development, functional and historical analyses of selected groups.

SA 342. NATIVE CULTURES OF THE NEW WORLD: MIDDLE AND SOUTH AMERICA. Spring term. Credit three hours. Assistant Professor Holm-BERG. M W F 2.

A survey of the culture areas from Yucatan to Tierra del Fuego. Topics include: the peopling of South America, linguistic classification, archaeology, functional and historical analyses of selected groups.

[SA 343. NATIVE CULTURES OF OCEANIA. Fall term. Credit three hours. Prerequisite, consent of instructor. Professor Sharp. M W F 9. Not given in 1949-1950.]

[SA 440. COMPARATIVE SOCIAL AND POLITICAL ORGANIZATION. Spring term. Credit three hours. Professor SHARP. M W F 11. Not given in 1949–1950.]

[SA 441. COMPARATIVE RELIGIOUS SYSTEMS OF NON-WESTERN PEOPLES. Fall term. Credit three hours. Professor OPLER. M W F 11. Not given in 1949–1950.]

SA 442. COMPARATIVE ECONOMIC SYSTEMS OF NON-WESTERN PEO-PLES. Spring term. Credit three hours. Assistant Professor Holmberg. M W F 10.

Analyses of economic systems of selected non-Western societies; methods of production, consumption, and distribution; economic integration; relation of the economy to other aspects of culture.

[SA 444. THE ARTS OF NON-LITERATE MAN. Spring term. Credit three hours. Dr. ADAIR. T Th S 9. Not given in 1949–1950.]

SA 601. CULTURAL ANTHROPOLOGY. Fall term. Credit three hours. Open to juniors, seniors, and graduate students. Professor SHARP. M W F 12.

Problems in the comparative study of cultures; the component parts of culture and their interrelations; analysis of processes involved in the impact of cultures on each other and in change. SA 602. CULTURE AND PERSONALITY. Spring term. Credit three hours. Open to juniors, seniors, and graduate students. Professor LEIGHTON and Professor SHARP. M W F 12.

A comparative study of personality formation in different cultures; behavior, both normal and abnormal, as a function of cultural determinants; the problem of type or group personality structure.

[SA 604. SEMINAR IN CONTEMPORARY CULTURE CHANGE IN SOUTH-EAST ASIA. Spring term. Credit two hours. Professor Sharp. M 3–5. Not given in 1949–1950.]

[SA 640. SEMINAR IN ANTHROPOLOGICAL THEORY. Spring term. Credit two hours. Professor OPLER. W 4-6. Not given in 1949–1950.]

[SA 641. SEMINAR IN METHOD AND FIELD WORK IN CULTURAL AN-THROPOLOGY. Fall term. Credit two hours. Assistant Professor Holmberg and Staff. W 3-5. Not given in 1949–1950.]

Discussions of field methods and techniques; informants and interpreters, participant observation, and experimentation; rapport, the native language, and note taking; questionnaires, schedules, and other techniques of gathering data.

SA 642. SEMINAR IN APPLIED ANTHROPOLOGY FIELD LABORATORY. Term to be arranged. Prerequisite, consent of instructor. Professor LEIGHTON and Dr. ADAIR.

Field training in New Mexico and Arizona. Designed for graduate students in the technical and social sciences. Research related to human problems resulting from technological change. Selected ethnic groups will be studied.

[SA 643. SEMINAR IN CULTURE AND CULTURE CHANGE IN INDIA. Fall term. Credit two hours. Professor OPLER. M 3-5. Not given in 1949-1950.]

SA 644. SEMINAR IN PERSONALITY STUDY AND INTENSIVE INTER-VIEWING. Spring term. Credit three hours. For graduate students majoring in human relations or closely related fields, preferably those interested in research. Prerequisite, consent of instructor. Professor LEIGHTON. T 10–12. Additional field work to be arranged.

Training in methods of intensive interviewing and the making of personality studies.

SA 645. SEMINAR IN CONTEMPORARY CULTURE CHANGE IN MIDDLE AND SOUTH AMERICA. Fall term. Credit two hours. Assistant Professor Holm-BERG. F 3-5.

Anthropology applied to planned programs of culture change in Latin America; discussions of recent changes in native cultures and of social problems arising from the introduction of modern technology.

SA 677. SEMINAR IN CASE STUDIES IN APPLIED ANTHROPOLOGY. To continue throughout the year. Students may register for both terms or either term. Professor SHARP and Staff. Th 3–5.

Case analyses of the relationship of social and technological problems that arise in the process of modernization and significant culture change.

SA 075. INFORMAL STUDY: REGIONAL ANTHROPOLOGY. Throughout the year. Credit to be arranged. Far East: Professors LEIGHTON, OPLER, and SHARP; Middle East: Professors OPLER and SHARP; North America: Dr. ADAIR, Professors LEIGHTON and OPLER; Middle and South America: Assistant Professor HOLMBERG; Oceania: Professor SHARP; Africa: Assistant Professor HOLMBERG.

For students who wish to acquire special competence in the anthropology of a recognized culture area or principal region of the world.

#### SOCIOLOGY

SA 076. INFORMAL STUDY: SPECIAL PROBLEMS IN ANTHROPOLOGY. Throughout the year. Staff.

For students who require thesis supervision or guidance in the study of special anthropological problems or who are doing intensive reading in special fields of anthropology such as archaeology. Consult appropriate staff members.

Attention is called to the following courses in other departments:

Physical Anthropology and Human Evolution (See Zoology 222)

Primitive Art (See Fine Arts 204)

Introduction to the Scientific Study of Language (See Linguistics 201-202)

Linguistic Analysis (See Linguistics 203-204)

Field Methods in Linguistics (See Linguistics 215)

An Introduction to Contemporary Southeast Asia (See Far Eastern Studies 202) An Introduction to Contemporary China (See Far Eastern Studies 201)

Seminar in Far Eastern Studies (See Far Eastern Studies 951-952)

Heredity and Eugenics (See Plant Breeding 1)

Genetics (See Plant Breeding 101)

History of Religion (See Philosophy 321)

See also related courses in General Sociology, Rural Sociology, Statistics, Psychology, Economics, and History.

## RURAL SOCIOLOGY

Note: For undergraduate courses which often meet needs of graduate students, see the *Announcement of the College of Agriculture*, Department of RURAL SO-CIOLOGY, courses 1, 12, 123, 124, 126, 128, 129, 130, 131. For course 123, preregistration is required.

111. RURAL COMMUNITY ORGANIZATION. Spring term. Credit three hours. Prerequisite, course 12, or permission of instructor. Assistant Professor REEDER. T Th S 11-12:20. Warren 325.

The purpose of this course is to consider the problems which confront a rural leader in helping the people and organizations of a community in working together to meet common needs. Students are given an opportunity to practice some organization techniques which have been found successful in community organization work.

132. RURAL LEADERSHIP. Spring term. Credit two hours. Prerequisite, permission of the instructor. Associate Professor LARSON. Th 2-4. Warren 302.

A study of the theories of leadership, a review of the significant research in the area of leadership, and a description and analysis of representative methods of recruiting and training lay leaders. Emphasis is on leadership in rural situations.

134. RURAL SOCIAL PROBLEMS AND PUBLIC POLICY. Fall term. Credit two hours. Open to seniors and graduate students. Prerequisite, permission of the instructor. Associate Professor LARSON. T 2-4. Warren 302.

This course relates the problem concept to a theoretical frame of reference, traces the development of social problems in American rural life and examines the social aspects of selected current problems including levels of living, socioeconomic status groups, institutionalized facilities and services, population and technological change. Public policies and action to meet these problems will be described and analyzed.

135. FARMERS' ORGANIZATIONS IN THE UNITED STATES. Spring term. Credit three hours. Open to juniors, seniors, and graduate students. Professor ANDERSON and members of the staff. T Th S 9. Warren 302.

A study of the important farmers' movements in the United States. The or-

ganization, programs, and policies of the farmers' organizations operating at present in the United States and New York State. Presentations of organization activities by their representatives.

203. SEMINAR: ORGANIZATION METHODS. Fall term. Credit three hours. Prerequisite, course 12 or permission of instructor. Assistant Professor REEDER. T Th S 11-12:20. Warren 340.

Methods and techniques for increasing the effectiveness of organization are studied. Practice is provided in basic organization skills.

[207. SOCIOLOGICAL THEORY. See General Sociology course list.]

208. SYSTEMATIC SOCIOLOGY. See General Sociology course list.

[211. THE RURAL COMMUNITY. Fall term. Credit three hours. Prerequisite, permission of instructor. Assistant Professor REEDER. T Th S 11. Not given in 1949–1950.]

The community is analyzed with regard to its structure and functions in present day society. A developmental analysis is made of contemporary rural communities in America and other countries.

212. RURAL SOCIOLOGY. Throughout the year. Fall term. Credit three hours. T Th S 8. Spring term. Credit two hours. T 2-4. Prerequisite, permission of the instructor or graduate standing. Associate Professor LARSON. Warren 302.

A study of rural life in the United States including population, patterns of making a living, group relationships, and the structure and functioning of institutionalized activities. These areas are considered from the standpoint of major trends and significant regional variations. A comprehensive review of the development and content of rural sociology and of the points of view represented in the field.

[217. SEMINAR: THE HISTORY OF RESEARCH IN RURAL SOCIOLOGY. Spring term. Credit three hours. Prerequisite, permission of the instructor. Professor ANDERSON. Not given in 1949–1950.]

A study of the development of research in rural sociology. Analysis of research methods, objectives, and results.

[218. SEMINAR: APPLICATIONS OF SOCIOLOGY TO PROBLEMS OF RURAL SOCIETY. Spring term. Credit two hours. Prerequisite, permission of a department staff member. Professor Polson and members of the staff. Not given in 1949–1950.]

Application of sociological information, theory, and methods to the programs of institutions and agencies concerned with rural life. Special attention is given to the extension service and the rural school.

219. SEMINAR: COMMUNITY ORGANIZATION. Spring term. Credit two hours. Prerequisite, permission of a department staff member. Professor Polson and members of the staff. M 2-4. Warren 302.

Application of sociology to the problems of rural community organization and community planning.

[220. SEMINAR: COMPARATIVE RURAL SOCIAL LIFE. Fall term. Credit two hours.<sup>a</sup>Open to seniors, special students, and graduate students. Professor ANDERSON. Not given in 1949–1950.]

A comparison of the ecological, economic, and social organization of rural life in foreign lands, including European, South American, Middle East, and Oriental countries, with consideration of major social problems. The specific countries to be studied will be determined by student interest.

221. SEMINAR: RURAL SOCIAL PARTICIPATION. Fall term. Credit three

hours. Prerequisite, permission of the instructor. Professor ANDERSON. M 4:10 to 5:50 and one hour to be arranged. Warren 302.

Study of the extent and intensity of formal and informal participation in rural areas. Participation of youth and adults in specific organizations such as Grange, Farm Bureau, Home Bureau, 4-H Club, Church, Cooperatives. Characteristics and types of participants.

240. SEMINAR: PROBLEMS IN TEACHING SOCIOLOGY. Spring term. Credit two hours. Prerequisite, permission of instructor. Assistant Professor REEDER and staff. W 2-4. Warren 302.

A consideration of the problems in teaching sociology in colleges and a study of some of the new approaches to teaching which are being tried in American universities.

250. INFORMAL STUDY IN RURAL SOCIOLOGY. Throughout the year. Credit one to three hours each term as arranged. Prerequisite, permission of department staff member concerned. MEMBERS OF THE STAFF.

251. RESEARCH IN RURAL SOCIOLOGY. Throughout the year. Hours and credit to be arranged. MEMBERS OF THE STAFF.

Special attention is called to the following courses in other departments:

Architecture (700, 710, 711, 713, 719)

Agricultural Economics (102, 126, 135, 181, 207, 236)

Child Development and Family Relationships (305, 360, 370)

Education (607, 618, 675, 680, RE 211)

Government (231, 232, 235, 241, 242, 275, 321, 322, 375, 376, 414)

History (721, 722, 726, 811, 812)

Mathematics (721, 722, 723)

Philosophy (301, 302, 313, 321, 324, 325, 485, 581, 582)

Psychology (401, 580)

# 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, and carries free tuition. The fellowships and the scholarship are awarded annually.

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

## ANIMAL BREEDING AND PHYSIOLOGY

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

## Animal Breeding 1, 2, 3, 4

## Animal Genetics 1, 2, 3, 4

Before entering graduate study in the field of Animal Breeding the student should have had courses in zoology, general biology, comparative anatomy, physiology, chemistry, and elementary courses in genetics and animal breeding. Some practical experience in animal husbandry, poultry husbandry, or plant breeding is desirable.

In the course of their graduate study, students will be expected to take certain courses in animal physiology, biochemistry, embryology, cytology, genetics, biometry, and histology. One or more of these may be selected as a minor subject.

Graduate studies in animal breeding may be taken in several departments of the University and the student should consult the course offerings under each of these departments.

Graduate work in genetics and breeding of large animals, including physiology of reproduction, is offered in the Department of Animal Husbandry. This work is supervised by Professors ASDELL, BRATTON, and HENDERSON.

Graduate study in animal genetics is offered in the Department of Poultry Husbandry, where work in that field is supervised by Professors HUTT, COLE, BRUCKNER, and HALL.

Courses in genetics and biological statistics are given in the Department of Plant Breeding by Professors SRB, SMITH, ATWOOD, FEDERER, LIVERMORE, and LOVE.

## ANIMAL NUTRITION

Dairy Building; *Professors* L. L. BARNES, G. F. HEUSER, J. K. LOOSLI, L. A. MAY-NARD, C. M. MCCAY, F. B. MORRISON, L. C. NORRIS, M. L. SCOTT, and S. E. SMITH.

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

Animal Nutrition 1, 2, 3, 4

(See also Food and Nutrition under HOME ECONOMICS, pp. 202-204)

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. Savage 100.

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

A.H. 111. ANIMAL NUTRITION ADVANCED LABORATORY. Fall term. Credit 3 hours. Prerequisite, Quantitative Analysis. Professor McCAY. M W F 2-4. Stocking 160. Preregistration required.

The student participates in a series of research problems in which he applies biochemical techniques in studies with living animals. The object is to teach methods of basic research in the science of nutrition by actual experience.

A.H. 115. ADVANCED LIVESTOCK FEEDING AND APPLIED ANIMAL NUTRITION. Spring term. See ANIMAL HUSBANDRY.

P.H. 210. EXPERIMENTAL METHODS IN POULTRY NUTRITION. Spring term. Credit one hour. Registration by permission. Professor Norris. Discussion and laboratory period, W 1:40–5. Rice.

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. Spring term. Credit one hour. Registration by permission. Professors LOOSLI, MAYNARD, and MCCAY. T 8. Stocking 160.

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. Professor McCay. Th 4:15. Stocking 160.

Reports and conferences about the original research that has provided the background of the modern science. Most attention is devoted to familiarizing the student with methods of searching the technical literature and using the libraries.

219. SEMINAR IN ANIMAL NUTRITION. Fall term. Credit one hour. Registration by permission. Professors MAYNARD, MCCAY, NORRIS, and LOOSLI. Weekly conferences, M 4:30. Savage 130.

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

## BIOCHEMISTRY

Savage Hall: *Professors* DANIEL, MAYNARD, NEAL, NELSON, RAMSTAD, SOMERS, SUMNER, and WILLIAMS.

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

Biochemistry 1, 2, 4

See also Food Science and Technology for graduate research in biochemistry as applied to food problems, pp. 228–229.

101. GENERAL BIOCHEMISTRY. Lecture. Fall term. Credit four hours. Prerequisites. Chemistry 215 or the equivalent; and 303 and 305, or the equivalent. Lectures, M W F S 11. Savage Hall 100. 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 W or T Th 2–4:20. Savage Hall 230. Professor WILLIAMS and assistants.

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

130. PRINCIPLES OF FOOD PRESERVATION. Spring term. Credit two hours. Prerequisite, Organic Chemistry. Lectures, T Th 10. Savage Hall 145. Associate Professor RAMSTAD.

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.

140. SELECTED TOPICS IN FOOD BIOCHEMISTRY. Spring term. Credit two hours. Prerequisite, Biochemistry 101. Lectures, M W 10. Savage Hall 145. Associate Professor RAMSTAD.

A discussion of some of the important nonmicrobial changes in foods, such as

denaturation and the Maillard browning reaction. Emphasis will be placed on the occurrence, significance, and prevention or control of the changes as they affect the color, odor, flavor, texture, or nutritive value of foods.

201. BIOCHEMISTRY OF LIPIDS AND CARBOHYDRATES. Spring term. Credit two hours. Prerequisite, Physical Chemistry 405 and 406, and Biochemistry 101 and 102, or the equivalent. Lectures, M W 9. Savage Hall 100. Professor SUMNER and Assistant Professor NELSON.

Discussion of the biological and physical chemistry of the lipids and carbohydrates.

202. BIOCHEMISTRY OF PROTEINS AND ENZYMES. Spring term. Credit two hours. Prerequisite, Physical Chemistry 405 and 406, and Biochemistry 101 and 102, or the equivalent. Lectures, T Th 9. Savage Hall 100. Professor SUMNER and Assistant Professor Nelson.

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 2-4:20. Savage Hall 230. Registration by permission only. Professor SUMNER and Assistant Professor NELSON.

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 or the equivalent. Given in alternate years. Given in 1949–1950. Lectures, T Th 11, Savage Hall 145. Associate Professor NEAL.

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

215. BIOCHEMISTRY SEMINAR. Fall term. Credit one hour. Registration by permission. M 4:15. Savage Hall 130. Professor SUMNER.

Assignments and discussion of recent advances in biochemistry.

## ENTOMOLOGY AND LIMNOLOGY

Comstock Hall: *Professors* W. E. BLAUVELT, J. C. BRADLEY, J. L. BRANN, F. H. BUTT, J. E. DEWEY, HENRY DIETRICH, E. J. DYCE, W. T. M. FORBES, G. G. GYRISCO, J. D. HOOD, R. W. LEIBY, J. G. MATTHYSSE, L. B. NORTON, C. E. PALM, V. S. L. PATE, R. L. PATTON, W. A. RAWLINS, H. H. SCHWARDT, E. H. SMITH, L. D. UHLER, and T. C. WATKINS

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

Apiculture 1, 2, 3, 4	Insect Physiology 1, 2, 3, 4
Insect Ecology 1, 2, 3, 4	Insect Toxicology 1, 2, 3, 4
Economic Entomology 1, 2, 3, 4	Insecticide Chemistry 1, 2, 3, 4
Insect Embryology 1, 2, 3, 4	Medical Entomology 1, 2, 3, 4
Insect Morphology and	Parasitology 1, 2, 3, 4
Histology 1, 2, 3, 4	Limnology 1, 2, 3, 4
Insect Taxonomy 1, 2, 3, 4	Entomology 4

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 the 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. Preregistration is required for all courses offered in the Department of Entomology and Limnology.

For undergraduate courses which often meet needs of graduate students, see Announcement of the College of Agriculture, Department of ENTOMOLOGY AND LIMNOLOGY, courses 12, 31, 32, 41, 43, 61.

16. INSECT ECOLOGY. Fall term. Credit three hours. Prerequisites, Biology 1 or Zoology 1, and Entomology 12. Professor PALM. Lectures, T Th 9. Comstock 145. Laboratory, 2–4:30. Comstock 110.

A study of insects in relation to their environment, with special attention given to the applied aspects of insect ecology.

[51. PARASITES AND PARASITISM. Spring term. Credit two hours. Prerequisite, Biology 1 or Zoology 1. Professor ------. Not given in 1949-1950.]

52. *MEDICAL ENTOMOLOGY*. Spring term. Credit three hours. Prerequisite, Zoology 1 or Biology 1. Professor —————. Lecture, Th 10. Comstock 245. Laboratory, Th or F 2–4:30, and one recitation period to be arranged. Comstock 200.

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.

30. TAXONOMY OF INSECTS. Spring term. Credit three hours. Prerequisite, course 12. Assistant Professor PATE. Lecture, T 10. Laboratory, M W 2–4:30. Comstock 300.

An introduction to, and principles of, insect classification; literature of systematic entomology; zoological nomenclature; and geographical distribution. Laboratory studies of orders, families, and representative species, with field work in late spring.

118. THE TECHNICS OF BIOLOGICAL LITERATURE. Fall term. Credit two or three hours. Professor BRADLEY. Lectures, W F 11, and library work by assignment. Comstock 300.

A critical study of biologists' reference works. Practice in the use of generic and specific indices, and of bibliographies; methods of preparing technical papers for publication; zoological nomenclature.

122. INSECT MORPHOLOGY, ANATOMY, AND HISTOLOGY. Throughout the year. Credit three hours a term. Prerequisite, course 12. Associate Professor BUTT. Lecture, M 10. Comstock 145. Laboratory, M W 2-4:30. Comstock 270.

The external and internal anatomy of insects. Laboratories include gross dissection and histological studies of internal organs of representative insects.

123. INSECT EMBRYOLOGY AND PO\$TEMBRYONIC DEVELOPMENT. Spring term. Credit two hours. Prerequisites, courses 12 and 122. Associate Professor Burr. Lecture and laboratory, hours by appointment. Comstock 270.

Lectures with assigned reading and reports by students.

124. INSECT HISTOLOGY. Technique. Fall or spring term. Credit two hours. Prerequisites, courses 12 and 122. Associate Professor BUTT. Two laboratory periods a week by appointment. Comstock 270.

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

131. THE PHYLOGENY AND CLASSIFICATION OF INSECTS. Fall term. Credit four hours. Prerequisite, courses 30, 31, and should be preceded or accompanied by 122. Professor BRADLEY and Assistant Professor PATE. Lectures, W F 10. Laboratory, T Th 2–4:30. Comstock 300.

The classification, evolution, comparative morphology, and bionomics of the orders and families of living and extinct insects. Laboratory studies of representative genera and species, and of the taxonomic literature. For continuation, see courses 133 and 134.

133. TAXONOMY OF THE HOLOMETABOLA: DIPTERA AND COLEOP-TERA. Spring term. Credit three hours. Given in alternate years. A continuation of course 131. Prerequisite, courses 30 and 122; should be preceded by course 131. Professor BRADLEY and Assistant Professor PATE. Lecture, F 10. Laboratory, T Th 2-4:30. Comstock 300.

The classification, comparative morphology, and bionomics of the Diptera and Coleoptera. Laboratory studies of the taxonomic literature, and of representative genera and species.

[134. TAXONOMY OF THE HOLOMETABOLA: LEPIDOPTERA AND HY-MENOPTERA. Spring term. Given in alternate years. Professor BRADLEY, Assistant Professors FORBES and PATE. Not given in 1949–1950.]

171. *LIMNOLOGY*. Spring term. Credit three hours. Prerequisite, course 12 and permission to register. Assistant Professor ————. Lecture, Th 11. Comstock 145. Laboratory, and field trips, F 2–4:30, and one period by appointment S. Comstock 110.

The relations between aquatic organisms and their environment.

[172. ADVANCED LIMNOLOGY. Fall term. Credit three hours. Prerequisite, permission to register. Assistant Professor -----. Not given in 1949–1950.]

185. INSECT PHYSIOLOGY. Fall term. Credit five hours. Given in alternate years. Prerequisite, course 122, Chemistry 105–106, and Physics 103–104. Lectures, M W F 9. Comstock 145. Laboratory, M W 2–4:30. Comstock 265. Associate Professor PATTON.

The physiology of insect systems is discussed and demonstrated by a series of laboratory exercises.

[195. CHEMISTRY AND TOXICOLOGY OF INSECTICIDES. Fall term. Credit five hours. Given in alternate years. Prerequisites, general chemistry and organic chemistry. Associate Professors NORTON and DEWEY. Not given in 1949– 1950.]

[241. SPECIAL TOPICS IN ECONOMIC ENTOMOLOGY. Fall term. Credit three hours. Given in alternate years. Prerequisite, course 41. Professor SCHWARDT and Associate Professor WATKINS. Not given in 1949–1950.]

Topics covered: insect pests of live stock; insect pests of stored products; and insect pests of vegetables.

[242. SPECIAL TOPICS IN ECONOMIC ENTOMOLOGY. Spring term. Credit three hours. Given in alternate years. Prerequisite, course 41. Assistant Professor Gyrisco, and Associate Professors Brann and Dewey. Not given in 1949– 1950.]

Topics covered: insect pests of forage crops; insecticide application equipment; and insect pests of fruit.

243. SPECIAL TOPICS IN ECONOMIC ENTOMOLOGY. Fall term. Credit three hours. Given in alternate years. Prerequisite, course 41. Professor BLAUVELT and Associate Professor RAWLINS. Lectures, M W F 11. Comstock 145.

The fundamental principles of insect control, with discussions of some of the major problems in economic entomology. A continuation of courses 241 and 242. Topics covered: insect pests of commercial florist crops and herbaceous ornamentals; rearing techniques and field experimentation; and insect vectors of plant diseases.

244. SPECIAL TOPICS IN ECONOMIC ENTOMOLOGY. Spring term. Credit

three hours. Given in alternate years. Prerequisite, course 41. Associate Professors WATKINS and MATTHYSSE. Lectures, M W F 11. Comstock 145.

A continuation of courses 241, 242, and 243. Topics covered: cultural control; biological control; insect pests of woody ornamentals, forests and turf; and legislative entomology.

261. ADVANCED BEEKEEPING. Fall and spring terms. Credit three hours a term. Registration by permission only. Professor DYCE. Hours by arrangement.

A technical course, covering scientific investigation in all phases of the subject. Special attention given to improved methods of apiary and honey-house management; preparation of honey for market; and reviews of current literature. Lectures and discussion supplemented by field trips.

#### RESEARCH

300-309. RESEARCH. Throughout the year. Prerequisite, permission to register from the professor under whom the work is taken. Comstock Hall.

300. INSECT ECOLOGY. Professor PALM.

301. INSECT MORPHOLOGY, HISTOLOGY, AND EMBRYOLOGY. Associate Professor BUTT.

302. INSECT TAXONOMY. All orders: Professor BRADLEY or Assistant Professor PATE. Lepidoptera: Assistant Professor Forbes. Thysanoptera: Professor HOOD.

303. ECONOMIC ENTOMOLOGY. Professors BLAUVELT, PALM, and SCHWARDT; Associate Professors BRANN, DEWEY, LEIBY, MATTHYSSE, RAWLINS, and WATKINS; and Assistant Professor Smith. At Geneva: Professors CHAPMAN and GLASGOW.

304. MEDICAL ENTOMOLOGY AND PARASITOLOGY. Professor -305. APICULTURE. Professor Dyce.

306. LIMNOLOGY. Assistant Professor -----.

307. INSECT PHYSIOLOGY. Associate Professor PATTON.

308. INSECT TOXICOLOGY. Associate Professor Dewey.

309. INSECTICIDAL CHEMISTRY. Associate 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. For further information see page 229.

#### SEMINAR

JUGATAE. Fall and spring terms. M 4:30-5:30. Comstock 245.

The work of an entomological seminar is conducted by the Jugatae, an entomological club that meets for a discussion of the results of investigations by its members.

## GENERAL BIOLOGY

Roberts Hall; Associate Professor Hoop.

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.

5. LABORATORY METHODS IN BIOLOGY. Fall term. Credit two or three

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hours. Prerequisite, Biology 1, Zoology 1, or Botany 1 and permission to register. Lecture and laboratory, T or F 10–12:30, and one or more periods by appointment. Roberts 302. Assistant Professor UHLER.

For students who intend to teach or to follow some phase of biology as a profession. This course includes such subjects as: laboratory equipment; collection, preservation, and storage of materials; sectional and non-sectional preparations of animal and plant tissues for histological study; injection of blood vessels and embalming; preparation of bird and mammal skins for study; introduction to photography including the preparation of lantern slides; use of micro-projector; theory and use of 16 mm. sound and silent projection apparatus.

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.

9. BIOLOGICAL BASIS OF SOCIAL PROBLEMS. Spring term. Credit three hours. Lectures T 9, Th 2. Roberts 392. Lecture demonstration, Th 8–10. Roberts 301. Assistant Professor UHLER.

An elementary course designed especially to furnish a background in biological science for students in the College of Home Economics who intend to enter the field of nursery-school teaching, though open to other interested students as well. Among the topics treated are reproduction and its consequence, heredity; the importance of heredity in connection with certain social problems; the effects of heredity and environment in controlling the development of the individual; the effect of birth and death rates, immigration, and war upon the composition of populations; the possibility of altering the direction of such changes; and the bearing of biological science upon education and government.

310. RESEARCH PROBLEMS. Credit and hours to be arranged.

## **PSYCHOLOGY**

Morrill Hall; Professors M. E. BITTERMAN, U. BRONFENBRENNER, R. H. DALTON, F. S. FREEMAN, H. S. LIDDELL, R. B. MACLEOD, F. L. MARCUSE, T. A. RYAN, A. L. WINSOR; Doctor J. HARALSON.

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

Applied Psychology 1, 2, 3, 4	Psychobiology 1, 2, 3, 4
Experimental Psychology 1, 2, 3, 4	Psychology 1, 2, 3, 4
History of Psychology 3	Social Psychology 1, 2, 3, 4
Physiological 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 seminars. This laboratory also includes a workshop for the construction and assemblage of apparatus.

### ANIMAL SCIENCES

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.

For undergraduate courses which often meet the needs of graduate students, see the *Announcement of the College of Arts and Sciences*, Department of Psy-CHOLOGY, courses 204, 207, 208, 210, 211, 250, 275, 301, 303, 401, 404, 450, 451, 520. 601, 607, 618.

For other related courses, see the Announcements of the College of Arts and Sciences, Department of Sociology and Anthropology, the College of Home Economics, Department of CHILD DEVELOPMENT AND FAMILY RELATIONSHIPS, the School of Education, the School of Industrial and Labor Relations, and the Department of Hotel Administration.

375. STATISTICAL METHODS IN PSYCHOLOGY. Spring term. Credit three hours. Prerequisites, Statistics 101 or equivalent. Professor RYAN. M W F 3.

403. MINOR RESEARCH PROBLEMS. Either for a single term or throughout the year. Credit three hours a term. All members of the staff. 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.

452. ADVANCED INDUSTRIAL PSYCHOLOGY. Fall term. Credit three hours. Prerequisites, Psychology 450 and 451. M W F 9, and laboratory periods to be arranged. Professor BITTERMAN.

475. TECHNIQUE OF EXPERIMENTATION. Spring term. Credit three hours. Prerequisite, consent of instructor. M W F 4, experimental hours to be arranged.

[502. PSYCHOPHYSICAL METHODS. Spring term. Credit three hours. Prerequisites, Psychology 204 and Statistics 101. Not given in 1949–1950.]

[510. THEORY OF RESPONSE SYSTEMS. Fall term. Credit three hours. Not given in 1949–1950.]

575. SEMINAR IN PSYCHOLOGY. Throughout the year. Credit three hours a term. M 7:30–9:30 P.M. Morrill, Seminar Room.

576. ADVANCED ABNORMAL PSYCHOLOGY. Spring term. Credit three hours. Professor MARCUSE. F 7–9:30 P.M.

580. CONDITIONING AND EXPERIMENTAL NEUROSES. Fall term. Credit three hours. Professor Liddell. M 2–4:30 and an hour to be arranged. Cornell Behavior Farm.

Seminar demonstrations of phenomena of conditioned reflex action and neurotic patterns in animals. Group discussions.

675. SEMINAR IN HUMAN DEVELOPMENT AND BEHAVIOR. Spring term. Credit two hours. Professor FREEMAN. M 4-6.

Recent experimental and clinical materials and theories, and their educational implications.

680. PROCEDURES IN CLINICAL CHILD GUIDANCE. Fall term. Credit three hours. Prerequisite, Education 607 or its equivalent. Professor FREEMAN. M 4–6, and conferences to be arranged.

#### ZOOLOGY

Professors H. B. Adelmann, L. C. Cole, P. W. Gilbert, D. R. Griffin, S. L. LEONARD, J. W. PAPEZ, W. A. WIMSATT, and B. P. YOUNG.

## ZOOLOGY

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

Comparative Anatomy 1, 2, 3, 4 Comparative and General Physiology 1, 2, 3, 4 Ecology 1, 2, 3, 4 Endocrinology 1, 2, 3, 4 Histology and Embryology 1, 2, 3, 4 Invertebrate Zoology 1, 2, 3, 4 Neurology 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 should also 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 and the Department of Conservation.

For undergraduate courses which often meet the needs of graduate students, see the Announcement of the College of Arts and Sciences, Department of ZOOLO-GY, courses 8, 9, 101–102, 103–104, 211–212, 222, 301. Preregistration is required in all courses.

## 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.

#### COMPARATIVE AND GENERAL PHYSIOLOGY

#### Stimson Hall; Professor D. R. GRIFFIN.

Facilities are available for advanced work in Comparative Physiology and General Physiology. There are especially favorable opportunities for research in comparative sensory physiology. Before undertaking advanced work in physiological zoology a student should ordinarily have taken elementary zoology, comparative anatomy, histology, embryology, physics, inorganic and organic chemistry, and at least one laboratory course in physiology. In addition, calculus, physical chemistry and biochemistry are almost indispensable. Special provision will be made in the seminars of Zoology 452 for advanced work by qualified graduate students.

451. COMPARATIVE PHYSIOLOGY. Fall term. Credit three hours. Prerequisites, one year of Biology or Zoology and college courses in Chemistry and Physics. Organic Chemistry and Comparative Anatomy are also desirable. Associate Professor GRIFFIN. Lectures, W F 9. Laboratory, T W Th or F 1:40–4:30.

This course covers the important physiological mechanisms occurring in all of the major phylogenetic groups of animals. The chief physiological functions such as respiration, metabolism, digestion, circulation, excretion, muscle contraction, nerve action, and physiological regulation are treated from the comparative point of view. Emphasis is placed on the functional adaptations of both vertebrates and invertebrates to their environments.

452. GENERAL AND CELLULAR PHYSIOLOGY. Spring term. Credit three hours. Prerequisites, Zoology 451, Organic Chemistry, and permission of the instructor. Histology and Calculus are also desirable. Associate Professor GRIFFIN. Seminars, M 2–4 and laboratory, T W or Th 1:40–4:30.

This course deals with the basic properties and functions of living material at the cellular and molecular level. Individual laboratory projects and seminars will cover such topics as the chemical and physical basis of protoplasm, ultrastructure, permeability, secretion, the dynamic state of cellular constituents as demonstrated by tracer techniques, irritability, and the physico-chemical aspects of the nerve impulse and receptor systems. The seminars will consist of discussion of the reading and the presentation and criticism of papers prepared by the students.

#### ECOLOGY

#### Stimson Hall; Professor L. C. COLE.

Advanced work in ecology is an individual matter but the student majoring in this field should have, or plan to obtain, a broad biological background including an acquaintance with genetics and the principles of systematics. Some training in statistical analysis is almost indispensable. A general background in the physical sciences, particularly geography, geology, chemistry, and meteorology is desirable.

401-402. ECOLOGY AND PHYSIOLOGY OF THE INVERTEBRATES. Throughout the year. Credit three hours a term. Prerequisites, one year of general biology or introductory zoology plus organic chemistry and college algebra. Assistant Professor Cole. Lectures, M W 11. Laboratory, W 2-4:30.

A course for advanced undergraduates and graduate students stressing function at the level of the individual organism. Emphasis will be on physiological processes as these relate to natural habitats, and on phylogenetic characteristics as these restrict the variety of habitats available for occupancy by various invertebrates. The methods of response and toleration physiology will be utilized to investigate life processes in various invertebrates exposed to experimentally varied conditions. The interpretation of life tables and mortality data will be introduced as experimental techniques.

404. *GENERAL ANIMAL ECOLOGY*. Spring term. Credit three hours. Prerequisites, Zoology 101–102 or 103–104, or their equivalent. Assistant Professor COLE. Lectures, W F 10. A total of 8 laboratory and field periods S 8–1.

Local and world-wide distribution of animals with reference to conditions of existence; effects of environmental factors on animals; adaptations to special habitats; modification of environment by animals; principles of population growth, composition, and density control. Field and laboratory study of local animals as they are adapted to particular habitats.

#### ENDOCRINOLOGY

#### Stimson Hall; Professor S. L. LEONARD.

476. 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 G-1. Laboratory, M 2-4:30, S 9-11:30 for a limited number of students.

Lectures on anatomy, physiology of the vertebrate endocrine glands, glandular inter-relationships; chemical and physiological properties of hormones, assay

## ZOOLOGY

methods. Laboratory, small animal surgery and microtechnique for the endocrines, illustrative experiments on the effects of hormones.

#### 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 should precede advanced work in this subject.

302. THE ORGANS: HISTOLOGY AND DEVELOPMENT. Spring term. Credit four hours. Prerequisite, course 301 or its equivalent. Associate Professor WIMSATT and assistants. Lectures, W F 9. Stimson G-1. Laboratory, W F 2-4:30. Stimson 206. Preregistration required.

A continuation of course 301. Courses 301 and 302 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.

304. 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 2-4:30. Stimson 206. Preregistration required.

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.

308-309. SEMINAR. First and second terms. One hour each week. Time to be arranged.

For the discussion of problems in the field of histology or embryology, the review of current literature, and the presentation of original work by the members of the staff and those doing advanced work in the department.

[315. EXPERIMENTAL EMBRYOLOGY. Credit two hours. Professor ADEL-MANN. 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 1949–1950.]

Undergraduate course 301 may often be attended with advantage by graduate students.

#### INVERTEBRATE ZOOLOGY

## Stimson Hall; Professor B. P. Young.

515–516. *INVERTEBRATE ZOOLOGY*. Throughout the year. Credit three hours a term. Prerequisite, Introductory or General Zoology, or equivalent. Associate Professor Young. Open to students interested in animals, including undergraduate majors and graduate students in the various fields of biology. Lecture, S 9. Stimson G–1. Laboratory, F 2–5, and S 10–12. Stimson 116.

Course deals with the body plans, the physiology, taxonomy, and the development of the major groups of animals lacking backbones. Life histories of animals affecting the welfare of man are stressed.

## ANIMAL SCIENCES

## NEUROLOGY

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

224. COMPARATIVE NEUROLOGY. Spring term. Credit three hours. Prerequisite, nine hours of Animal Biology. Professor PAPEZ. Hours to be arranged. Stimson 316. Preregistration required.

A comparative study of the vertebrate nervous system based on sections of primate brain stem; study of chief nerve mechanisms that determine the form and structure of the nervous systems, their evolutionary and functional significance. Two lectures, T Th 12, and one laboratory period, W 2–4:30.

226. CEREBRAL MECHANISMS. Spring term. Credit three hours. Prerequisite, course 224. Professor PAPEZ. Given if desired by a sufficient number of students. Hours to be arranged. Stimson 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.

## CONSERVATION

Fernow Hall; *Professors* A. A. Allen, W. R. EADIE, C. H. GUISE, W. J. HAMILTON, JR., O. H. HEWITT, P. P. KELLOGG, E. L. PALMER, A. M. PHILLIPS, E. C. RANEY, G. A. SWANSON, and D. A. WEBSTER.

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

Fishery Biology 1, 2, 3, 4

Forest Conservation 2, 4

Herpetology 1, 2, 3, 4

Ichthyology 1, 2, 3, 4

Mammalogy 1, 2, 3, 4

Ornithology 1, 2, 3, 4

Vertebrate Taxonomy and Ecology 3, 4

Wildlife Management 1, 2, 3, 4

To undertake graduate study the student should be well prepared in general and vertebrate zoology, and should have or must acquire a foundation in the specialized field of study which he intends to pursue. A strong background in the other natural and physical sciences is highly desirable, and a working knowledge of statistical methods is important in all fields. Staff members are available to direct graduate study during the regular University summer session, and selected summer courses are offered.

Attention is also directed to the fields of study and courses offered in the Departments of Botany, Zoology, and Entomology and Limnology. Graduate study in Conservation Education is directed by Dr. Palmer in the School of Education under Nature Study and Science Education.

For undergraduate courses which often meet needs of graduate students, see announcements of the *College of Agriculture*, Department of CONSERVATION, courses 1, 2, 3, 4, 8, 9; Department of ENTOMOLOGY AND LIMNOLOGY, courses 12 and 16; Department of BOTANY, courses 55 and 56; and the *College of Arts and Sciences*, Department of ZOOLOGY, courses 101–102, 103–104, 211–212. Preregistration is required for all.

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### CONSERVATION

## FISHERY BIOLOGY

#### Fernow Hall; Assistant Professors D. A. WEBSTER and A. M. PHILLIPS.

173. FISHERY BIOLOGY. Fall term. Credit three hours. Prerequisite, consent of instructor. Assistant Professor WEBSTER. Lectures, M W F 12; Fernow 122.

The life histories and ecological requirements of some fresh-water game fishes; and the principles and techniques of fishery management.

174. FISH CULTURE. Spring term. Credit two hours. Prerequisite, consent of instructor. Assistant Professor Phillips. Lecture, M 12, laboratory, M 2-4:30.

Production of fish in hatcheries and hatchery management.

175. FISHERY BIOLOGY LABORATORY. Spring term. Credit two hours. Prerequisite, Conservation 173. Limited to graduate majors and minors and qualified seniors. Assistant Professor WEBSTER. Hours to be arranged. Fernow 102. Field and biometrical work on fishery management and biology.

179. SEMINAR IN FISHERY BIOLOGY. Fall and spring terms. Without credit. Registration by permission of instructor. Time and place to be arranged. Assistant Professors WEBSTER and PHILLIPS.

For the discussion by qualified students of important literature and current research in fishery biology.

### FORESTRY

Fernow Hall; Professors C. H. GUISE and -----.

Graduate students, candidates for the degrees Master of Science or Doctor of Philosophy, may elect to do work of non-professional character in forest conservation.

#### ORNITHOLOGY

Fernow Hall; Professors A. A. ALLEN and P. P. KELLOGG.

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 and laboratory, T Th 2–5. Fernow 210. Preregistration required.

Structure and classification of birds; geographical distribution; identification of representative birds of the world. Field work on the fall migration and the identification of birds in winter plumage.

131. TECHNIQUES IN ORNITHOLOGY. Fall term. Credit three hours. Prerequisite, courses 8 and 9, Botany 1, and Entomology 12, or consent of instructor. Associate Professor KELLOGG. Lecture and laboratory, M W 2–5. Fernow 210.

For students planning to teach or engage in ornithology or wildlife management professionally. Feeding habits of birds, field collecting, preparation of specimens, and photography are emphasized, together with classroom, museum, extension, and survey methods.

133. BIRD SPECIATION AND MUSEUM METHODS IN ORNITHOLO-GY. Fall term. Credit three hours. Professor ALLEN and Mr. PARKES. Lecture and laboratory, S 8–1. Fernow 308. Preregistration required. For students planning to participate in scientific expeditions and to carry on taxonomic work in ornithology. Prerequisite, courses 8, 9, 11, 126, and 131, or permission to register.

136. ORNITHOLOGY SEMINAR. Throughout the year. M 7:30-9 p.m. Fernow 122. Required of all graduate students in Ornithology.

#### ANIMAL SCIENCES

## VERTEBRATE TAXONOMY AND ECOLOGY

Fernow Hall; Professors W. J. HAMILTON, JR., W. R. EADIE, and E. C. RANEY.

22. ICHTHYOLOGY. Spring term. Credit three hours. Prerequisite, consent of instructor. Associate Professor RANEY. Lectures, T Th 8. Fernow 122. Laboratory, F 2–4:30. Fernow 14. Preregistration required.

Lectures cover ecology, life histories, speciation, and the phylogeny of fishes. Laboratory periods are utilized in studies on structure and identification of fishes with field trips for studies on ecology and life histories.

[23. HERPETOLOGY. Spring term. Credit three hours. Professor HAMILTON and Associate Professor RANEY. Not given in 1949–1950.]

25. MAMMALOGY. Fall term. Credit three hours. Prerequisite, consent of instructor. Professor HAMILTON. Lectures, T Th 8. Fernow 122. Laboratory, F 2–4:30. Fernow 14. Preregistration required.

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.

67. SEMINAR IN SYSTEMATIC VERTEBRATE ZOOLOGY. Fall term. Professor HAMILTON, Associate Professor RANEY, and Associate Professor EADIE. W 12 m. Fernow 122. Limited to graduate students and upperclass zoology majors. Registration by permission of instructor.

112. LITERATURE OF ECONOMIC ZOOLOGY, CONSERVATION, AND ECOLOGY. Spring term. Credit one hour. Professor HAMILTON, and Associate Professors EADIE, and RANEY. W 9 a.m. Fernow 122. Limited to upperclass students and graduates.

The literature of economic zoology, ecology, and kindred fields; fish and fisheries, aquaria; amphibians and reptiles, their uses; zoological gardens; preserves; game farms, animals in relation to recreation.

#### WILDLIFE MANAGEMENT

Fernow Hall; Professor Swanson, Associate Professor Eadle, and Assistant Professor Hewitt.

102. WILDLIFE MANAGEMENT. Fall term. Credit three hours. Prerequisite, Conservation 8, 9, and 131 and Botany 1 and 117, or consent of instructor. Assistant Professor Hewitr. Lecture and laboratory, S 8–1. Fernow 212.

Life histories and ecological requirements of principal game and fur animals of North America and representative species abroad. Methods used to increase production of desirable species under natural conditions.

110. ECONOMIC ZOOLOGY. Fall term. Credit one hour. Prerequisite, consent of instructor. Associate Professor EADIE. F 8. Fernow 122.

Food habits of mammals of economic importance; control of injurious species; economics of wildlife resources; conservation legislation.

111. SEMINAR IN WILDLIFE MANAGEMENT. Fall and spring terms. Without credit. Time and place to be arranged.

## CONSERVATION, ALL BRANCHES

400–405. *RESEARCH PROBLEMS*. Either term. Credit and hours to be arranged. Problems may be undertaken in any of the fields of study in the department, but adequate preparation in the specialized field, and consent of the instructor are prerequisites. Fernow Hall.

400. FISHERY BIOLOGY. Assistant Professors WEBSTER and PHILLIPS.

## CONSERVATION

401. HERPETOLOGY. Professor HAMILTON and Associate Professor RANEY.

402. ICHTHYOLOGY. Associate Professor RANEY.

403. MAMMALOGY. Professor HAMILTON.

404. ORNITHOLOGY. Professor Allen, Associate Professor Kellogg.

405. WILDLIFE MANAGEMENT. Professor Swanson, Associate Professor EADIE, Assistant Professor HEWITT.

410. CONSERVATION SEMINAR. Fall and spring terms. Without credit. Staff. Time and place to be arranged.

Discussions of literature and current research in the broad field of conservation of birds, mammals, and fishes.

# 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 early. Failure to arrange for laboratory space in advance will probably result in exclusion from courses.

## BACTERIOLOGY

Stocking Hall; Professors J. M. SHERMAN, GEORGES KNAYSI, M. R. ZELLE, C. N. STARK, H. W. SEELEY, JR., and E. A. DELWICHE.

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. HAGEN, PETER OLAFSON, J. A. BAKER, P. P. LEVINE, 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. Professors SHERMAN, SEELEY, and assistants. Lectures, M W F 11. Laboratory practice, M W F 1:40-4. Dairy Industry Building 218 and 301. Preregistration required.

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, Professor SEELEY, and assistants. Lectures, recitations, and laboratory practice. M W F 1:40–5. Dairy Industry Building 119 and 301. Preregistration required.

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 assistant. Lectures, recitations, and laboratory practice. T Th 1:40–5. Dairy Industry Building 119 and 323. Preregistration required.

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.

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.

## BOTANY

210. *PHYSIOLOGY OF BACTERIA*. Fall term. Credit two hours. Prerequisites, course 1 and at least one additional course in bacteriology. Professor DELWICHE. Lectures, T Th 8. Dairy Building 120.

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

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. Professor DELWICHE.

The chemistry of metabolism, fermentation, and nutrition of microorganisms.

221. SEMINAR. 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

See Food Science and Technology for graduate work in bacteriology, particularly as applied to food problems.

## BOTANY

Professors Lewis KNUDSON, O. F. CURTIS, W. C. MUENSCHER, L. C. PETRY, L. F. RANDOLPH, D. G. CLARK, R. T. CLAUSEN, and C. H. UHL; at Geneva, Professor M. T. MUNN and W. F. CROSIER.

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

Botany 2, 4	Paleobotany 1, 2, 3, 4
Cytology 1, 2, 3, 4	Plant Physiology 1, 2, 3, 4
Economic Botany 1, 2, 3, 4	Plant Taxonomy 1, 2, 3, 4
Plant Morphology (including Anatomy)	1 9 8 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 facilities 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, 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, including 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 1949–1950 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 and carries 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 2–4:30; W F 2–4:30; M 2–4:30; S 8–10:30. Preregistration required.

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 143.

Lectures and discussions on physiological processes of plants and the factors influencing them and the relations of these processes to plant behavior.

232. PLANT PHYSIOLOGY, ADVANCED LABORATORY COURSE. A twoterm course, fall and spring. Credit three hours a term. Prerequisite or parallel, course 231. Professors KNUDSON, CURTIS, and 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. SEMINAR IN PLANT PHYSIOLOGY. Fall and spring terms. Required of graduate students in Plant Physiology. Professors KNUDSON, CURTIS, and CLARK. Conference, F 11. Plant Science.

The presentation and discussion of current contributions to plant physiology; reports on the research problems of graduate students and members of the staff.

RESEARCH IN PLANT PHYSIOLOGY. Professors KNUDSON, CURTIS, and CLARK.

## PLANT ANATOMY

A detailed study of the internal structure of vascular plants with emphasis on determination and interpretation.

RESEARCH IN ANATOMY. Professor -----.

## BOTANY

#### CYTOLOGY

124. GENERAL CYTOLOGY. Fall term. Credit four hours. Prerequisite, Botany 1 or Zoology 1 or equivalent. Assistant Professor UHL. 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. Preregistration required.

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. CYTOGENETICS. Spring term. Credit three hours. Prerequisites, Botany 124, Plant Breeding 101 or equivalent. Lectures, M W 9. Plant Science 143. Laboratory, M or W 10–12:30. Plant Science 219. Professor RANDOLPH.

An advanced course dealing mainly with the chromosome mechanism of heredity and recent researches in cytogenetics.

RESEARCH IN CYTOLOGY. Professor RANDOLPH and Assistant Professor UHL.

#### 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 ——— and Doctor Moselley. Lecture, F 9. Plant Science 143. Laboratory, W 9–12:30; F 10–12:30. Plant Science 228. Preregistration required.

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

RESEARCH IN MORPHOLOGY. Professors ----- and PETRY.

## TAXONOMY

117. TAXONOMY OF VASCULAR PLANTS. Fall term. Credit four hours. Prerequisite, course 1 or its equivalent. Associate Professor CLAUSEN. Lectures, T Th 9. Plant Science 143. Laboratory, T Th 2-4:30. Plant Science 211. Preregistration required.

A survey of the families of ferns, gymnosperms and dicotyledons, their gross morphology, geographical distribution, and economic importance. Methods of identification are stressed. In the early part of the term, several trips are scheduled during laboratory periods. Courses 117 and 118 are planned as a unit, though either course may be taken alone provided that the prerequisites are fulfilled.

118. TAXONOMY OF VASCULAR PLANTS, ADVANCED COURSE. Spring term. Credit four hours. Prerequisite, course 117 and either course 124 or Plant Breeding 101. Lectures, T Th 9. Plant Science 143. Laboratory, T Th 2–4:30. Plant Science 211. Associate Professor CLAUSEN. Preregistration required.

A continuation of course 117, including a consideration of the families of monocotyledons; a study of variation, natural selection, isolating mechanisms, hybridity and modes of reproduction in relation to taxonomy; and a brief survey of the vegetation of North America. Attention is also given to the literature of

## PLANT SCIENCES

the subject and to taxonomic methods. The laboratory periods afford opportunity for a detailed study of the spring flora of the Cayuga region.

RESEARCH IN TAXONOMY. Professor MUENSCHER and Associate Professor CLAUSEN.

## PALEOBOTANY

RESEARCH IN PALEOBOTANY. Professors PETRY and -----.

## ECONOMIC BOTANY

55. WEEDS AND POISONOUS PLANTS. Fall term. Credit three hours. Prerequisite course 1 or its equivalent. Lecture, F 8. Laboratory, W F 2-4:30. Plant Science 353. Professor MUENSCHER. Preregistration required.

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.

56. SEED ANALYSIS. Spring term. Credit one hour. Prerequisite Course 1 or its equivalent. Lectures and laboratory, F 2–4:30. Plant Science 353. Professor MUENSCHER. Preregistration required.

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.

115. AQUATIC PLANTS. Spring term. Credit three hours. Prerequisite, course 1 or its equivalent. Lecture, M 9. Laboratory, M W 2–4:30. Plant Science 353. Professor MUENSCHER. Preregistration required.

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.

### **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, ECONOM-IC BOTANY, TAXONOMY, MORPHOLOGY, ANATOMY, PALEOBOTANY, CYTOLOGY, AND PHYSIOLOGY. Throughout the year. Credit not less than two hours a term. Professors KNUDSON, CURTIS, PETRY, MUENSCHER, RANDOLPH and CLARK. Associate Professor CLAUSEN, and Assistant Professor UHL. 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

Opportunity for graduate research work at Geneva, N. Y. is available in the following fields of botany: cytological investigation on cultivated plants, taxonomic investigation on fruits and vegetables, and investigations on seeds. For further information see page 230.

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## PLANT BREEDING

## PLANT BREEDING

Professors ————, R. G. WIGGANS, S. S. ATWOOD, W. T. FEDERER, N. F. JENSEN, A. A. JOHNSON, J. R. LIVERMORE, H. M. MUNGER, R. P. MURPHY, H. H. SMITH, A. M. SRB; 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 interested in crop improvement through breeding will register in *plant breeding*. Problems for research may involve studies of breeding technics, the application of genetic principles to breeding, and the correlation of knowledge from other fields in attacks on problems such as yield, quality, adaptability, and disease and insect resistance. The Department now has active research projects with cereal, forage, and vegetable crops, and certain materials from these are available for graduate student problems. Those students interested in theoretical phases will register in *genetics* and their research problems will generally deal with genic and chromosomal analyses, mutations, and gene action. Almost any suitable material can be utilized, but corn, tobacco, Drosophila, and certain microorganisms are currently available. For those students to whom problems of experimental technic and mathematical analysis of biological data hold the greater appeal, registration will be in *statistical methods of analysis*.

It is advisable that the student entering upon graduate work be well grounded in the fundamentals of the natural sciences. The student should have had elementary courses in inorganic and organic chemistry, college algebra, botany or zoology or biology, and plant, animal, or human physiology. Students intending to specialize in biological statistics will find it to their advantage to have additional training in mathematics. Broad training and experience in the field of agriculture is essential for those planning to major in the field of plant breeding.

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.

For undergraduate courses which often meet the needs of graduate students, see the *Announcement of the College of Agriculture*, Department of PLANT BREEDING, courses 1, 101, 102, 150.

201. BIOCHEMICAL GENETICS. Spring term. Credit two hours. Prerequisite, course 101, a course in organic chemistry, or permission to register. Lectures, M W 8. Plant Science 141. Associate Professor SRB.

The nature and function of hereditary units studied in terms of physiology and biochemistry. Students will be expected to do extensive readings in the periodical literature of genetics and to prepare a term paper in some field of special interest.

203. *METHODS OF PLANT BREEDING*. Fall term. Credit three hours. Prerequisite, course 101, Botany 1, and a course in at least one of the following: field crops, vegetable crops, floriculture, or pomology. Lectures, T Th 9. Plant Science 141. Laboratory, T 2–4. Plant Science 146. Professor MURPHY.

A course designed primarily for graduate students, but open to properly qualified seniors who expect to engage in plant breeding. A study of the principles and practices of plant breeding. Lectures, supplemented by periods in the greenhouse and experimental fields. A one-day field trip is taken.

204. EXPERIMENTAL EVOLUTION. Spring term. Credit two hours. Prerequisite, course 101 and Botany 124. Lectures, T Th 9. Plant Science 141. One discussion period, to be arranged. Professor SMITH.

A survey of the mechanisms involved in evolutionary changes in populations, races, species, or breeds. Included are discussions on chromosome number and structure, polygenic inheritance, selection, adaptation, isolating mechanisms, environmental influences, population genetics, and the evolution of certain crop plants.

211. STATISTICAL METHODS OF ANALYSIS. Fall term. Credit three hours. T 11. Plant Science 143; Th 2–4. Plant Science 233. Associate Professor LiverMore.

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. EXPERIMENTAL METHODS. Spring term. Credit two hours. Prerequisite, course 211 or equivalent. Professor Atwood. T 12, F 9. Plant Science 146.

The use of statistical methods and experimental design in problems of plot technique and related agricultural research.

213. ADVANCED STATISTICAL METHODS I. Fall term. Credit four hours. Prerequisite, course 211 or equivalent. Professor Federer. M W F 8. Plant Science 141. Laboratory to be arranged.

The principles and interpretation of statistical methods in connection with the small sample theory as applied to experimental results. The topics covered are the study of variation, analysis of variance and covariance, multiple and curvilinear regression, individual degrees of freedom, and tests of significance.

214. ADVANCED STATISTICAL METHODS. II. Spring term. Credit four hours. Prerequisite, course 213 or equivalent. Professor FEDERER. T Th S 8, W 1-4. Plant Science 146.

Application of the material presented in course 213 on experimental and sampling designs. The factorial experiment, randomized block design, Latin Square design, and some of the incomplete block designs are discussed.

222. SEMINAR. Fall and spring terms. Credit one hour. Required of all graduate students taking either a major or a minor in this department. Members of departmental staff. F 4:30. Plant Science 404.

## PLANT PATHOLOGY

Professors L. M. MASSEY, DONALD REDDICK, M. F. BARRUS, H. M. FITZPATRICK, W. H. BURKHOLDER, C. CHUPP, 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, H. S. CUNNINGHAM, L. C. PETERSON, W. F. MAI, A. A. FOSTER, R. E. WILKINSON, and C. E. WILLIAMSON; at Geneva, Professors O. A. REINKING, J. M. HAMILTON, D. H. PALMITER, W. T. SCHROEDER, A. J. BRAUN, and R. E. FOSTER.

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. They should also have some practice in teaching, for which opportunity will be provided. 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. See Announcement of the College of Agriculture.

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, WELCH, and L. J. TYLER. Lecture, T 11. Plant Science 336. Practice, three 3-hour periods weekly at the students' convenience. Preregistration required.

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; preference to graduates in fall and to undergraduates in spring. Credit three hours. Prerequisite, Course 1 or 200 or the equivalent. Professor L. J. TYLER. Lecture hour to be arranged. Plant Science 336. Laboratory, T Th 2-4:30. Plant Science 342. Preregistration required.

A consideration of the principles and methods of plant disease control. Required of graduate students with major or minor in plant pathology.

## PLANT SCIENCES

201. ADVANCED PLANT PATHOLOGY. A two-term course, fall and spring terms. Prerequisites, course 200, 2, 121 or 221, and permission to register. Associate Professor Ross, Assistant Professor WILLIAMSON and 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. Major attention is given to virus diseases and the nature of viruses. The course is designed chiefly for students majoring in plant pathology.

111. DISEASES OF TREES AND SHRUBS. Spring term. Credit three hours. Prerequisite, course 1 or 200. Professor WELCH. Lecture, W F 10. Plant Science 336. Practice, F 2–4:30. 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 2–4:30. Plant Science 329. Given in alternate years. Not given in 1950–1951.

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 2–4:30 and one equivalent additional period to be arranged. Plant Science 329. Given in alternate years. Not given in 1949–1950.]

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. Spring term. Credit five hours. Prerequisite, course 221. Professor FITZPATRICK. Practice hours and weekly conferences to be arranged. Plant Science 329. Given in alternate years. Not given in 1950–1951.

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, Fitzpatrick, Chupp, Burk-Holder, Blodgett, Welch, Fernow, Newhall, Mills, Burrell, Kent, Parker, Dimock, Tyler, H. S. Cunningham, A. F. Ross, L. C. Peterson, W. F. Mai, A. A. Foster, R. E. Wilkinson, and C. E. Williamson.

242. SEMINAR. Members of the staff. Weekly.

243. LITERATURE REVIEW. Members of the staff. Bi-weekly.

# PHYSICAL SCIENCES

## ASTRONOMY

#### Professors R. W. SHAW and M. E. STAHR.

### 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.

For undergraduate courses which often meet needs of graduate students, see the Announcement of the College of Arts and Sciences, Department of ASTRONO-MY, courses 101 and 102 (preregistration required).

## INTERPRETATIONAL ASTRONOMY

221. ORIGIN OF THE SOLAR SYSTEM. Fall term. Credit three hours. Prerequisite, the Calculus. Associate Professor SHAW. M W F 11.

Analysis of the physical and chemical properties of the members of the solar system. Critical study of the proposed modes of origin and evolution of the system. Age of the planets. Other planetary systems. General problem of origins.

226. THEORY OF ORBITS. Spring term. Credit three hours. Prerequisite, the Calculus. Assistant Professor STAHR. M W F 12.

Theory of objects moving according to Newton's Law of Gravitation. Determination of the elements of the orbit of a comet or asteroid from three or more observations. Use of computing machines.

231. STELLAR STRUCTURE. Spring term. Credit three hours. Prerequisite, the Calculus. Associate Professor SHAW. M W F 11.

Theory of radiation. Stellar atmospheres and internal structure. Energy sources. Stars with extended atmospheres. White dwarfs. Interstellar matter.

[238. ASTROCHEMISTRY. Fall term. Credit three hours. Prerequisite, the Calculus. Associate Professor SHAW. Not given in 1949–1950.]

[241. THE GALAXY. Fall term. Credit three hours. Prerequisite, the Calculus. Assistant Professor STAHR. Not given in 1949–1950.]

[244. EXTERNAL GALAXIES. Spring term. Credit three hours. Prerequisite, the Calculus. Assistant Professor STAHR. Not given in 1949–1950.]

[275. ASTROPHYSICS. Fall and spring terms. Credit three hours a term. Pre-

requisites, Differential Equations and Astronomy 231 or 238. Associate Professor SHAW. Not given in 1949–1950.]

285. ADVANCED GALACTIC STRUCTURE. Spring term. Credit three hours. Prerequisites, Differential Equations and Astronomy 241 and 244. Assistant Professor STAHR. M W F 12.

Distribution functions and their use in stellar statistics. Luminosity functions. Analysis of star counts. Determination of stellar space and velocity distributions. Interstellar absorption. Elements of stellar dynamics.

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.

#### OBSERVATIONAL ASTRONOMY

[461. ASTRONOMICAL SPECTROSCOPY. Fall term. Credit three hours. Prerequisite, consent of instructor. Associate Professor SHAW. Not given in 1949– 1950.]

464. ASTROMETRY. Fall term. Credit three hours. Prerequisite, consent of instructor. Assistant Professor STAHR. T Th 12 and one laboratory period to be arranged.

Determination of stellar positions from photographic plates. Parallax and proper motions. Orbits of visual binaries. Sunspots, Occultations. Use of the coordinate measuring machine and the filar micrometer. Practice in astronomical photography. Emphasis is on observational methods and techniques.

[468. PRACTICAL ASTRONOMY. Spring term. Credit three hours. Prerequisite, consent of the instructor. Associate Professor SHAW. Not given in 1949–1950.]

[475. ADVANCED ASTROPHYSICAL LABORATORY. Either term. Credit one to three hours. Prerequisites, Astronomy 461, 464, or 468 and the consent of the instructor. STAFF. Not given in 1949–1950.]

#### CHEMISTRY

Professors Peter Debye, S. H. BAUER, A. T. BLOMQUIST, J. K. BRAGG, T. R. BRIGGS, C. K. CAIN, P. J. FLORY, J. L. HOARD, J. R. JOHNSON, A. W. LAUBEN-GAYER, F. A. LONG, D. R. MILLER, W. T. MILLER, M. L. NICHOLS, J. PAPISH, E. R. VAN ARTSDALEN, L. A. WOOD; *Doctors* D. F. DETAR, E. E. MUSCHLITZ, H. POSVIC, R. A. REINHARDT, H. A. SCHERAGA, and M. J. SIENKO.

APPROVED MAJOR AND MINOR	SUBJECTS	(key to symbols on p. 44)
Inorganic Chemistry 1, 2, 3, 4	Organic	Chemistry 1, 2, 3, 4
Analytic 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

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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 105 and 106; Qualitative Analysis 201, 205 and 207, or 212; Quantitative Analysis 215, or 220 and 222; Introductory Organic Chemistry 307 and 308 and 311; Introductory Physical Chemistry 403 and 404 or 407 and 408, and 411; 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 Quantitative Analysis 220 and 222, Introductory Organic Chemistry Laboratory 312, and Introductory Physical Chemistry Laboratory 412. 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.

Proficiency Tests will be required of all entering candidates for advanced degrees (M.S. or Ph.D.) in Chemistry. These tests, which will be given a few days before registration for the fall term, will cover the divisions of Inorganic, Analytical, Organic, and Physical Chemistry. Each test will be from two to two and one-half hours in length and will cover material normally presented in elementary courses in the subjects listed above.

Results of these tests will be used to aid the student's Special Committee in the selection of his program of courses. While the results will not be considered in the usual sense of "passing" or "failing", low marks in one or more of the tests may require a preponderance of elementary courses during a term and a reduced residence credit for that term.

Qualifying Examinations required of all candidates for the Ph.D. degree will follow the general procedure outlined on page 25 of this Announcement.

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 under-

graduate students. It may be necessary for a graduate student in chemistry to take one or more of the courses 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 and research assistantships are open to entering graduate students.

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

#### INORGANIC CHEMISTRY

For undergraduate courses in Inorganic Chemistry which often meet the needs of graduate students, see the Announcement of the College of Arts and Sciences, Department of CHEMISTRY, courses 105, 106, 111, 112, and 115. Preregistration is required in all these courses.

575 and 576. *ADVANCED INORGANIC CHEMISTRY*. Throughout the year. Credit three hours a term. Prerequisite or parallel courses, Chemistry 403 and 404, or 407 and 408, or consent of the instructor. Professor LAUBENGAYER. M W F 11. Baker 107.

Theories of atomic structure and chemical bonding are applied systematically to the elements as they appear in the Periodic System, with emphasis on the stereochemistry of inorganic substances.

580. ADVANCED INORGANIC LABORATORY. Either term. Credit two to six hours. Prerequisite, Chemistry 307 and 308 and 311 and 312 and consent of the instructor. Chemistry 580 is designed to accompany Chemistry 575 and 576 but may be taken separately. Professor LAUBENGAYER and Assistant Professor VAN ARTSDALEN. Day and hours to be arranged. Baker 178.

Laboratory practice. The preparation, purification, properties, and reactions of inorganic compounds, including those of the rarer elements.

585 and 586. SELECTED TOPICS IN ADVANCED INORGANIC CHEMIS-TRY. Throughout the year. Credit two hours a term. Students may register for either term separately. Prerequisite, Chemistry 403 and 404, or 407 and 408 and consent of the instructor. Instructors and topics to be announced and hours to be arranged.

Detailed consideration is given each term to one or two special topics selected from the field of theoretical and experimental inorganic chemistry. Topics are varied from year to year.

[590. CHEMISTRY OF THE RARE ELEMENTS. Either term. Credit two or more hours. Prerequisite, Chemistry 575 and 576. Professor PAPISH. Not given in 1949–1950.]

#### ANALYTICAL CHEMISTRY

For undergraduate courses in Analytical Chemistry which often meet the needs of graduate students, see the *Announcement of the College of Arts and Sciences*, Department of CHEMISTRY, courses 201, 205, 207, 212, 215, 220 and 222. Preregistration is required in all these courses.

240. SPECIAL METHODS OF QUANTITATIVE ANALYSIS. Either term. Credit three hours. Prerequisite, Chemistry 220 and 222, or the consent of the instructor. Professor NICHOLS and assistants. Lecture, T 11, Baker 207. Laboratory, M T or Th F 2–4:30, or W 2–4:30 and Th 10–12:30. Baker 282 and 294. Preregistration required.

The analysis of gaseous and solid fuels, and gas evolution methods. The application of instrumental methods to quantitative analysis including nephelometric, refractometric, colorimetric, electrolytic, combustion, conductometric, and potentiometric methods.

#### CHEMISTRY

[250. GAS AND FUEL ANALYSIS. Fall term. Credit three hours. Prerequisite, Chemistry 220 and 222, or consent of the instructor. Professor NICHOLS. Not given in 1949–1950.]

265. ADVANCED, QUANTITATIVE LABORATORY. Spring term. Credit three hours. Prerequisite, Chemistry 215 or 220 and 222. Professor NICHOLS and assistant. Conference, one hour a week, to be arranged. Laboratory, M T W Th or F 2–4:30. Baker 294. Students should register for a combination of laboratory periods that will total seven and one-half hours a week. Preregistration required.

Laboratory practice in the application of special methods of quantitative analysis and the analysis of special materials.

275. QUANTITATIVE MICROANALYSIS. Fall term. Credit three or more hours. Prerequisite, consent of the instructor. Enrollment is limited. Professor NICHOLS and assistant. Laboratory, W F 9–5. Baker 358. Preregistration required.

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

280. EMISSION SPECTROSCOPY IN CHEMICAL ANALYSIS. Either term. Credit three hours. Prerequisite, consent of the instructor. Professor PAPISH and assistant. Conference, one hour, to be arranged. Laboratory, hours to be arranged. Baker 396. Preregistration required.

The construction and use of spectroscopic equipment; spectrum excitation; qualitative and quantitative spectrochemical analysis.

285. SPECTROCHEMICAL ANALYSIS. Either term. Credit two or more hours. Prerequisite, Chemistry 280. Professor PAPISH and assistant. Laboratory, hours to be arranged. Baker 396. Preregistration required.

A continuation of Chemistry 280, as well as a study of the elements of absorption spectroscopy in chemical analysis.

[290. ADVANCED QUANTITATIVE ANALYSIS. Spring term. Credit two hours. Prerequisite, Chemistry 403 or 407. Professor NICHOLS. Given in alternate years. Not given in 1949–1950.]

### ORGANIC CHEMISTRY

For undergraduate courses in Organic Chemistry which often meet the needs of graduate students, see the *Announcement of the College of Arts and Sciences*, Department of CHEMISTRY, courses 303, 305, 307, 308, 311 and 312. Preregistration is required in all these courses.

320. IDENTIFICATION OF ORGANIC COMPOUNDS. Either term. Credit four hours. Prerequisite, Chemistry 307 and 308 and 311 and 312, at grades of 75 or better. Professor MILLER and assistants. Lectures, T Th 8. Baker 377. Laboratory, T Th 2–4:30, or F 2–4:30 and S 10–12:30. Baker 378. Preregistration required.

The classification reactions of organic compounds and the preparation of solid derivatives are applied to the identification of unknown organic substances.

330. ADVANCED ORGANIC LABORATORY. Either term. Credit two to four hours. Prerequisite, Chemistry 312 and 320, and the consent of the instructor. Professor Johnson, Professor MILLER, Associate Professor BLOMQUIST, Assistant Professor CAIN, and Doctor DETAR. Hours to be arranged. Baker 352.

An advanced course in organic synthetic procedures, involving preparation of intermediates for organic research and use of standard reference works.

365 and 366. ADVANCED ORGANIC CHEMISTRY. Throughout the year. Credit two hours a term. Prerequisite, Chemistry 307 and 308, 311 and 312 and 320, or the consent of the instructor. Students may register for either term separately. Professor JOHNSON, Associate Professor BLOMQUIST, and Doctor DETAR. Lectures, T Th 9. Baker 177.

First term: survey of the more important classes of organic compounds and their reactions. Second term: discussion of general topics (tautomerism, molecular rearrangements, stereochemistry).

375 and 376. SELECTED TOPICS IN ORGANIC CHEMISTRY. Throughout the year. Credit two hours a term. Prerequisite, Chemistry 365 and 366. Associate Professor BLOMQUIST. Lectures, M W 12. Baker 377.

Fall term: organic compounds of nitrogen and sulfur. Spring term: the simpler heterocycles and alicyclic compounds. Given in alternate years.

[380. ORGANIC CHEMISTRY OF HIGH POLYMERS. Fall term. Credit two hours. Prerequisite, Chemistry 365 and 366, or consent of the instructor. Professor MILLER. Lectures, M W 11. Baker 377. Given in alternate years. Not given in 1949– 1950.]

385. PHYSICAL ASPECTS OF ORGANIC CHEMISTRY. Fall term. Credit two hours. Prerequisite, Chemistry 320 or 365 and 366, and the consent of the instructor. Professor MILLER. Lectures, M W 11. Baker 377.

A discussion of recent theoretical developments in organic chemistry and their application to typical reactions. Given in alternate years.

[395 and 396. CHEMISTRY OF NATURAL PRODUCTS. Throughout the year. Credit two hours a term. Prerequisite, Chemistry 320 or 365 and 366. Students may register for either term separately. Assistant Professor CAIN. Lectures, T Th 11. Baker 377. Given in alternate years. Not given in 1949–1950.]

## PHYSICAL CHEMISTRY

For undergraduate courses in Physical Chemistry which often meet the needs of graduate students, see the *Announcement of the College of Arts and Sciences*, Department of CHEMISTRY, courses 403, 404, 407, 408, 411, and 412. Preregistration is required in all these courses.

[431 and 432. *APPLIED ELECTROCHEMISTRY*. Throughout the year. Credit two hours a term. Prerequisite, Chemistry 403 and 404 or Chemistry 407 and 408. Professor BRIGGS. Lectures, T Th 11. Baker 7. Given in alternate years. Not given in 1949–1950.]

[435. INTRODUCTORY ELECTROCHEMISTRY. Spring term. Credit three hours. Prerequisite, Chemistry 403 and 404 or Chemistry 407 and 408. Professor BRIGGS and assistant. Lectures, M W 12, Baker 7. Laboratory, one period a week to be arranged. Baker 1A. Not given in 1949–1950.]

440. COLLOID CHEMISTRY. Spring term. Credit three hours. Prerequisite, Chemistry 403 and 404, or 407 and 408. Professor BRIGGS. Lectures, M W F 11. Baker 7.

The general theory of colloid chemistry and adsorption. Applications of the theory, with emphasis on emulsions and the inorganic colloids.

445. APPLICATION OF THE PHASE RULE. Fall term. Credit three hours. Prerequisite, Chemistry 403 and 404 or Chemistry 407 and 408. Professor BRIGGS. Lectures, M W F 12. Baker 7.

A study of phase equilibria in two-component, three-component, and fourcomponent systems. Interpretation of phase diagrams, equilibria in saturated salt solutions, indirect analysis, and paths of crystallization.

[450. SOLID STATE. Spring term. Credit three hours. Prerequisite, Chemistry 403 and 404 or Chemistry 407 and 408. Professor HOARD. Not given in 1949–1950.]

455. KINETICS OF CHEMICAL REACTIONS. Spring term. Credit three

#### CHEMISTRY

hours. Prerequisite, Chemistry 403 and 404 or Chemistry 407 and 408 and consent of the instructor. Professor Long. Lectures, M W F 11. Baker 207.

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. Not given in 1949–1950.]

461. RADIOCHEMISTRY. Fall term. Credit three hours. Prerequisite, Chemistry 403 and 404, or 407 and 408. Assistant Professor MILLER. M W F 12. Baker 18.

A discussion of properties of the nucleus; spontaneous and induced nuclear reactions; radioactivity measurement; applications of radioisotopes; chemical techniques in the investigation of nuclear phenomena; and chemistry of radioactive elements.

465. ADVANCED LABORATORY PRACTICE IN PHYSICAL CHEMISTRY. Either term. Credit variable, but not to exceed six hours a term. Prerequisite, determined in each case by the professor in charge. Professors BRIGGS, HOARD, and LONG, Associate Professor BAUER, and assistants. Hour and place to be arranged.

471 and 472. *THERMODYNAMICS*. Throughout the year. Credit three hours a term. Prerequisite, Chemistry 403 and 404 or 407 and 408. Professor HOARD. 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 physiochemical equilibria in gases, liquids, solids, and liquid solutions. Problems.

[475. THEORY OF SOLUTIONS. Fall term. Credit three hours. Prerequisite, Chemistry 471 and 472. Professor HOARD. Not given in 1949–1950.]

480. *STATISTICAL MECHANICS*. Spring term. Credit three hours. Prerequisite, Chemistry 491 or equivalent is desirable but not required. Assistant Professor BRAGE. M W F 12. Baker 107.

An introduction to quantum statistical mechanics with applications to chemistry. Given in alternate years.

[482. PHYSICAL CHEMISTRY OF HIGH POLYMERS. Spring term. Credit two hours. Prerequisite, Chemistry 380, 471 and 472, or consent of the instructor. Professor FLORY. Lectures M W 11. Baker 377. Given in alternate years. Not given in 1949–1950.]

[491. INTRODUCTION TO QUANTUM MECHANICS. Fall term. Credit three hours. Prerequisite, consent of the instructor. Assistant Professor BRAGG. Lectures, M W F 9. Baker 377. Given in alternate years. Not given in 1949–1950.]

[492. QUANTUM CHEMISTRY. Spring term. Credit three hours. Prerequisite, Chemistry 491 or its equivalent. Assistant Professor BRAGG. Lectures, M W F 9. Baker 377. Given in alternate years. Not given in 1949–1950.]

495. *MOLECULAR SPECTRA*. Either term. Credit three hours. Prerequisite, consent of the instructor. Associate Professor BAUER. Hours to be arranged. Baker 18. Given upon registration of five or more students.

Description of various types of molecular spectra. The rotational and vibrational spectra of polyatomic molecules (energy levels, normal coordinate treatment, selection rules). Relations between molecular structure and molecular constants.

## PHYSICAL SCIENCES

## GEOLOGY AND GEOGRAPHY

Professors W. S. Cole, C. M. Nevin, J. W. Wells, A. L. Anderson, J. D. Burfoot, Jr., and W. T. Holser.

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

Regional Geography 1, 2 Mineralogy 1, 2, 3, 4 Economic Geology 1, 2, 3, 4 Paleontology 1, 2, 3, 4 Petrology 1, 2, 3, 4 Geomorphology 1, 2, 3, 4 Glacial Geology 1, 2, 3, 4 Structural Geology 1, 2, 3, 4 Stratigraphy 1, 2, 3, 4 Sedimentation 1, 2, 3, 4 Physical Geography 2, 4 Geology 4 Geography 4

Under the general title of geology and geography are included 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 very large 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.

For undergraduate courses which often meet needs of graduate students see the Announcement of the College of Arts and Sciences, Department of GEOLOGY.

## STRUCTURAL GEOLOGY, SEDIMENTATION, AND PETROLEUM GEOLOGY

#### Professor NEVIN.

Graduate research in any of these subjects should preferably be based on field work.

301. STRUCTURAL GEOLOGY. Fall term. Credit three hours. Prerequisite, Geology 101-102 or equivalent. Professor NEVIN. Two lectures, one laboratory. M W 11, M 2-4:30. McGraw 150.

Geologic structures and their causes.

303. SEDIMENTATION. Spring term. Credit three hours. Prerequisite, Geology 101–102 or equivalent. Professor NEVIN. Two lectures, one laboratory. M W 11, M 2–4:30. McGraw 150.

The principles involved in the formation of sediments.

321. PETROLEUM GEOLOGY. Spring term. Credit three hours. Prerequisite, Geology 101–102 or equivalent. Professor NEVIN. Two lectures, one laboratory. T Th 9, Th 2–4:30. McGraw 150.

The geology of oil and natural gas, and a discussion of the methods used to discover them.

391-392. SEMINAR IN STRUCTURAL GEOLOGY AND SEDIMENTATION.

Throughout the year. Credit variable. For advanced students. Professor NEVIN. M 4:45. McGraw 150.

395-396. ADVANCED OR 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. Day and hour to be arranged.

901. GEOLOGIC MAPPING. Given at the summer field camp. Credit six hours. Professor NEVIN. (Special circular, on request, from the department.)

## GEOMORPHOLOGY AND GLACIAL GEOLOGY

Assistant Professor -----

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.

401. *GEOMORPHOLOGY*. Fall term. Three hours credit. Prerequisite, Geology 101–102 or equivalent. Assistant Professor ————. T Th 9. Laboratory, T 2–4:30. 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.

403. GLACIERS AND GLACIATION. Spring term. Three hours credit. Prerequisite, Geology 101–102 or equivalent. Assistant Professor ————. T Th 10. Laboratory, T 2–4:30. 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.

495-496. ADVANCED OR SPECIAL WORK IN GEOMORPHOLOGY AND GLACIAL GEOLOGY. Throughout the year. Credit variable. Prerequisite, an adequate background of course work in geology. Assistant Professor ———. 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

Associate Professor BURFOOT and Acting Assistant Professor HOLSER.

The laboratory equipment for microscopical work is modern and complete. For mineralogical work it includes the universal stage, which is being adapted to the double variation procedure. Other equipment for determinative mineralogy includes a small carbon-arc spectroscope and adequate equipment for silicate analysis. Laboratory facilities for x-ray diffraction studies are at present provided in the Department of Physics.

The study collections in mineralogy and petrology are widely representative of species and types of occurrence from localities throughout the world, and are constantly being expanded. A collection of more than 6000 thin sections enables microscopical study of representative specimens from the petrological collections. The mineralogical collection includes the Benjamin Silliman, Jr., collection, which was acquired before the opening of the University in 1868.

The program of advanced study and research will be adapted to the needs of the individual student. Research projects will, where possible, include correlative field and laboratory work. The research program emphasizes the solution of fundamental problems of mineralogy and petrology by the application of physicochemical principles.

207-208. MINERALOGY. Throughout the year. Credit three hours a term. Prerequisite, Chemistry 105-106. Fall term prerequisite to spring term. Acting Assistant Professor Holser. Lectures, M W 10. Laboratory, F 2-4:30. McGraw 145, and B65.

Fall term: Fundamentals of crystal structure, with emphasis on symmetry; principles of crystal chemistry; relations of structure and chemistry to morphological, mechanical, optical, and other physical properties of crystals. Laboratory work includes demonstrations of these principles and relationships, and their application in identification of minerals.

Spring term: Study of the common minerals by application of the fundamental concepts of the work of the fall term with emphasis on isomorphous substitution. Modes of occurrence are discussed, and laboratory work emphasizes mineral identification and relationships.

209. LITHOLOGY. Spring term. Credit two hours. Prerequisite, Geology 101– 102 and 207–208. Associate Professor Burfoot and Acting Assistant Professor HOLSER. T Th 2–4:30. McGraw 145.

The mineral composition, texture, classification, identification, modes of origin, and properties of igneous, sedimentary, metamorphic, and metalliferous rocks, studied without the use of the petrographic microscope.

501. OPTICAL MINERALOGY. Fall term. Credit three hours. Prerequisite, Geology 207–208. Acting Assistant Professor HOLSER. Lectures W, 9, McGraw 145. Laboratories, F 8–10:30 and S 9–11:30, McGraw 345. Given in 1949–1950 and alternate years.

Expansion of the theory of optical properties of crystals as developed in Geology 207. Application of the theory to the determination and study of minerals with the petrographic microscope. The common rock-forming minerals are studied in fragments and in thin sections.

502. *PETROGRAPHY*. Spring term. Credit three hours. Prerequisite, Geology 501. Acting Assistant Professor Holser. Lecture, W 9, McGraw 145. Laboratories, F 8–10:30, S 9–11:30, McGraw 345. Given in 1949–1950 and alternate years.

A study of the mineral and chemical composition, and textures of igneous, sedimentary, and metamorphic rocks; their classification and determination by means of the petrographic microscope.

521. SEDIMENTARY PETROGRAPHY. Fall term. Credit three hours. Prerequisite, Geology 501. Associate Professor BURFOOT. Lectures, M W 11, McGraw 145. Laboratory, F 10:30–1:00. McGraw 345 and B65. Given in 1949–1950 and alternate years.

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 geological problems. Emphasis is placed on the methods of preparation of mineral grains for study and on the identification and interpretation of these grains by means of the petrographic microscope.

[575. IGNEOUS PETROGENY. Fall term. Credit three hours. Prerequisite, Geology 502. Associate Professor BURFOOT. Lectures, M W 9. McGraw 145. Laboratory, F 10:30–1. McGraw 345. Given in 1950–1951 and alternate years.]

[577. *METAMORPHIC GEOLOGY*. Spring term. Credit three hours. Prerequisite, permission of instructor. Associate Professor BURFOOT. Lectures, M W 9. McGraw 145. Laboratory, F 8–10:30. McGraw 145 and 345. Preregistration required. Given in 1950–1951 and alternate years.]

[581. STRUCTURAL MINERALOGY. Fall term. Credit three hours. Prerequisite, Geology 207–208. Acting Assistant Professor Holser. Lectures, M W 11. Laboratory, S 10:30–1. McGraw 145. Given in 1950–1951 and alternate years.]

[583. CHEMICAL MINERALOGY. Spring term. Credit three hours. Prerequisite, Geology 207–208; recommended but not required: Geology 501, 581, Chemistry 407–408. Acting Assistant Professor HOLSER. Lectures, M W 11. Laboratory, F 10:30–1. McGraw 145. Given in 1950–1951 and alternate years.]

Principles of physical chemistry in their application to mineralogy.

591–592. SEMINAR IN MINERALOGY AND PETROLOGY. Throughout the year. Credit one hour a term. Prerequisite, permission of instructor. Acting Assistant Professor Holser and Associate Professor Burfoot. W 4:45. McGraw 145.

Literature, special topics, advanced methods. For all interested students; attendance expected of majors and minors in mineralogy and petrology.

595-596. ADVANCED OR SPECIAL WORK IN MINERALOGY AND PE-TROLOGY. Throughout the year. Credit variable. Prerequisites, variable. Associate Professor BURFOOT and Acting Assistant Professor HOLSER. Days and hours to be arranged. McGraw 145, 345, B-65.

Adapted to the needs of the individual student. Advanced methods, special problems, research.

#### PALEONTOLOGY AND STRATIGRAPHIC GEOLOGY

#### Professors COLE and J. W. WELLS.

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 New-comb collection (10,000 species of recent shells); and a wealth of conchological literature in the geological and general library.

201. HISTORIC GEOLOGY. Fall term. Credit three hours. Prerequisite, Geology 101–102. Professor Wells. Lectures, M W 9. Laboratory, W 2–4:30. 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

#### PHYSICAL SCIENCES

identification and correlation depend. Special emphasis on American geology. Field studies in the laboratory period in so far as weather and other circumstances permit.

601-602. *INVERTEBRATE PALEONTOLOGY*. A two-term course: fall and spring terms. Credit three hours a term. Prerequisite, Geology 101-102 and, if possible, Invertebrate Zoology. Professors COLE and WELLS. Lectures, T Th 10. McGraw 450. Laboratory, Fall term, Th 2-4:30; Spring term, W 2-4:30. 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.

605-606. STRATIGRAPHY. Throughout the year. Credit three hours a term. Prerequisites, Geology 101-102 and first term of 601-602. Intended for students majoring in geology. T Th 9, W 10. Mr. COLE, Mr. WELLS.

The principles of stratigraphy, developed by detailed study of selected American and European systemic examples. Fall term: the Paleozoic; Spring term: the Mesozoic and Cenozoic.

675. *MICROPALEONTOLOGY*. Spring term. Credit two hours. Prerequisite, permission of the instructor. Student should have Geology 101–102, 605, and 601–602. Professor CoLE. W 9 and hours to be arranged. McGraw 450.

Study of the microfossils, chiefly Foraminifera, in their relation to correlation of strata, as used in the development of oil fields.

681. GEOLOGY OF NEW YORK STATE. Spring term. Credit two hours. Prerequisites, Geology 101–102, 605, 601–602, or permission of instructor. Professor Wells. Lectures in winter months, all-day field trips in spring months. T Th 12 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.

695-696. ADVANCED OR SPECIAL WORK IN PALEONTOLOGY AND STRATIGRAPHY. Throughout the year. Credit variable. Prerequisites, Geology 605 and 601-602. Professors Cole and Wells. Day and hours to be arranged. McGraw 450.

Particular problems in paleontology and stratigraphy adapted to the needs of the individual student.

912. GEOLOGIC INTERPRETATION OF AERIAL PHOTOGRAPHY. Spring term. Credit three hours. Prerequisite, Geology 301. Intended for majors in geology. Lecture, M 9, two laboratories by arrangement. Mr. WELLS.

Aerial photographs as a substitute for maps; interpretation of geology and preparation of maps from aerial photographs.

## 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

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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.

701–702. *GENERAL ECONOMIC GEOLOGY*. A two-term course. Credit three hours a term. Prerequisite, Geology 101–102 or 113 and 207 or permission of the instructor. Associate Professor ANDERSON. Lectures, T Th 11. Laboratory, F 2–4:30. 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, asbestos, 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.

712. METALLURGICAL RAW MATERIALS. Fall term. Credit three hours. For second year students in Metallurgical Engineering. Associate Professor ANDERSON. Lectures, M W F 10, McGraw 150.

The source, occurrence, associations, distribution, and economic aspects of the commercially important ore, refractory and fluxing materials that enter metallurgical operations.

[721. MICROSCOPIC STUDY OF ORE MINERALS. Fall term. Credit two hours. Prerequisite, Geology 207–208. Associate Professor Anderson. F 8–10:30, S 8–10:30. McGraw 250. Given in alternate years; not given in 1949–1950.]

732. MINING GEOLOGY. Spring term. Credit three hours. Prerequisites, Geology 701-702. Associate Professor Anderson. Given in alternate years; not given in 1949-1950. M W F 1. McGraw 150.]

775-776. MINERAL DEPOSITS. A two-term course. Credit three hours a term. Prerequisites, Geology 701-702. Associate Professor Anderson. Lectures, M W F 1. McGraw 150. Given in 1949-1950 and alternate years.

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.

791-792. ECONOMIC GEOLOGY SEMINAR. Throughout the year. Credit one hour a term. Associate Professor Anderson. T 4:45. McGraw 150.

Seminar on timely topics in Economic Geology.

795–796. 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.

## PHYSICAL SCIENCES

## MATHEMATICS

Professors W. A. HURWITZ, R. P. AGNEW, J. B. ROSSER, WM. FELLER, MARK KAG, R. J. WALKER, HARRY POLLARD, K. L. CHUNG; Doctors BRYANT TUCKERMAN, BERTRAM YOOD, CHRISTINE WILLIAMS, M. D. DONSKER.

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

Algebra 1, 2, 3	Applied Mathematics 1, 2, 3
Mathematical Analysis 1, 2, 3	Mathematics 1, 2, 4
Geometry 1, 2, 3	

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 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.

For undergraduate courses which often meet needs of graduate students, see the Announcement of the College of Arts and Sciences, Department of MATHE-MATICS, courses 201, 221, 301, 341, 401, 402, 409, 549, 605, 607, 608, 611, 612, 711, 712, 721, 722.

#### ALGEBRA

371, 372. MODERN ALGEBRA. Throughout the year. Prerequisite, Mathematics 173 or the equivalent. Professor POLLARD. T Th S 9.

For graduate students and qualified undergraduates. An introductory course in modern algebra, serving as a basis for further work in algebra and geometry.

373. ADVANCED THEORY OF FIELDS. Fall term. Prerequisite, Mathematics 372. Dr. WILLIAMS. T Th S 9.

A study of finite and infinite extensions of fields. Galois theory and applications of Galois theory.

374. ADVANCED THEORY OF RINGS. Spring term. Prerequisite, Mathematics 372. Dr. WILLIAMS. T Th S 9.

The course will start with a development of general structure theorems for rings. A study will be made of the radical, semi-simple and simple rings. Applications to theory of algebras.

[GROUPS, RINGS AND FIELDS. Not given in 1949-1950.]

[THEORY OF EQUATIONS. Not given in 1949-1950.]

[FOUNDATIONS OF MATHEMATICS. Not given in 1949-1950.]

[SYMBOLIC LOGIC. Not given in 1949-1950.]

[ANALYTIC THEORY OF NUMBERS. Not given in 1949–1950.]

[TOPOLOGICAL GROUPS. Not given in 1949–1950.]

### GEOMETRY

451, 452. ALGEBRAIC GEOMETRY. Throughout the year. Prerequisite, consent of the teacher. Professor WALKER. M W F 9.

An introductory course in the modern theory of curves, surfaces, and higher dimensional figures defined by algebraic equations. For graduate students and qualified undergraduates.

[DIFFERENTIAL GEOMETRY. Not given in 1949–1950.]

[RIEMANNIAN GEOMETRY. Not given in 1949–1950.]

[ALGEBRAIC CURVES. Not given in 1949-1950.]

[DIMENSION THEORY. Not given in 1949-1950.]

### ANALYSIS

501, 502. ADVANCED CALCULUS. Throughout the year. Prerequisite, Mathematics 173 or the equivalent. M W F 11.

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.

515, 516. FUNCTIONAL ANALYSIS. Throughout the year. Prerequisite, Mathematics 512. Professor Yood. T Th S 10.

Banach spaces, Banach algebras and related topics in the theory of abstract spaces. Applications to problems in analysis are considered.

531, 532. COMPLEX VARIABLES. Throughout the year. Prerequisite, Mathematics 502. M W F 10.

Complex number systems; 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.

561. INTEGRAL EQUATIONS. Fall term. Prerequisite, Mathematics 502. Professor HURWITZ. T Th S 11.

Volterra and Fredholm integral equations. The Hilbert-Schmidt theory. Special integral equations occurring in applied mathematics.

[REAL FUNCTIONS. Not given in 1949–1950.]

[FOURIER AND LAPLACE TRANSFORMS. Not given in 1949-1950.]

[CALCULUS OF VARIATIONS. Not given in 1949-1950.]

[INFINITE SERIES. Not given in 1949–1950.]

## PHYSICAL SCIENCES

#### APPLIED MATHEMATICS

621, 622. MATHEMATICAL METHODS IN PHYSICS. Throughout the year. Prerequisite 201 or the equivalent. Professor KAC. M W F 12.

For graduate students and qualified advanced undergraduates. Lectures and problem work designed to give the students a working knowledge of the principal mathematical methods used in advanced physics.

681, 682. DIFFERENTIAL EQUATIONS OF MATHEMATICAL PHYSICS. Throughout the year. Prerequisite, Mathematics 502 or the equivalent. Professor Agnew. M W F 11.

For graduate students and qualified undergraduates. The derivation of the differential equations, with appropriate boundary conditions, which arise in certain problems of mathematical physics; the mathematical properties of solutions, and the physical meanings of these properties.

715, 716. ADVANCED MATHEMATICAL STATISTICS. Throughout the year. Prerequisite, Mathematics 712. M W F 9.

Mathematical methods of statistics with special reference to statistical inference, estimation, and sequential analysis. Elements of probability theory, and elementary statistical notions and techniques are absolute prerequisites.

723, 724. ADVANCED PROBABILITY. Throughout the year. Prerequisite, consent of teacher. Professor KAC. T Th S 11.

For graduate students and qualified advanced undergraduates. Selected topics of the advanced theory of probability.

[VECTOR ANALYSIS. Not given in 1949-1950.]

[POTENTIAL THEORY. Not given in 1949-1950.]

[RELATIVITY. Not given in 1949–1950.]

[ANALYTICAL MECHANICS. Not given in 1949-1950.]

[ORTHOGONAL FUNCTIONS. Not given in 1949–1950.]

## METEOROLOGY

Professor -----

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. See Announcement of the College of Agriculture.

2. CLIMATOLOGY. Fall term. Prerequisite, Meteorology 1 or the equivalent. Professor —————. M W 9. Plant Science 114. Preregistration is required.

A course covering general climatology and the various climates of the United States with emphasis on those of New York State.

221. *RESEARCH*. Fall or spring term. Prerequisite, Climatology 2 or the equivalent. Professor -----. Hours by appointment.

Original investigations in meteorology and climatology.

#### PHYSICS

212. SEMINAR. Spring term. Prerequisite, Climatology 2 or the equivalent. Professor -----. 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 (On Leave), (C. P. BAKER, Nuclear Studies), L. L. BARNES, H. A. BETHE, D. R. CORSON, (T. R. CUYKENDALL, Engineering Physics), J. W. DE WIRE, R. P. FEYNMAN, G. E. GRANTHAM, K. I. GREISEN, P. L. HARTMAN, H. E. HOWE, CHENG-YANG HSU, J. A. KRUMHANSL, B. D. MCDANIEL, P. MORRISON, C. C. MURDOCK, H. F. NEWHALL, L. G. PARRATT, (H. S. SACK, Engineering Physics), R. L. SPROULL, D. H. TOMBOULIAN, W. M. WOODWARD, and R. R. WILSON; *Doctors* G. COCCONI, C. W. GARTLEIN, J. S. LEVINGER, J. S. SABY, and R. L. WALKER.

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

Physics 1, 2, 3, 4	Theoretical Physics 1, 2, 3, 4
Experimental 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 Physics as a minor, and Theoretical Physics only if accompanied by Experimental Physics as a minor.

Members of the staff are especially interested in directing graduate research in the following fields:

EXPERIMENTAL PHYSICS. Nuclear Physics; cosmic rays; atomic spectra; x-rays; x-ray and electron diffraction; physical electronics, 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.

A colloquium in general physics and a seminar in theoretical physics meet regularly, and seminars in special fields meet as arranged.

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.

215. PHYSICAL OPTICS. Fall term. Credit three or five hours. Prerequisites, Physics 206, or equivalent, and Calculus. Lectures, M W F 9. Laboratory, Th F 1:40–4:30, also T W 1:40–4:30 if a second section is warranted. Associate Professor HARTMAN.

Huygens and Fermat's principles with applications to geometrical optics, velocity of light, Fraunhofer and Fresnel diffraction, polarization of light, double refraction, optical activity, electromagnetic characteristics, dispersion, absorption, and reflection.

225. ELECTRICITY AND MAGNETISM. Fall term. Credit three hours. Prerequisite, Physics 117 or 206. Lectures, T Th S 9, and an optional problem period to be arranged. Professor MURDOCK.

Electrostatic and electromagnetic fields, polarization of dielectrics and magnetic media, displacement current, plane electromagnetic waves, the Poynting vector.

236. ELECTRICITY AND MAGNETISM. Spring term. Credit three or five hours. Prerequisites, Physics 225 and Differential Equations. Lectures, T Th S 9, and two laboratory periods T W 2:00-4:30, also Th F 2:00-4:30 if a second section is warranted. Assistant Professor KRUMHANSL.

Circuit theory from the standpoint of the electromagnetic field. Validity and limitations of circuit concepts. Steady and alternating circuits and networks, frequency characteristics, distributed parameters, introductory topics in high frequency fields.

242. ANALYTICAL MECHANICS. Spring term. Credit three hours. Prerequisites, Physics 205 or 208, and Mathematics 201, or their equivalents. T Th S 9. Associate Professor Sproull.

Analytical mechanics of material particles, systems of particles, and rigid bodies; oscillations and forced vibrations; planetary motion; stability of orbits; Euler's equations; gyroscopic motion; Lagrange's equations.

243. ATOMIC AND MOLECULAR PHYSICS. Fall term. Credit three hours. Prerequisite, Physics 225. T Th S 9. Dr. WALKER.

The fundamental particles; statistical physics; the concepts of quantum mechanics; atomic structure and spectra; the periodic table; molecular structure and the chemical bond; fundamentals of nuclear physics.

254. ELECTRONIC PROPERTIES OF SOLIDS AND LIQUIDS. Spring term. Credit three or five hours. Prerequisite, Physics 243. Lectures, T Th S 9. Laboratory, Th F 1:40-4:30, also T W 1:40-4:30 if a second section is warranted. Associate Professor SACK.

Lattice structure, specific heat, lattice energy, elastic properties; electric conduction; thermoelectric effects; contact potential; barrier effect; lattice defects; dielectric, magnetic, and optical properties.

020. INFORMAL STUDY IN PHYSICS. Either term. Reading or laboratory work in any branch of Physics under the direction of a member of the staff. Hours to be arranged.

380. ADVANCED LABORATORY. Either term. Credit three hours. Prerequisite, Physics 210 or equivalent. Laboratory, T W or Th F 1:40–4:30. Rockefeller 306. Professor PARRATT, Associate Professors Corson, CUYKENDALL, HARTMAN, MCDANIEL, and Assistant Professor WOODWARD.

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.

NOTE-The Special Topics Laboratory courses from 382 to 396, inclusive, cover systematic laboratory work in the field indicated, together with appropriate lectures and discussions.

[382. HIGH TEMPERATURE MEASUREMENTS. Spring term. Credit two hours. Not offered in 1949–1950.]

383. X-RAY EXPERIMENTS. Fall term. Credit two or three hours. Prerequisite, consent of instructor. Professor PARRATT.

Operation of x-ray tubes; intensity, absorption, and scattering measurements; emission and absorption spectra; polarization, refraction, and dosage measurements.

387. SPECTROSCOPY. Credit two or three hours. Prerequisite, Physics 380 or equivalent. Laboratory, T W or Th F 1:40-4:30. Rockefeller 306. Given upon sufficient demand.

Experiments and discussion on the production, analysis, and theory of atomic, molecular, and Raman spectra.

### PHYSICS

[388. X-RAY DIFFRACTION BY CRYSTALS. Credit two hours. Not offered in 1949–1950.]

391. *ELECTRONICS AND IONICS*. Fall term. Credit three hours. Prerequisite, one term of Physics 380. Two laboratory periods and one seminar. Associate Professor Sproull.

Thermionic emission of electrons and ions, secondary electron emission, ionization and resonance potentials, gas discharges, electron optics, vacuum technique and construction of experimental vacuum tubes.

393. NUCLEAR PHYSICS LABORATORY. Fall term. Credit two hours. Prerequisite, consent of instructor. Assistant Professor De Wire.

Operation and use of Geiger counters, ionization chambers, electrometers, and linear amplifiers; range of alpha particles; absorption of beta and gamma rays; experiments with slow neutrons; beta-ray spectroscopy; and nuclear reactions.

396. COSMIC RAY EXPERIMENTS. Spring term. Credit two hours. Prerequisite, consent of instructor. Associate Professor GREISEN. Two afternoons each week. T W Th F 1:30–4:30.

Detection of cosmic rays, their absorption and shower production, by means of cloud chamber, proportional counter, and Geiger counter telescope.

475. THEORETICAL MECHANICS. Fall term. Credit three hours. Prerequisite, Physics 242 or equivalent. T Th S 11. Associate Professor MORRISON.

Classical mechanics, including the equation of Lagrange and Hamilton, theory of vibrations, special relativity theory.

476. *ELECTRODYNAMICS*. Spring term. Credit three hours. Prerequisite, Physics 225 or equivalent. T Th S 11. Associate Professor Morrison.

Maxwell's equations and their applications, including electromagnetic radiation, scattering, refraction and interference of light, waves in guides, cavity resonators, etc.

477. STATISTICAL MECHANICS AND KINETIC THEORY. Fall term. Credit two hours. Prerequisites, Physics 475, and (or in parallel) Physics 485. T Th 9. Associate Professor FEYNMAN.

Statistical mechanics and its application to the properties of gases, crystals, etc.; chemical equilibria fluctuations; transport phenomena.

480. THEORETICAL PHYSICS READING COURSE. Fall term. Repeated in the spring term. Credit two hours. Hours to be arranged. Associate Professor FEYNMAN.

Supervised reading and problem work in thermodynamics and optics. This course should, in general, be completed by physics majors not later than Physics 477.

485. INTRODUCTORY QUANTUM MECHANICS. Fall term. Credit three hours. Prerequisites, Physics 475 and 476. T Th S 12. Professor BETHE.

The wave function and its interpretation. The Schrödinger equation; oscillator, hydrogen atom. Approximate methods of solution. Operators and matrices. Electron spin, the exclusion principle.

486. APPLICATIONS OF QUANTUM MECHANICS. Spring term. Credit three hours. Prerequisite, Physics 485. T Th S 12. Professor BETHE.

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.

[491. ADVANCED QUANTUM MECHANICS. Fall term. Credit three hours. Not offered in 1949–1950.]

582. X-RAY CRYSTALLOGRAPHY. Spring term. Credit three hours. Prerequisite, Physics 225 or consent of the instructor. M W F 10. Professor MURDOCK.

Space groups, reciprocal lattices, three dimensional diffraction, interpretation of x-ray and electron diffraction data, resolving power of crystalline powders structure determination by Fourier synthesis.

588. X-RAYS. Spring term. Credit three hours. Open to qualified students by consent of the instructor. M W F 10. Professor PARRATT.

X-ray scattering, absorption, diffraction, and spectra; the relation of these processes to modern concepts of atomic and solid structure.

681. ADVANCED ELECTRON PHYSICS. Fall term. Credit three hours. Prerequisites, Mathematics 201, Physics 225, and 391, or their equivalents. M W F 8. Associate Professor NewHALL.

Motion of charged particles in electromagnetic fields; focusing problems; space charge effects; electronic phenomena in gaseous conduction; thermionic, secondary, field, and photoelectric emission.

683. THE THEORY AND PROPERTIES OF SOLIDS. Fall term. Credit three hours. Prerequisite, Physics 485 or its equivalent. T Th S 11. Professor SMITH.

Lectures on theoretical and experimental aspects of various solid types covering structure of solids; cohesive properties; electronic behavior of metals, insulators and semi-conductors; magnetic and optical properties, etc.

692. ADVANCED ELECTRONICS LABORATORY. Spring term. Credit three hours. Prerequisite, Physics 681. Hours to be arranged. Professor SMITH and Associate Professor SPROULL.

Advanced, semi-research laboratory work furnishing experience in thermionics, secondary and field emission, excitation and ionization cross-sections, electrical phenomena in gases, electron behavior in solids, mass spectroscopy, etc.

781. NUCLEAR PHYSICS. Fall term. Credit two hours. Prerequisites, Physics 243 and (or in parallel) Physics 485 and the consent of the instructor. M F 9. Professor WILSON.

The phenomena and methods of nuclear physics. A study of stable and radioactive nuclei, the interaction of nuclear particles and the interpretation of measurements in terms of basic nuclear concepts.

782. THEORY OF NUCLEI. Spring term. Credit two hours. Prerequisites, Physics 485 and 781, or its equivalent. M F 9. Professor BETHE.

Properties of atomic nuclei and fundamental particles. Theory of simple nuclear systems. Theory of nuclear transformations.

784. COSMIC RAYS. Spring term. Credit two hours. Prerequisite, a course in introductory Theoretical Physics. Lectures, T Th 9. Dr. G. COCCONI.

[786. THEORY OF HIGH ENERGY PHENOMENA. Spring term. Credit two hours. Not offered in 1949–1950.]

080. INFORMAL STUDY IN PHYSICS. Either term. Special reading or problem work done under the direction of a member of the staff. Hours to be arranged.

090. SPECIAL LABORATORY WORK. Either term. Laboratory work in any branch of physics under the direction of a member of the staff. Hours to be arranged.

## AGRICULTURE

## AGRICULTURAL ECONOMICS

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, S. W. WARREN, L. C. CUNNINGHAM, G. W. HEDLUND, T. N. HURD, HERRELL DEGRAFF, L. B. DARRAH, E. A. LUTZ, MAX BRUNK, C. A. BRATTON, L. E. SLATER, H. E. CONKLIN, R. G. MURPHY, E. N. SEARLS, CARLTON WRIGHT, MARY B. WOOD, and (MIS.) LORRAINE HOULIHAN.

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.

121. FINANCIAL STATEMENTS. Fall term. Credit three hours. Professor -----. Lectures, M W 11. Warren 225. Discussion, 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. Two lectures and one laboratory period a week. [Not given in 1949–1950.]

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 HEDLUND. Lectures, W F 8. Discussion, M 2-4. Warren 225.

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. Lectures, M W F 9, Warren 125. (Attention is called to a similar course in Hotel Administration, M W F 8.) Limited to upperclassmen. Mr. ALLAN H. TREMAN.

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.

226. RESEARCH METHODS AND PROBLEMS IN THE FIELD OF FARM-ERS' COOPERATIVES. Fall term. Offered in alternate years. Credit two hours. Open to graduate students who have had courses 126 and 240 or their equivalents. Professor Hedlund. Monday 2–4. Warren 205.

A study of research problems in this field, review of the literature, and consideration of some fundamental problems of cooperatives.

#### FARM MANAGEMENT

102. FARM MANAGEMENT. Spring term. Credit five hours. Professor WAR-REN. Lectures, M W F 10. Warren 25. Laboratory, F 4–6. Warren 101. On days when farms are visited laboratory period will be 2–6.

Farming as a business; farm accounts; factors affecting profits; size of business; choice of enterprises; 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.

203. BUSINESS ORGANIZATION AND MANAGEMENT OF SUCCESSFUL NEW YORK FARMS. Fall term. Credit four hours. Prerequisite, course 102 or its equivalent. F 2–4, S 8–10. Warren 140. Approximate transportation expenses for trips, \$20.

During the term some all-day trips are taken, usually on Saturdays. Two twoday trips are taken, leaving Friday morning and returning Saturday night.

204. FARM COSTS AND WORK SIMPLIFICATION. Spring term. Credit three hours. Prerequisite, course 102 or its equivalent. Lectures, M W 11. Warren 325. Discussion and laboratory, M 2–4. Warren 340.

The significance of differences in unit costs; methods of measuring costs; opportunities of reducing unit costs, with special attention to labor, equipment, and building costs; trends in important cost items; work simplification procedures as a means of finding easier and more economical ways to do farm work.

205. FARM LABOR. Fall term. Credit two hours. Prerequisite, course 102 or its equivalent. T Th 11. Warren 325. Professor T. N. HURD.

Importance of farm labor; effect of farm organization, farm labor management and governmental programs on productivity of farm labor; consideration of wages, hours, accidents and insurance, housing, migrant labor, social security, and other problems.

207. METHODS OF RESEARCH IN FARM MANAGEMENT AND LAND ECONOMICS. Fall and spring terms. Credit two hours each term. Professor WARREN and Assistant Professor CONKLIN 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. Professor Hedlund. Lectures, T Th 8. Discussion, Th 2–4. Warren 225.

A study of the credit institutions which serve agriculture.

187. FARM APPRAISAL. Fall term. Credit three hours. Professor WARREN. Lecture, T 10. Laboratory, T 1-5. Warren 101.

A study of factors governing the price of farms; methods of farm valuation; and practice in the appraisal of farms of various types.

284. RESEARCH METHODS AND PROBLEMS IN FARM FINANCE. Spring term. Offered in alternate years (Not offered in 1949–1950). Credit two hours. Open to graduate students who have had Agricultural Economics 184 and one

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term of 207 or their equivalents. Professors H1L1 and Hedlund. F 4–6. Warren 205.

A study of research, review of literature, and consideration of fundamental problems in farm finance.

## LAND ECONOMICS AND AGRICULTURAL GEOGRAPHY

2. AGRICULTURAL GEOGRAPHY. Fall term. Credit three hours. Professor DEGRAFF. Lectures, W F 9 or 11. Warren 25. Discussion, graduate students, F 4–6. Warren 325.

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.

160. FOOD ECONOMICS. Spring term. Credit three hours. Professor DE-GRAFF. Designed especially for students in the School of Nutrition and in the College of Home Economics. Not open to students in the College of Agriculture except by permission of the instructor. Lectures and discussion, M W F 8. Warren 325.

Economic aspects of food, including production, distribution, and consumption, with special emphasis on the economics of diet.

181. LAND ECONOMICS. Spring term. Credit three hours. Primarily for juniors, seniors, and graduate students. For undergraduates, courses 2 and 102 should precede or accompany this course. Lectures, T Th 8. Warren 125. Discussion and laboratory primarily for undergraduate students, Th 2–4; primarily for graduate students, T 2–4. Warren 140. Assistant Professor CONKLIN.

Physical characteristics of land as related to land use; economic principles of land use; methods of physical and economic land classification; changes in land use due to economic developments and technological advances; the effect of institutions and governmental policies upon land use; problems of conservation; and considerations involved in establishing a land policy. Two half-day field trips are taken.

280. SEMINAR IN AGRICULTURAL GEOGRAPHY. Spring term. Credit two hours. Registration by permission. W 7:30. Warren 330. Professor DEGRAFF.

Consideration of basic problems of comparative agriculture, and of population and the food supply. Specific topics vary from year to year.

281. SPECIAL PROBLEMS IN LAND ECONOMICS. Fall or spring term. Credit one or more hours. Open only to graduate students. Registration by permission. Assistant Professor CONKLIN.

Special work on any subject in the field of land economics that is of particular interest to the student. The student normally is expected to prepare a report on his work that is suitable for mimeograph reproduction and distribution.

#### MARKETING

141. MARKETING. Fall term. Credit three hours. Lectures, M W 10. Warren 25. Discussion, W or Th 2–4. Associate Professor BRUNK.

Development of agricultural marketing; characteristics of consumer demand; peculiarities of agricultural supply; and the costs, functions, and services involved in the marketing of farm products.

142. MARKETING FRUITS AND VEGETABLES. Fall term. Credit four hours. Professor RASMUSSEN. Lectures, M W F 9. Warren 225. Laboratory, W or F 2–4. Warren 240.

### AGRICULTURE

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; type 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 four hours. Professor SPENCER. Lectures, M W F 9. Warren 225. Laboratory, Th or F 2–4. (Thursday preferred for graduate students). 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.

144. MARKETING POULTRY, EGGS, AND LIVESTOCK. Spring term. Credit three hours. Associate Professor DARRAH. Lectures, T Th 10. Warren 225. Discussion, Th 2-4. Warren 225. Two half-day field trips are taken during the term.

A study of the economic factors involved in the marketing of poultry, eggs, hogs, cattle, and sheep. Subjects to be discussed include demand for and supply of poultry, eggs, and livestock, ways of balancing demand and supply, marketing systems, marketing costs, and ways of reducing marketing costs.

147. MARKETING TRIP TO NEW YORK CITY. Spring term. Credit one hour. Enrollment limited. Associate Professors DARRAH and BRUNK.

Four 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 \$50 in addition to transportation to and from New York City.

240. INTRODUCTION TO MARKETING RESEARCH. Spring term. Credit two hours. Enrollment limited to graduate students. M 7:30. Warren 240. Associate Professor BRUNK.

History of marketing research; administrative organization of research agencies; selecting and planning projects; preliminary investigation procedures; questionnaires; sampling; collection of data; field and office supervision; sorting and tabulating procedures; preparation of reports; and application of results.

242. CURRENT PROBLEMS IN THE MARKETING OF FRUITS AND VEGETABLES. Fall term. Not given in 1949–1950. Credit two hours. Professor RASMUSSEN. S 9–11. Warren 225. Limited to students who have done superior work in course 142 or its equivalent. Registration by special permission.

Discussion of current major problems in the field of fruit and vegetable marketing, such as the economics of grading; packing and prepackaging; facilities, both at city terminals and country shipping points; transportation; government marketing programs and policies; consumer preferences; margins; and the like.

[243. MARKETING PROBLEMS IN THE FLUID MILK INDUSTRY. Spring term. Credit three hours. Professor SPENCER. Discussion periods, M W 11–12:30. Warren 240. Prerequisite, Agricultural Economics 143 or equivalent. Not given in 1949–1950.]

[245. RESEARCH IN MARKETING OF FRUITS AND VEGETABLES. Fall term. Offered in alternate years. Not given in 1949–1950. Credit two hours. Professor RASMUSSEN and Associate Professor BRUNK. W 4–6. Warren 228. Open to graduate students who have had Agricultural Economics 142 and 240, or their equivalent.]

246. RESEARCH IN MARKETING OF DAIRY PRODUCTS. Spring term. Offered in alternate years. Credit two hours. Professor SPENCER. W 4–6. Warren 213. Consult instructor for permission to register.

A review of previous and current research in the marketing of fluid milk and other dairy products. Case studies of representative projects with particular attention to and evaluation of their scope, objectives, and procedures; application of findings; practice in planning research projects.

247. SEMINAR IN POULTRY AND LIVESTOCK MARKETING RESEARCH. Spring term. Offered in alternate years. Not given in 1949–1950. Credit two hours. Associate Professor DARRAH. W 4–6. Warren 238. Open to graduate students who have had Agricultural Economics 144 and 240 or the equivalent.

A study of research and problems in conducting research in the field of poultry and livestock marketing; application of findings; and planning of research projects.

### PRICES AND STATISTICS

Attention is directed to courses in mathematics and statistics in the Colleges of Arts and Sciences and Engineering, and in the School of Industrial and Labor Relations.

111. STATISTICS. Fall term. Credit three hours. Professor PEARSON. Lecture, M 8. Warren 125. Laboratory, M 2–4. 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 2–4. Warren 125. Not given in 1949–1950.]

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 2-4. Warren 25.

A study of the factors affecting the prices of farm products.

[215. PRICES. Fall and spring terms. Credit one hour a term. Professor PEARson. Prerequisite, course 115. Not given in 1949–1950.]

#### PUBLIC ADMINISTRATION AND FINANCE

Attention is directed to the courses in Government and Economics in the College of Arts and Sciences.

135. LOCAL GOVERNMENT. Fall term. Credit three hours. Associate Professor Lutz. Lectures, T Th 9. Warren 125. Laboratory, T or Th 2-4. Warren 201.

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. Fall term. Credit three hours. Professor KENDRICK. Lectures, M W F 11. Plant Science 233.

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 fiscal policy.

### AGRICULTURE

236. *PROBLEMS IN PUBLIC ADMINISTRATION*. Fall term. Credit three hours. Associate Professor Lutz. Time and room to be arranged. Primarily for graduate students.

Attention is given to a number of problems in public administration with special reference to New York including state and local planning, personnel administration, financial administration, and administrative organizations.

238. SEMINAR IN PUBLIC FINANCE. Spring term. Credit two hours. Professor KENDRICK. W 2-4. Warren 218. Prerequisite, graduate status with necessary preparation.

An examination of basic problems in public finance.

502. FEDERAL PUBLIC FINANCE. Spring term. Credit three hours. Prerequisite, Taxation 138. M W F 11. Professor KENDRICK.

An examination of national problems of taxation, expenditures, public debt, and fiscal policy.

[503. STATE AND LOCAL FINANCE. Spring term. Credit three hours. Prerequisite, Taxation 138. M W F'11. Professor Кенргіск. Not offered in 1949– 1950.]

#### AGRICULTURAL POLICY

251. PUBLIC PROBLEMS OF AGRICULTURE. Fall term. Credit two hours. Professor HILL. Lecture, W 8. Discussion, W 2–4. Warren 125.

A discussion of some of the more important problems of agriculture that involve collective or governmental action.

## DEPARTMENTAL SEMINAR

299. SEMINAR. Continues through fall and spring terms. Departmental staff. M 4. Warren 401.

## AGRICULTURAL ENGINEERING

Professors O. C. FRENCH, B. B. ROBB, A. M. GOODMAN, B. A. JENNINGS, C. W. TERRY, F. B. WRIGHT; Associate Professor C. N. TURNER; Assistant Professors H. E. GRAY, L. L. BOYD.

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 knowledge of farm life and of rural conditions generally is 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.

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#### AGRONOMY

For undergraduate courses which often meet needs of graduate students see the Announcement of the College of Agriculture, Department of AGRICULTURAL ENGINEERING, courses 101, 102, 103, 121, 122, 21, 31, 40, 41, 42, 43, Drawing 2.

251. RESEARCH IN AGRICULTURAL ENGINEERING. Fall and spring term. One or more hours. Prerequisite, permission to register. Professors FRENCH, ROBB, GOODMAN, JENNINGS, TERRY, and WRICHT. Associate Professor TURNER and Assistant Professors BOYD, GRAY, and GUNKEL. Hours as arranged.

Investigations for which the student is prepared and for which adequate facilities can be provided.

252. SEMINAR. Required of graduate students. Both terms. Credit one hour a term. Professor FRENCH and Staff. T 12:30–1:30.

Presentation and discussion of papers on special problems in Agricultural Engineering.

253. AGRICULTURAL MACHINERY DESIGN. Fall term. 3 hours. Professor TERRY. Prerequisites, Engineering Drawing, Mechanics (Statics, Dynamics), Strength of Materials. Two lectures and one computing period a week, to be arranged.

Methods of stress analysis and machine design applied to typical agricultural machines. Analytical and empirical treatment of velocities and accelerations, static and dynamic forces. Suitability of materials, power requirements, lubrication, safety, and economic factors.

254. FARM STRUCTURES DESIGN. Spring term. Three hours. Assistant Professors BOYD and GRAY. Prerequisite, Strength of Materials.

The design of farm buildings including houses, storage buildings, and production structures with emphasis on functional requirements and characteristics of materials. Principles of sanitation, ventilation, heating, and refrigeration are included.

#### AGRONOMY

Professors R. BRADFIELD, H. O. BUCKMAN, F. B. HOWE, H. B. HARTWIG, R. B. MUSGRAVE, MICHAEL PEECH, M. G. CLINE, H. A. MACDONALD, M. B. RUSSELL, J. E. DAWSON, R. E. BLASER, N. C. BRADY, EARL STONE, and GEORGE STANFORD.

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 <u>STONE</u> in forest soils; Professor <u>DAWSON</u> in organic soils; Professor STONE in forest soils; Professor <u>BLASER</u> and <u>MACDONALD</u> in pasture production and management; and Professor <u>MUSCRAVE</u> in field crop ecology and hay; Professor <u>BRADF</u> in plant nutrition; and Professor

STANFORD in soil testing. 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, genetics, plant physiology, and geology. Opportunity will be afforded for further study of some of these subjects after entering the Graduate School, but a student deficient in two or more of these foundation courses cannot expect to receive a degree in the minimum time required for residence. Some practical experience with soil and crop management problems is also desirable. Opportunity to acquire additional experience will be afforded a limited number of students majoring in the Department by summer employment on Departmental projects.

Students must consult professor in charge before registering for any course numbered above 100.

### SOIL SCIENCE

1. The Nature and Properties of Soils. Fall or spring term. Credit five hours. Preregistration required.

6. Soils. Spring term. Credit three hours. Preregistration required.

101. SOILS OF NEW YORK: ORIGIN, IDENTIFICATION, CLASSIFICA-TION. 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, Agronomy 1 or 6 and 2 or 11 or their equivalent. Farm background essential. Lectures, T Th 11. Caldwell 143. Professor ————.

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. T Th 9. Room 31. Assistant Professor Dawson.

Physical and chemical properties of organic soils used for crop production and soil conditioning. One all-day Saturday field trip. Transportation costs to be arranged.

104. FOREST SOILS. Fall term. Credit two hours. Given in alternate years. Prerequisite, course 1 and Botany 31. Assistant Professor STONE.

Assigned readings and semi-weekly discussions of the more important forestsoils literature. There are occasional field trips. Transportation costs to be arranged.

[105. SOIL AND CROP MANAGEMENT. Fall term. Credit three hours. Primarily for advanced undergraduates and graduate minors in Agronomy. Prerequisite, Agronomy 1 or 6 and 2 or 11, or permission of the instructor. Lectures, T Th 9. Laboratory, Th 2–4:30. Caldwell 143. Professor CLINE. Not given in 1949–1950.]

The application of the principles of soil science and crop production to complete soil-management systems under common farm conditions in New York.

#### AGRONOMY

Emphasis is on the use and evaluation of rotations, manure, fertilizers, lime, and supporting practices for crop production in systems that maintain soil productivity. Laboratories consist of (1) field trips to study operating farms and (2) problems in planning systems of management under specified farm conditions.

106. SOIL MICROBIOLOGY. Spring term. Credit three hours. With the approval of the instructor, the lectures without the laboratory may be taken for two-hour 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 2–4:30. Caldwell 201. Professor ————.

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. Professor PEECH.

Chemical composition and properties of soils. Discussion of chemical processes 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. T Th 2–4:30. Caldwell 350. Preregistration required. 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. Credit three hours. Lectures, M W F 9. Caldwell 143. Given in alternate years. Professor CLINE.

The course deals with (1) the principles of classification as applied to soils. (2) the factors of soil formation and their effects on the soil, and (3) the characteristics, development, and use of the Great Soil Groups of the world. Two all-day Saturday field trips. A fee of \$3 will be collected from each student to cover cost of transportation.

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. M W F 8. Caldwell 143. Professor RUSSELL.

A study of physical processes and changes that occur in soils with emphasis placed, in alternate years, on (1) the application of these processes to agronomic problems and (2) the fundamental principles involved. Consultation with the instructor prior to registration is essential.

208. PHYSICAL PROPERTIES OF SOILS, LABORATORY. Fall term. Credit three hours. Must be preceded or accompanied by course 207. Enrollment limited. M W 2–4:30. Caldwell 294. Professor Russell.

Lectures, laboratory exercises, and demonstrations designed to familiarize the student with certain physical and physiochemical techniques used in soil investigations.

209. RESEARCH IN SOIL SCIENCE. Fall and spring terms. Professors BRAD-

FIELD, BUCKMAN, PEECH, HOWE, CLINE, and RUSSELL; Associate Professor STANFORD, and Assistant Professors DAWSON, BRADY, and STONE.

210. SELECTED 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 1948–1949:

Fall term:

(a) Soil Moisture. Professor RUSSELL. One credit hour.

(b) To be arranged. STAFF. One to three credit hours.

Spring term:

(a) Soil Structure. Professor RUSSELL. One credit hour.

(b) Ionic Exchange in Soils. Professor PEECH. One credit hour.

(c) To be arranged. STAFF. One to three credit hours.

#### FIELD CROPS

2. Introduction to Field Crops. Spring term. Credit three hours. Preregistration required.

11. Production of Field Crops. Fall term. Credit four hours. Preregistration required.

211. SPECIAL TOPICS IN FIELD CROPS. Spring term. Credit one to two hours. Professors BLASER, HARTWIG, MACDONALD, MUSGRAVE. Meeting once weekly for graduate students and undergraduate majors. The student is expected to review and evaluate the more important research publications. Research methods and techniques will also be discussed. Topics will be announced each semester.

112. PASTURE AND HAY CROPS. Spring term. Credit three hours. For juniors, seniors, and graduate students. Prerequisite, courses 1 and 11 or 2 and 6 by permission. Lectures, T Th 9. CALDWELL 143. Laboratory and field trip, W Th 2–4:30, and two all-day field trips. Professor BLASER.

Fundamental factors concerning the establishment, maintenance, productivity, and quality of various pasture and hay crops are discussed. Practical applications will be emphasized. Of particular value to those interested in agronomy and animal production and soil conservation.

[213. CROP ECOLOGY. Fall term. Credit three hours. Prerequisite, course 11 and Botany 31 or their equivalent. Lectures, T Th S 10. Caldwell 31. Associate Professor MUSCRAVE. Not given in 1949–1950.]

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. GRASSLANDS AND GRASSLAND CROPS. Fall term. Credit three hours. Prerequisite, courses 1 and 11. Plant Breeding 102 and Botany 31 or their equivalent. Associate Professor MACDONALD. Not given in 1950–1951.

Consideration of principles and practices in relation to grass and legume production of forage and other uses; characteristics, adaptation, production, management, and use of various grassland plants; current problems and research methods. Special problems and discussions will be arranged on subjects of special interest.

219. RESEARCH IN FIELD-CROP PRODUCTION. Fall, spring, and summer terms. Professors HARTWIG and BLASER; and Associate Professors MUSGRAVE and MACDONALD.

#### DEPARTMENTAL SEMINAR

290. SEMINAR. Fall and spring terms. Required of graduate students taking work in the department, S 11-12:30. Caldwell 143.

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## ANIMAL HUSBANDRY

## ANIMAL HUSBANDRY

Professors K. L. TURK, S. A. ASDELL, J. K. LOOSLI, L. A. MAYNARD, C. M. MCCAY, J. I. MILLER, F. B. MORRISON, and J. P. WILLMAN; Associate Professors R. W. BRATTON, C. R. HENDERSON, J. T. REID, S. E. SMITH, and G. W. TRIMBERGER; Assistant Professor J. J. WANDERSTOCK.

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 Nutrition and detailed descriptions of the courses in this field see the statements under this subject.

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, biological statistics, and other related fields.

For undergraduate courses which often meet needs of graduate students, see the *Announcement of the College of Agriculture*, Department of ANIMAL HUS-BANDRY, courses 1, 10, 20, 50, 60, 70, 80, and 90.

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 NU-TRITION. Spring term. Credit two hours. Prerequisites, a course in livestock feeding and course in animal nutrition. Professor MORRISON. Lectures and discussions, T Th 9.

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. Prerequisite, Animal Husbandry 20 or Plant Breeding 101. Professor HENDERSON. T Th 11. Not given in 1949–1950.]

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

125. PHYSIOLOGY OF REPRODUCTION. Spring term. Credit two hours. Prerequisite, a course in human or veterinary physiology. Professor AsDELL. M W 10.

An advanced course in reproduction, principally in mammals.

126. APPLIED ANIMAL PHYSIOLOGY. Fall term. Credit one hour. Professor Aspell. T 9.

The application of physiological methods to growth, reproduction, and lactation in farm animals.

127. ELEMENTARY ENDOCRINOLOGY. Fall term. Credit one hour. Professor Aspell. Th 9.

A general course in the physiology of the endocrine system.

150. ADVANCED DAIRY PRODUCTION. Spring term. Credit three hours. Prerequisite, Course 50. Professor TRIMBERGER. Lecture, T Th 11. Discussion and practice, T 2-4:30.

Analysis of breeding and management programs in successful herds. Evaluation of the programs of dairy cattle breed associations. Emphasis is placed on the application of the principles of dairy breeding, feeding, and management to the development and operation of a successful dairy farm.

210. SPECIAL TOPICS IN ANIMAL NUTRITION. Spring term. See ANIMAL NUTRITION.

215. HISTORY OF NUTRITION. Fall term. See ANIMAL NUTRITION. 219. SEMINAR IN ANIMAL NUTRITION. Fall term. See ANIMAL NU-TRITION.

200. RESEARCH. Fall and spring terms. Hours by arrangement. Professors Morrison, Miller, Reid, Smith, Trimberger, Turk, J. P. Willman, Bratton, Henderson, Asdell, Loosli, Maynard, and McCay.

201. SEMINAR 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, A. C. DAHLBERG, B. L. HERRINGTON, R. F. HOLLAND, H. B. NAYLOR, W. E. AYRES, V. N. KRUKOVSKY, J. C. WHITE, and F. V. KOSI-KOWSKY.

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. Fall term. Credit three hours a week.

5. Technical Control of Dairy Products. Second term. Two hours a week.

102. MARKET MILK. Spring term. Credit five hours. Prerequisites, course 1, and Bacteriology 1 or its equivalent. Professors Holland and White. Lectures, M W 11; laboratory, M W 2-5:30. Dairy Building 119 and 146. Preregistration required.

The scientific, technical, and sanitary aspects of the fluid milk industry.

103. MILK-PRODUCTS MANUFACTURING. Fall term. Credit five hours. Prerequisite, course 1. Professor Kosikowsky. Lectures, recitations, and laboratory practice, T Th 11-4:30. Dairy Building 120. Preregistration required.

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. Professor NAYLOR. Lectures, recitation, and laboratory practice, F 12–5, S 8–1. Preregistration required.

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 11. Laboratory practice, T 1–5. Dairy Industry Building 120. Preregistration required.

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 1 or its equivalent. Professor HERRINGTON. Lectures, M W 8. Dairy Building 119.

A consideration of milk 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 1949–1950.]

An advanced consideration of the scientific and technical aspects of milk products.

252. SEMINAR. 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, W. E. Snyder, Truman Fossum, J. F. Cornman, and J. G. Seeley.

APPROVED MAJOR AND MINOR SUBJECTS (key to symbols on p. 44) Floriculture and Ornamental Horticulture 1, 2, 4

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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.

For undergraduate courses which often meet needs of graduate students, see the Announcement of the College of Agriculture, Department of FLORICULTURE AND ORNAMENTAL HORTICULTURE, courses 1, 2, 5, 10, 12, 13, and 32. For courses 10, 12, 13, and 32, preregistration is required.

113. WOODY-PLANT MATERIALS, ADVANCED COURSE. Fall term. Prerequisite, course 13. Assistant Professor CORNMAN. Lecture, T 9. Laboratory, Th 2–4:30. Preregistration required.

A continuation of course 13 for students in landscape nursery service. An opportunity for the more intimate study of important groups of ornamental plants, particularly their adaptability to landscape use.

114. TURF. Spring term. Prerequisite, Agronomy 1 and permission to register. Assistant Professor CORNMAN. Lecture, W 11. Laboratory, Th 2–4:30.

A course dealing with the principles, practices, and materials for the construction and maintenance of lawn areas and sports turf.

115. PLANT PROPAGATION. Fall term. Prerequisite, courses 12 and 13 and Botany 31 or their equivalent. Assistant Professor SNYDER. Lectures, T Th 8. Laboratory, Th 2–4:30, S 9–11:30. Preregistration required.

A study of the principles and methods involved in the propagation of woody and herbaceous plants by seeds, division, layers, cuttings, budding, and grafting.

215. PLANT PROPAGATION, ADVANCED COURSE. Fall term. Prerequisite, course 115 or permission to register. Assistant Professor SNYDER. Lecture and laboratory, hours to be arranged.

A seminar type course involving a critical review and evaluation of the fundamental principles of plant science in plant propagation research and cultural practices.

[125. FLOWER STORE MANAGEMENT. Spring term. Prerequisite, course 5 and permission to register. Assistant Professor Fossum. Not given in 1949–1950.]

123. FLORIST CROP PRODUCTION. Fall term. Prerequisites, courses 115, Botany 31, Agronomy 1, and the practice requirement. Professor Post. Lectures and recitation, M W F 9. Laboratory, M 2–4:30.

A comprehensive study of the application of basic science to the culture of ornamental plants.

124. COMMERCIAL GREENHOUSE PRODUCTION. Spring term. Prerequisite, course 123. Assistant Professor SEELEY. Lectures, M W 9. Laboratory, W 2-4:30.

#### POMOLOGY

Supplementary to course 123 dealing with the commercial production of florists crops with emphasis on the practical problems concerned.

125. ORCHID CULTURE. Fall term. Prerequisite, a knowledge of plant physiology, greenhouse practice, and permission to register. Professors KNUDSON and Post. Lecture laboratory, T 2–4.

A course dealing with the classification, propagation, and greenhouse culture of orchids.

117. COMMERCIAL NURSERY MANAGEMENT. Spring term. Prerequisite, course 115. Associate Professor PRIDHAM. Lectures, T Th 11. Laboratory, T 2–4:30.

Supplementary to course 115 dealing with the problems of commercial propagation and management of nursery plants.

119. PLANTING AND MAINTENANCE OF ORNAMENTAL PLANTS. Fall term. Prerequisite, course 115. Associate Professor PRIDHAM. Lectures, T Th 11. Laboratory, T 2-4:30.

A study of the basic principles and practices employed in the maintenance of plants used as landscape materials.

132. LANDSCAPE PLANNING AND PLANTING OF SMALL PROPERTIES. Both terms. Prerequisites, courses 12, 13, 32 and Drawing 10. Associate Professor PORTER. Lecture, T 10. Laboratory, T Th 2–4:30, and one additional three-hour period. Preregistration required.

An advanced course in the design of small properties to follow course 32.

134. CONSTRUCTION AND PLANTING OF SMALL GARDENS. Fall term. Prerequisite, fall term of course 132. Associate Professor PORTER. Lecture, Th 9. Laboratory, Th 10–12:50 and one additional three-hour period. Preregistration required.

For advanced students specializing in landscape service. A study of the design, construction, and planting of intimate garden areas.

241. SEMINAR. Fall and spring terms. One hour to be arranged. Required of all graduate students in the department and recommended for senior majors.

## **POMOLOGY\***

Professors A. J. HEINICKE, M. B. HOFFMAN, R. M. SMOCK, DAMON BOYNTON, and L. J. EDGERTON.

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

Pomology 1, 2, 4

Laboratory, greenhouse, and orchard facilities at Ithaca and Geneva are available for graduate use. Each year a large collection of exotic fruit is brought together at the College; herbarium and preserved material is also available. Opportunity for investigation of fruit storage problems is afforded by a 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 at Geneva (For further information, see page 228.)

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 Sys-

\* See also Pomology p. 229 (Agricultural Sciences at Experiment Station at Geneva).

## AGRICULTURE

tematic Pomology. 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 to choose one minor in some phase of Botany, particularly Plant Physiology.

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.

For undergraduate courses, see the Announcement of the College of Agriculture, Department of POMOLOGY Courses 1, 102, 112. Preregistration required.

111. HANDLING, STORAGE, AND UTILIZATION OF FRUIT. Credit three hours. Fall term, Prerequisite Pomology 1. Professor R. M. SMOCK. Lectures, T Th 8. Laboratory, Th or F 2–4:30. The physiology and chemistry of most of the common fruits are considered. Emphasis is placed on the practices and problems in handling fruit before and during storage. Consideration is given to the principles and practices of storage of fruits, and to the utilization of fruits in the dehydrated, frozen, canned, and juice forms.

121. ECONOMIC FRUITS OF THE WORLD. Fall term, alternate years. Credit three hours. Prerequisites, Pomology 131 or permission to register. Professor BOYNTON. Lectures, T Th 12. Laboratory, F 2–4:30.

A study of all species of fruit-bearing plants of economic importance. 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. Fall term. Credit three hours. Prerequisites, Botany 31. Professors HEINICKE, BOYNTON, or HOFFMAN. Lectures, M W F 9.

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. Spring term, alternate years. Credit three hours. Prerequisite, Pomology 131. Professors HEIN-ICKE, HOFFMAN, BOYNTON, and SMOCK; and Assistant Professor EDGERTON. Conference periods, M W F 9. 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. SEMINAR. Fall and spring terms. 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. W. HILL, F. B. HUTT, L. C. NORRIS, A. L. ROMANOFF, M. L. SCOTT.

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

Animal Genetics 1, 2, 3, 4

Animal Nutrition 1, 2, 3, 4

Chemical Embryology 1, 2, 3, 4

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 6000 birds of various breeds of domestic fowl, ducks, and turkeys is maintained, and geese and game birds can be obtained when needed. There is a wellequipped 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.

Students for the Ph.D. degree in this department may elect Animal Genetics, Animal Nutrition, or Chemical Embryology as the major field of study. They may also be elected as major or minor fields of study for the M.S., or M.S. in Agriculture degree. For requirements and courses in Animal Nutrition see p. 89.

Poultry Husbandry may be elected as a major or minor for the M.S., or M.S. in Agriculture degree, and as a minor for the Ph.D. degree when the major is taken in a field of study other than Animal Genetics, Animal Nutrition, or Chemical Embryology.

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.

For undergraduate courses which often meet needs of graduate students, see the *Announcement of the College of Agriculture*, Department of POULTRY HUS-BANDRY, courses 124, 140. Preregistration is required.

120. POULTRY GENETICS. Spring term. Credit three hours. Prerequisites, Zoology 103–104, Plant Breeding 101, or equivalents, and permission of the instructor. Professor HUTT. M W F 9. Given in alternate years.

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.

209. SEMINAR 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. Spring term. For details see Animal Nutrition.

219. ANIMAL NUTRITION SEMINAR. Spring term. For details see Animal NUTRITION.

220. SPECIAL TOPICS IN ANIMAL GENETICS. Fall term. Credit one hour. Registration by permission. Professors HUTT and COLE. Hours to be arranged. Not given every year, but only when the number of qualified students warrants.

Assigned readings, with discussion of techniques and literature in this field.

230. AVIAN EMBRYOLOGY. Spring term. Given in alternate years with the course 235. Credit two hours. For graduate students. Undergraduates by special permission. Prerequisite, Biology 1, or Zoology 103–104 or the equivalent. Lecture and laboratory demonstration, Th 2–4:30, or hours to be arranged. Rice Hall. Professor ROMANOFF.

The principles of embryonic growth and development, with specific emphasis on various manifestations of biochemical phenomena. The study, in general, is designed to provide basic facts for natural and artificial propagation of birds.

[235. THE AVIAN EGG. Spring term. Credit two hours. Given in alternate years with the course 230. For graduate students and qualified juniors and seniors. Prerequisite, Biology 1, or Zoology 103–104 or the equivalent, and per-

## AGRICULTURE

mission of the instructor. Lecture and laboratory, Th 2–4:30, or hours by arrangement. Rice Hall. Professor ROMANOFF. Not given in 1949–1950.]

Biological constitution and physiochemical properties of the egg as a reproductive cell, and as an article of food.

239. SPECIAL TOPICS IN CHEMICAL EMBRYOLOGY. Fall term. Credit one hour. Registration by permission. Rice Hall. Professor ROMANOFF.

A critical review of current literature.

## VEGETABLE CROPS

Professors H. C. THOMPSON, PAUL WORK, E. V. HARDENBURG, ORA SMITH, G. J. RALEIGH, J. D. HARTMAN, A. J. PRATT, R. D. SWEET, H. M. MUNGER, W. C. JACOB, H. J. CAREW, J. H. ELLISON, and W. C. KELLY; at Geneva, Professors C. B. SAYRE, W. T. TAPLEY, C. H. DEARBORN, and M. T. VITTUM.

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

Vegetable Crops 1, 2, 4

Research in Vegetable Crops is the application of fundamental scientific methods to the solution of problems in the growing and handling of vegetables. These problems may involve control of flowering and fruiting, use of organic growth regulators, determination of fertilizer requirements, adaptation of rapid tests for diagnosing nutrient deficiencies, development of objective methods for the determination of edible and market quality, physiological effects of various methods of harvesting, shipping, packaging, storing, and otherwise handling vegetables, control of physiological diseases, chemical and mechanical weed killing, and the like.

The facilities available include the usual classrooms and laboratories; research laboratories with equipment for chemical, physiological, and anatomical work; cold storage and common storage rooms; greenhouses (about 7500 square feet) with heat controls; about 30 acres of land at Ithaca devoted to research and teaching and an additional 30 acres devoted to research on Long Island. 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 courses 101, 113, 225, and to attend the seminar. Basic training in quantitative chemical analysis, organic chemistry, biological chemistry, physics and mathematics, through elementary analytical geometry or calculus, is highly desirable.

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 four hours. Preregistration required.

2. Special Cash Crops. Spring term. Credit three hours. Botany 1 should precede or accompany this course. Preregistration required.

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. Preregistration required.

This course is devoted to a systematic study of 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. Lectures, T Th 8. East Roberts 222. Laboratory, T or W 2–4:30. East Roberts 223, greenhouses or gardens. Professor HARTMAN. Preregistration required.

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. One two-day and three afternoon trips are required. Estimated partial cost of transportation to be collected from the student: \$6. This course with Pomology 111 and Agricultural Economics 142 afford training in marketing of vegetables and fruits.

[113. TYPES AND VARIETIES OF VEGETABLES. Fall term. Credit three hours. Prerequisite, course 1 or 2 or permission to register. Lecture and laboratory, F 2–4:30. East Ithaca Gardens or East Roberts 223. Professor WORK. Given in alternate years. Not given in 1949–1950. Preregistration required.

Laboratory work preceding the beginning of regular instruction is required.]

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 principal varieties of the vegetable crops are grown each year. The value of the course depends to a great extent on studying 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, RALEICH, SMITH, and HARTMAN, and Associate Professor Sweet. East Roberts 223. Given in alternate years.

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 discussion, attention will be given to research methods and technique.

231. *RESEARCH*. Members of the staff are prepared to direct investigations in the various lines of vegetable production and handling.

232. SEMINAR. Fall and spring terms. Credit one hour. Members of the department staff. Recent literature is taken up for discussion and graduate thesis problems are reported. 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 230.

# SCHOOL OF EDUCATION

## EDUCATION AND RURAL EDUCATION

Professors T. L. BAYNE, C. K. BEACH, SARA BLACKWELL, J. M. BROPHY, J. E. BUTTERWORTH, C. H. CRAWFORD, R. H. DALTON, L. H. ELLIOTT, L. A. EMERSON, JEAN FAILING, F. S. FREEMAN, E. L. GORDON, ESTHER HARRIS, HELEN HOEFER, E. R. HOSKINS, M. HUTCHINS, C. B. MOORE, H. MOSER, A. G. NELSON, R. A. OLNEY, E. L. PALMER, H. I. PATTERSON, V. E. SCHMIDT, W. A. SMITH, F. H. STUTZ, ETHEL WARING, A. L. WINSOR, and Deans LUCILE ALLEN and FRANK BALDWIN.

# APPROVED MAJOR AND MINOR SUBJECTS FOR A.M., M.S., M.S. IN AGR., Ed.D., and Ph.D. (key to symbols on p. 44)

Agricultural Education 1, 2, 3, 4	Home Economics Education 1, 2, 3, 4
Curriculum 1, 2, 3, 4	Industrial Education 1, 2, 3, 4
Education 3, 4	Nature Study 1, 2, 3, 4
Educational Administration 1, 2, 3, 4	Rural Education 1, 3, 4
(including Statistics) 2, 3, 4	Rural Secondary Education 1, 2, 3, 4
Educational and Mental Measurement	Science Education 1, 2, 3, 4
Educational Method 3, 4	Secondary Education 1, 2, 3, 4
Educational Psychology 1, 2, 3, 4	Social Studies Education 1, 2, 3, 4
Extension Education 1, 2, 3, 4	Supervision 1, 2, 3, 4
Guidance and Personnel Adminis- tration 1, 2, 3, 4	Theory and Philosophy of Education 1, 2, 3, 4
History of Education 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, Doctor of Education, and Doctor of Philosophy, administered by the Graduate School.

2. The degrees of *Master of Science in Education* and *Master of Education*, administered by the Graduate School under the special jurisdiction of the School of Education.

## ADMISSION

A student may be admitted to candidacy for any of the degrees, Master of Arts, Master of Science, Master of Science in Agriculture, Doctor of Education, 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.

## EDUCATION AND RURAL EDUCATION

## 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, extension workers, 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 and hours see the Announcements of the colleges concerned.

For undergraduate courses which often meet needs of graduate students, see the Announcement of the School of Education, Courses 10, 106, 107, 108, 111, 112, 117, 121, 128, 129, 130, 131, 132, 133, 134, 135, 136, 138, and 190; also the Announcement of the College of Arts and Sciences, Courses HG & D 201–202, Soc. 101.

### SECONDARY SCHOOL TEACHING

200. APPRENTICE TEACHING. (Ed. and R.E.) An eight-week period offcampus to be arranged. 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 PROBLEMS IN TEACHING. (Ed and R.E.) Fall or spring term. Members of the staff.

A critical study of some phase of teaching undertaken during the period of apprentice teaching.

R.E. 244. PHILOSOPHY OF EDUCATION. Spring term. Professor MOORE. S 9-10:40.

For mature students, preferably with teaching experience.

Psych. 675. SEMINAR IN HUMAN DEVELOPMENT AND BEHAVIOR. Spring term. Primarily for graduate students. Professor FREEMAN. M 4-6.

Recent experimental and clinical materials and theories. Educational implications.

#### NATURE STUDY AND SCIENCE TEACHING

[R.E. 202. NATURE LITERATURE. Fall term. Alternate years. Assistant Professor Gordon. Not given in 1949–1950.]

**R.E.** 203. RESEARCH AND WRITING IN NATURE AND CONSERVATION EDUCATION. Spring term. Professor PALMER. T Th 10.

Designed to improve the interpretation of Natural History and the expression of interpretations through the written word. Each student should prepare a publishable article in this course.

[R.E. 205. THE TEACHING OF CONSERVATION. Spring term. Professor PALMER. Alternate years. Not given in 1949–1950.]

**R.E.** 207. METHODS AND MATERIALS FOR THE TEACHING OF SCIENCE IN SECONDARY SCHOOLS. Spring term. Registration by permission only. Assistant Professor SCHMIDT. Hours to be arranged.

A consideration of problems of selection and organization of subject matter, of choice and use of materials, and of methods of teaching science at the secondary level.

R.E. 209. THE DEVELOPMENT OF NATURE AND SCIENCE EDUCATION IN THE UNITED STATES. Fall term. Assistant Professor Gordon, M W 10.

A survey of origins and developments in nature and science education, both in and out of schools, with emphasis on leaders and their philosophies.

R.E. 226. *RESEARCH IN SCIENCE TEACHING*. Fall or spring term. Professor PALMER, Assistant Professors SCHMIDT and GORDON. M 12.

Special problems in science teaching.

#### EDUCATIONAL PSYCHOLOGY

R.E. 211. EDUCATIONAL PSYCHOLOGY. Fall term. for mature students with teaching experience. Professor ------. M F 11-12:20.

**R.E.** 213. PSYCHOLOGY OF LEARNING IN THE SCHOOL SUBJECTS. Fall term. Associate Professor BAYNE. S 9–10:30.

R.E. 218. SEMINAR IN EDUCATIONAL PSYCHOLOGY. Spring term. Professor ------. Th 4-5:30.

R.E. 219. SEMINAR IN PERSONNEL ADMINISTRATION IN EDUCA-TIONAL INSTITUTIONS. Spring term. For graduate students in education. Professor WINSOR. Th 4–6.

Personnel management in relation to school administration.

R.E. 228. SEMINAR IN CHILD GUIDANCE (Child Development and Family Relationships 450). Spring term. Professor WARING. W 4-6.

Psych. 618. INDIVIDUAL DIFFERENCES. Spring term. Prerequisite, Psych. 607 or equivalent, or consent of instructor. Professor FREEMAN. T Th 2-3:15.

The nature, causes, and implications of individual differences in abilities and personality. Study and observation of atypical groups.

## AGRICULTURAL EDUCATION

**R.E.** 230. SEMINAR IN AGRICULTURAL EDUCATION. Spring term. Professor OLNEY. W 4–6. For students whose progress in graduate study is satisfactory.

[R.E. 231. THE SUPERVISION OF VOCATIONAL AGRICULTURE IN THE SECONDARY SCHOOL. Spring term. Associate Professor SMITH. Not given in 1949–1950.]

**R.E.** 232. EVALUATION AND PROGRAM PLANNING IN AGRICUL-TURAL EDUCATION. Spring term. Associate Professor Hoskins. M 4:15–6 and special trips to be arranged.

The evaluation of programs of vocational education in agriculture in actual situations as a basis of more effective planning.

**R.E.** 233. SUPERVISED FARMING PROGRAMS IN VOCATIONAL AGRI-CULTURE. Fall term. Professor OLNEY. M 2–5 and special trips to be arranged. Spring term, off campus. Associate Professor SMITH.

Field studies of programs in nearby schools, with critical study of the basic concepts, the development and the future needs for such programs.

R.E. 234. SPECIAL EDUCATION FOR OUT-OF-SCHOOL YOUTH AND ADULTS. Fall term. Associate Professor HOSKINS. M 7:15–9. Spring term, off campus.

Designed for leaders in the fields of agricultural education and for organizers of comprehensive programs of adult education. A consideration of the objectives and trends in educational and social-economic problems in rural areas.

[R.E. 235. THE TECHNICAL AND PROFESSIONAL PREPARATION OF TEACHERS OF AGRICULTURE. Fall term. Should follow course 211 or its equivalent. Professor Olney. Not given in 1949–1950.]

**R.E.** 236. THE ORGANIZATION AND ADMINISTRATION OF VOCA-TIONAL AGRICULTURAL EDUCATION IN THE PUBLIC SCHOOLS. Spring term. Professor OLNEY. T Th 11–12:30.

Designed for persons who will be responsible for the development of vocational agriculture programs at the local, county, state, and national levels. A copy of the state plan for Vocational Education for his state should be available for use by the student.

[R.E. 237. COURSES OF STUDY IN VOCATIONAL AGRICULTURE. Fall term. Associate Professor Hoskins. Not given in 1949–1950.]

**R.E.** 238. MATERIALS OF INSTRUCTION IN VOCATIONAL AGRICUL-TURE. Spring term. Open to students with experience in teaching vocational agriculture. Associate Professor SMITH.

Evaluation, selection, adaptation, and organization of instructional materials appropriate for use in teaching vocational agriculture classes.

#### SUPERVISION

[R.E. 241. THE PREPARATION OF TEACHERS FOR NORMAL SCHOOLS AND COLLEGES. Spring term. Professor Moore. Not given in 1949–1950.]

R.E. 243. PROCEDURES AND TECHNIQUES IN SUPERVISION. Fall term. Professor Moore. M W F 10.

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.** 245. SEMINAR FOR PRINCIPALS. Fall term. Required of all graduate students who are candidates for a principal's certificate. Professor Moore. S 9–10:40.

**R.E.** 246. THE SUPERVISION OF THE ELEMENTARY SCHOOL. Spring term. Candidates for a principal's certificate may register for two hours' credit. Professor Moore. T Th S 2–3:30.

A course designed for supervisors, elementary school principals, and superintendents.

[R.E. 247. SEMINAR IN ELEMENTARY EDUCATION. Spring term. Professor Moore. Not given in 1949–1950.]

#### APTITUDE AND ACHIEVEMENT TESTS

R.E. 251. EDUCATIONAL MEASUREMENT. Spring term. Candidates for the principal's certificate may register for two hours' credit. Prerequisite, a course in

educational psychology. Associate Professor BAYNE. S 11-12:30 and an additional hour to be arranged.

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*. Spring term. Associate Professor BAYNE. T Th 10 and an hour to be arranged.

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 problem of the individual student.

[R.E. 254. STATISTICAL INSTRUMENTS IN EDUCATION. Spring term. Prerequisite, a first course in statistics and permission of the instructor. Associate Professor BAYNE. T 10 and a period to be arranged. Not given in 1949–1950.]

**R.E.** 255. USE AND ADMINISTRATION OF TESTS IN GUIDANCE AND PERSONNEL ADMINISTRATION. Fall term. Open to students in guidance or personnel administration. Professor WINSOR. Th 4–6.

This course deals with the development, use, and interpretation of aptitude tests as a basis for guidance and selection.

Psych. 607. *PSYCHOLOGICAL TESTS*. Fall term. For undergraduate and graduate students. Prerequisite, a course in psychology and a course in statistics or consent of instructor. Professor FREEMAN. T Th S 9.

Development of individual and group tests of intelligence, specific aptitudes, and personality; principles underlying their construction and use; their use in schools, psychological clinics, and in other fields. Demonstration in administering and interpreting tests.

## ADMINISTRATION, SECONDARY EDUCATION, AND CURRICULUM

[R.E. 260. THE TWELVE-GRADE PRINCIPALSHIP. Spring term. T Th 2– 3:30. Not given in 1949–1950.]

**R.E.** 261. FUNDAMENTALS OF EDUCATIONAL ORGANIZATION AND ADMINISTRATION. Fall term. Professor BUTTERWORTH. T Th 11–12:30.

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. Candidates for a state administrative certificate must register also for course R.E. 400.

**R.E.** 262. *THE SECONDARY SCHOOL PRINCIPALSHIP*. Spring term. Th 2–4. Assistant Professor ELLIOTT.

A course in school administration dealing with the responsibilities of the secondary school principal within the school building. An opportunity will be afforded to make an analysis of procedures and techniques employed by a secondary school principal.

[R.E. 263. THE PRINCIPALSHIP OF THE ELEMENTARY SCHOOL. Professor Moore. Not given in 1949–1950.]

R.E. 264. FINANCIAL POLICIES AND PRACTICES IN PUBLIC SCHOOLS. Fall term. Prerequisite, R.E. 261 or equivalent. Professor BUTTERWORTH. S 11– 12:30.

Typical problems: how local school funds are levied, collected, and disbursed; cost accounting; budget making; bonding; sources of state funds and their distribution. The discussion is based upon actual problems; prospective members of the class are urged, therefore, to bring with them financial data regarding their schools.

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**R.E.** 265. THE SCHOOL PLANT. Spring term. Prerequisite, R.E. 261 or equivalent. Professor BUTTERWORTH. S 11–12:30.

The planning and utilization of the school building to serve community needs. Each student will work on a project for his community.

[R.E. 267. THE LEGAL PROBLEMS OF THE SCHOOL ADMINISTRATOR. Mr. ————. Not given in 1949–1950.]

**R.E.** 268. SEMINAR IN RURAL SCHOOL ADMINISTRATION. Spring term. Professor BUTTERWORTH. W. 4:15-5:45. Topic to be announced.

R.E. 269. SEMINAR IN CITY SCHOOL ADMINISTRATION. Spring term. Special lecturer. S 9-10:30.

Current problems in the organization and administration of a city school system.

**R.E.** 276. *PRINCIPLES OF CURRICULUM BUILDING*. Fall term. Assistant Professor ELLIOTT. 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 scope and content in elementary and secondary schools.

**R.E.** 277. SEMINAR IN CURRICULUM. Fall term. Assistant Professor ELLIOTT. Prerequisite, R.E. 276 or equivalent. S 9–11.

An analysis and appraisal of modern curriculum practices in the public schools. Planned for experienced teachers, administrators, supervisors, and curriculum specialists.

R.E. 278. SEMINAR IN RURAL SECONDARY EDUCATION. Spring term. Assistant Professor Elliott. S 11-12:30.

Identification and analysis of the fundamental problems of secondary education with a view to appraisal of trends.

## GUIDANCE AND PERSONNEL ADMINISTRATION

Ed. 280. STUDENT PERSONNEL ADMINISTRATION. Fall and spring terms. Graduates only. Prerequisite, Sociology, Psychology, Economics, Political Science, or practical field experience such as teaching, administration or other kinds of personnel work. Limited enrollment. Students will be admitted upon consultation with the instructor. Dean LUCILE ALLEN, Dean F. C. BALDWIN, and assistants. T 9–11. Conference Room, Administration Building.

Study in administration areas, organization and administration of personnel programs, including counseling and counseling techniques. This course is designed primarily for students expecting to become assistant deans or personnel workers in colleges.

Ed. 281. SEMINAR IN STUDENT PERSONNEL ADMINISTRATION. Fall and spring term. Graduates only. Students will be admitted upon consultation with the instructor. Dean LUCILE ALLEN, and assistant.

R.E. 282. EDUCATIONAL AND VOCATIONAL GUIDANCE. Fall term. For graduate students. T 4:15-6:00. Associate Professor NELSON.

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; the organization, administration, and appraisal of guidance programs.

**R.E.** 283. COUNSELING METHODS. Spring term. Prerequisite, course 255 or its equivalent. Associate Professor NELSON. T Th 4:15-6:00.

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. Associate Professor Nelson. M 4:15–6:00.

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 group methods.

R.E. 285. OCCUPATIONAL AND EDUCATIONAL INFORMATION. Fall term. Associate Professor NELSON. T Th 1:00. Field trips on Wednesday afternoons.

Survey and appraisal of occupations and training opportunities; study of sources of educational and vocational information; job analysis; vocational trends. Field trips to places of employment.

**R.E.** 289. SUPERVISED PRACTICE IN TESTING AND COUNSELING. Spring term. For advanced graduate students only. Prerequisites, 255, 282, 283 (or their equivalent), and permission of the instructor. Associate Professor NeLson. W. 5:00. Hours for observation and practice to be arranged.

Practice in the administration, scoring, and interpretation of psychological tests. Observation and supervised experience in counseling at the Cornell Guidance Center. Case conferences and assigned readings.

Psych. 680. PROCEDURES IN CLINICAL CHILD GUIDANCE. Fall term. Primarily for graduate students. Prerequisite, Psych. 607 or equivalent. All students must have consent of the instructor. Professor FREEMAN. M 4–6. and conferences.

Procedures and instruments used in case studies of psycho-educational problems of learning and adjustment. Study of case materials.

#### GENERAL

**R.E.** 194. *PRINCIPLES OF VOCATIONAL EDUCATION*. Spring term. Open to graduate students and others who have permission to register. Associate Professor W. A. SMITH. T 4:15–6.

**R.E.** 199. *INFORMAL STUDY IN EDUCATION*. Maximum credit three hours each term. Members of the staff.

R.E. 290. RURAL SECONDARY EDUCATION. Fall term. Assistant Professor ELLIOTT. M W 4-5:30.

A consideration of some of the more basic problems in the functions, nature, organization, curriculum, and extensions of secondary education in its adaptations to rural and village needs and conditions.

**R.E.** 291. THE EDUCATIONAL PROGRAM IN UNDEVELOPED COM-MUNITIES. Spring term. Assistant Professor ELLIOTT. T 4-5:30.

Attention is focused upon the principles that should govern the planning of educational programs for undeveloped communities. Several different countries are called upon for illustrations.

Ed. 292. SEMINAR IN SOCIAL STUDIES EDUCATION. Spring term. Assistant Professor STUTZ. T 4:15.

A course designed for resident or extramural students who are working on special problems in social studies education.

[R.E. 293. ADULT EDUCATION. Associate Professor HOSKINS. Not given in 1949–1950.]

[R.E. 295. COMPARATIVE EDUCATION. Fall term. Professors BUTTERWORTH and MOORE. Not given in 1949–1950.]

[Ed. 296. HISTORY OF AMERICAN EDUCATION. Spring term. Assistant Professor STUTZ. Not given in 1949–1950.]

Ed. 297. *HISTORY OF EDUCATION IN THE MODERN PERIOD*. Fall term. Assistant Professor Stutz. T Th S 9.

A survey of education from the beginning of the seventeenth century to the present, with emphasis on public schools and on consideration of social and economic developments affecting education in Western Europe.

**R.E.** 298. SEMINAR IN RURAL EDUCATIONAL LEADERSHIP. Spring term. Professor BUTTERWORTH and others. T Th 11-12:30.

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.** 299. *RESEARCH METHODS AND TECHNIQUES.* Fall term. Recommended for graduate students preparing for or engaged in research in education. Associate Professor SMITH and members of the staff. T 7:15–9 p.m.

An analysis and evaluation of types of research used in education. Special attention given to appropriate techniques, instruments, and devices.

#### RESEARCH

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.

**R.E.** 400. *INTERNSHIP IN EDUCATION*. Throughout the year. Credit two to six hours as arranged. Members of the staff.

Opportunity for apprentice or similar practical experience on the graduate level in administration, agricultural education, guidance, personnel administration, supervision, and other types of professional service in education.

## ADULT AND HIGHER EDUCATION

**R.E.** 401. *PROBLEMS IN HIGHER EDUCATION*. Spring term. Professor BUTTERWORTH, Professor PETRY, and others. T 4:15-5:45.

A seminar dealing with faculty and student personnel problems, and with the organization, curriculum, administration, physical plant, and financing of institutions of higher education, including junior colleges, community colleges, and institutes.

R.E. 223. SEMINAR IN EXTENSION EDUCATION. Spring term. Professor ------. T 4-5:30.

R.E. 224. PROGRAM PLANNING IN EXTENSION EDUCATION. Fall term. Professor ------. T 4-5:30.

Topics suggested for additional basic work in this field:

RURAL EDUCATION (211, 244, 293)

EDUCATION (280, 281, 296, 297)

HOME ECONOMICS EDUCATION (437, 438, 459)

#### HOME ECONOMICS EDUCATION

(See under Home Economics, pp. 205–207.)

## INDUSTRIAL AND TECHNICAL EDUCATION

(See under Industrial and Labor Relations, pp. 213-214, 217.)

# CHILD DEVELOPMENT AND FAMILY RELATIONSHIPS (See under Home Economics, pp. 198–201.)

# 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 (Aero.E., Chem. and Met.E., C.E., E.E., E.P., 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 six subdivisions is as follows:

### COMMITTEES ON GRADUATE WORK IN THE ENGINEERING DIVISION

AERONAUTICAL ENGINEERING – W. R. SEARS, Chairman, 269 Aeronautical Engineering Building; J. M. WILD, Secretary, 256 Aeronautical Engineering Building.

CHEMICAL AND METALLURGICAL ENGINEERING-F. H. RHODES, Chairman, 124 Olin Hall; C. C. WINDING, Secretary, 228 Olin Hall; C. W. MASON, 318 Olin Hall.

CIVIL ENGINEERING – N. A. CHRISTENSEN, Chairman, 122 Lincoln Hall; R. Y. THATCHER, Secretary, 308 Lincoln Hall; M. BOGEMA, 234 Temporary Building.

ELECTRICAL ENGINEERING – C. R. BURROWS, *Chairman*, 107 Franklin Hall; J. G. TARBOUX, *Secretary*, 105 Franklin Hall; E. M. STRONG, 116 Franklin Hall.

MECHANICAL ENGINEERING — W. J. KING, *Chairman*, 15 West Sibley; W. R. CORNELL, *Secretary*, 304 West Sibley; L. L. OTTO, Mechanical Laboratory.

ENGINEERING PHYSICS – LLOYD P. SMITH, *Chairman*, 120 Rockefeller Hall; A. B. CREDLE, M-207 Franklin Hall; H. S. SACK, 156 Rockefeller Hall.

DIVISION REPRESENTATIVE on the General Committee of the Graduate School, and Chairman of Group E-C. O. MACKEY.

## 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 engi-

\* Except in the case of candidates for the degree M.Aero.E. (see p. 166).

#### ADMISSION

neering 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.

Many of the courses described below are to be given in only one of the two terms. Information regarding the availability of any course may be obtained from the office of the School concerned.

## ADVANCED DEGREES OFFERED

The degrees of 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 Metallurgical Engineering (M.Met.E.), Master of Engineering Physics (M.E.P.), Master of Science (M.S.), and Doctor of Philosophy (Ph.D.) are granted in the field of engineering.

## THE DEGREES OF M.CHEM.E., M.C.E., M.E.E., M.M.E., M.Met.E., M.E.P.

Subject to certain general regulations of the Graduate School,<sup>1</sup> the rules governing admission to candidacy for, and graduation with, one of the engineering degrees, M.Chem.E., M.C.E., M.E.E., M.Met.E., M.E.P., M.M.E., 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 five Committees on Graduate Work, one for each of the subdivisions (Chem. and Met.E., C.E., E.E., M.M.E., and M.E.P.).

## THE DEGREE M.AERO.E.

The degree Master of Aeronautical Engineering (M.Aero.E.) is administered by the Faculty of the Graduate School of Aeronautical Engineering. Candidates for this degree are not admitted to the Graduate School of the University. Information regarding the requirements for this degree will be found in the Announcement of the College of Engineering.

## 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.<sup>2</sup>

#### 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.

(2) If the applicant wishes to become a candidate for one of the advanced Engineering Degrees his credentials should include not only information request-

<sup>&</sup>lt;sup>1</sup> See pages 13-17.

<sup>&</sup>lt;sup>2</sup> 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.
\* Candidates for the degree of M.Aero.E. see p. 166.

ed on page 8, but in addition, (a) a statement showing, if possible, his relative standing in his class, (b) a catalogue of the institution from which he was 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 (Aeronautical, Chemical, Civil, Electrical, or Mechanical Engineering) for advice or information.

(5) Candidacy for M.Chem.E., M.C.E., M.E.E., M.Met.E., M.E.P., 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.

(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.

Preregistration is required for all courses.

## RULES

## 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. Additional time may be required to make up shortages when the applicant's training in his proposed fields of study is not equivalent to that required for the corresponding first degree at Cornell.

(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 the Graduate School.

In making up shortages, a student is under the general supervision of the Committee on Graduate Work of the School of the chairman of his special committee.

(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<sup>1</sup> 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., Met.E., E.P., or M.E.) in which his major subject falls. No change in the program of study or in the personnel of the Special Committee shall be made without the written approval of the appropriate Committee on Graduate Work and the advice of the student's Special Committee.

(15) When a candidate for an advanced degree in Engineering takes a course specified by the 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

<sup>\*</sup> Candidates for the degree of M.Areo.E. see p. 166. <sup>1</sup> 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."

must conform to the general requirements of the Graduate School. It may take one of the following forms:

(a) An analytical or interpretative discussion of results already in existence.

(b) A design or construction or both, of sufficient importance and originality to demonstrate thoroughly a knowledge of the principles involved and of their applications.

(c) A dissertation based upon his own original investigation, analytical or experimental.

(18) When a student has satisfied all the requirements set by his Special Committee, including a satisfactory final examination, the Special Committee will so certify to the Committee on Graduate Work. The Committee on Graduate Work will then review the student's record and if the student has fulfilled all scholastic requirements imposed upon him, he will be duly recommended for his degree.

## FIELDS OF GRADUATE INSTRUCTION IN ENGINEERING

(19) A candidate for the Master's degree (M.Chem.E., M.Met.E., M.C.E., M.E.E., M.M.E., M.E.P.) 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 AND METALLURGICAL ENGINEERING

#### Chemical Engineering 1, 2, 4

Metallurgical Engineering 1, 2, 4

(A candidate for the degree of Master of Chemical Engineering or Master of Metallurgical Engineering will be expected to be thoroughly familiar with the general field of his major subject.

Candidates for these degrees will be required to select a minor in some other field of engineering or in a related science.)

## IN CIVIL ENGINEERING

Astronomy	Mechanics 1, 2, 3, 4
Geodetic Astronomy 2, 3, 4	Railroad Engineering
Geodesy 1, 2, 3, 4	Railroad Maintenance 1, 2, 3, 4
Highway Engineering 1, 2, 3, 4	Railroad Location 1, 2, 3, 4
Hydraulic Engineering 1, 2, 3, 4	Railroad Operation and Manage-
Hydraulics	ment 1, 2, 3, 4
Theoretical 1, 2, 3, 4	Sanitary Engineering 1, 2, 3, 4
Experimental 1, 2, 3, 4	Sewage Treatment 2, 3, 4
Management Engineering 1, 2, 3, 4	Water Purification 2, 3, 4
Materials of Engineering 2, 3, 4	Soil Mechanics 1, 2, 3, 4

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## FIELDS OF GRADUATE INSTRUCTION IN ENGINEERING

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

**Electric Power System Engineering** Transmission and Distribution 1, 2, 3, 4 System Stability 1, 2, 3, 4 Economics of Utilities 2, 3, 4 High Voltage Engineering 2, 3, 4 Power Generation 2, 3, 4 Relaying and Control 2, 3, 4 Electric Power Utilization Electrical Machinery 1, 2, 3, 4 Industrial Control and Applications 1, 2, 3, 4 Industrial Electronics 1, 2, 3, 4 Servomechanisms 1, 2, 3, 4 **Communication Engineering** Communication Systems 1, 2, 3, 4 Electron Tubes 1, 2, 3, 4 Electromagnetism 1, 2, 3, 4 Microwave Engineering 1, 2, 3, 4 Radio Engineering 1, 2, 3, 4 Radio-Wave Propagation 1, 2, 3, 4 Acoustical Engineering 2, 3, 4 Carrier Systems 2, 3, 4 Economics of Communication Services 2, 3, 4 Wire Transmission 2, 3, 4 General Electric-Circuit Analysis 1, 2, 3, 4 Electrical Measurements 1, 2, 3, 4 Illumination Engineering 2, 3, 4 Materials in Electrical Engineering 2, 3, 4

## IN MECHANICAL ENGINEERING

Administrative Engineering 1, 2, 3, 4	Machine Design 1, 2, 3, 4
Automotive Engineering 1, 2, 4	Materials of Engineering 1, 2, 3, 4
Fluid Mechanics 1, 2, 3, 4	Mechanics 1, 2, 3, 4
Heat-Power Engineering 1, 2, 3, 4	Metallography 1, 2, 4
Industrial Engineering 1, 2, 3, 4	

IN AERONAUTICAL ENGINEERING Aeronautical Engineering 1, 3, 4 Aerodynamics 4

#### IN ENGINEERING PHYSICS

Engineering Physics 1, 2, 4

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## AERONAUTICAL ENGINEERING

## Professors W. R. SEARS; Associate Professors A. R. KANTROWITZ and J. M. WILD; Assistant Professors Y. H. KUO and C. RIPARBELLI.

Application for admission to candidacy for the degree M.AeroE. should be made directly to the Director of the Graduate School of Aeronautical Engineering, College of Engineering, Cornell University. A special application blank for this purpose can be obtained from the office of the Director. This degree is awarded upon satisfactory completion of a required curriculum of studies and an acceptable thesis. For further details, see the Announcement of the College of Engineering.

Students who desire to work for the Ph.D. degree with Aeronautical Engineering as their major subject must be admitted to the Graduate School of the University in the usual manner. They should make application to the Dean of the Graduate School. Such candidates will be expected to complete courses and original research in the scientific fields that constitute the background of aeronautics, such as mechanics, fluid dynamics, and structural theory.

Close contact is maintained between the Graduate School of Aeronautical Engineering at the University and the Cornell Aeronautical Laboratory in Buffalo, N. Y. Certain periods of employment at the Laboratory are usually offered to aeronautical engineering students — ordinarily during their summer vacations. It is also possible that certain experimental equipment of that Laboratory will occasionally be available to graduate students in connection with their original research.

The Graduate School of Aeronautical Engineering is equipped with a fluid mechanics laboratory on the campus for fundamental scientific research in fluid mechanics and aerodynamics.

### GRADUATE COURSES

7101. AIRPLANE MECHANICS I. Fall term. Credit four hours. Prerequisite: Engineering Mechanics. Associate Professor WILD.

Introduction; the nature of fluid forces; characteristics of airfoils; airplane performance; wind-tunnel methods.

7102. AIRPLANE MECHANICS. Spring term. Credit four hours. Prerequisite: 7101. Associate Professor WILD.

Airplane stability; airplane dynamics; control surfaces; flight-test methods.

7103. AIRCRAFT PROPELLER DESIGN. Spring term. Credit three hours. Prerequisite, 7101. Preregistration required.

The aerodynamics of propellers and fans; Betz-Glauert theory of lightly-loaded propellers; refined theories.

7104. MECHANICS OF ROTARY-WING AIRCRAFT. Spring term. Credit three hours. Prerequisite, 7101. Preregistration required.

Fundamentals of propellor theory; rotor in vertical flight, dynamics of blade flapping, rotor in forward flight; estimation of performance of rotary-wing aircraft; helicopter control; blade loading and bending; survey of vibration problems.

7204. GASDYNAMICS. Spring term. Prerequisites: Physics, Integral Calculus, Engineering Thermodynamics. Associate Professor KANTROWITZ. Credit four hours.

One-dimentional steady flow of a perfect gas with heat addition, etc., wavepropagation phenomena, method of characteristics for 2-dimensional and axisymmetric supersonic steady flow and unsteady channel flow. Experimental methods.

7205. KINETIC THEORY. Fall term. Prerequisites: Physics, Integral Calculus, Engineering Thermodynamics. Associate Professor KANTROWITZ. Credit two hours.

Topics in kinetic theory and thermodynamics related to gasdynamics. Equation of state of gases. Maxwell distribution law and relation to thermodynamics, transport phenomena, heat capacity of gases.

7203. AERODYNAMICS OF POWER PLANTS. Fall term. Credit three hours. Prerequisites, 7101, Physics. Associate Professor WILD. Preregistration required.

Engine-supercharger characteristics at altitude, characteristics of turbojets, ramjets, etc., aerodynamic problems of cooling, cowling, combustion and deicing; principles of aerodynamic design of compressors and turbines.

7301. THEORETICAL AERODYNAMICS I. Six hours a week throughout the first half of the fall term. Credit three hours. Prerequisites, Math 611 and 612 or equivalent, Engineering Mechanics or Analytical Mechanics. Professor SEARS.

Introduction to theoretical hydrodynamics, the theory of ideal fluids, potential flows, use of complex variable.

7302. THEORETICAL AERODYNAMICS II. Spring term. Credit three hours. Prerequisite, 7301. Professor SEARS.

Wing theory; thin-airfoil theory, two-dimensional airfoil theory, Prandtl wing theory, lifting surfaces, general multiplane theory, non-stationary wing theory; corrections for compressibility (linearized theory); wing theory for supersonic speeds.

7303. THEORETICAL AERODYNAMICS III. Six hours a week throughout the second half of the fall term. Credit three hours. Prerequisites, 7201, 7202, 7301. Assistant Professor Kuo and Professor SEARS.

The aerodynamics of compressible fluids: equations of motion, small-perturbation theory (subsonic and supersonic), Janzen-Rayleigh theory, the hodograph methods, the method of characteristics, Prandtl-Meyer flow, hypersonic flow.

7304. THEORETICAL AERODYNAMICS IV. Spring term. Credit three hours. Prerequisite, 7301. Assistant Professor Kuo. Preregistration required.

The aerodynamics of viscous fluids: the boundary layer, heat transfer, fundamentals of boundary-layer stability; turbulence, the fundamentals of isotropic turbulence; experimental methods.

7401. *AIRPLANE STRUCTURES*. Fall term. Credit three hours. Prerequisite, Strength of Materials. Assistant Professor RIPARBELLI.

Stress analysis: reinforced panels in tension and compression, bending, shear and torsion of unsymmetrical semimonocoque members, diagonal-tension-field beams, mechanical properties of materials, allowable stresses, columns, plates in compression and shear strain measurements.

7402. AIRPLANE STRUCTURES. Spring term. Credit three hours. Prerequisite, 7401. Assistant Professor RIPARBELLI.

Stress analysis continued: fundamentals of air and ground loads determination and distribution, load factors, design conditions, design requirements, static testing, applied stress analysis of wing, fuselage, details.

7403. AIRPLANE DESIGN. Fall term. Credit one hour.

Orientation: the airplane and its components, the philosophy of airplane design, aircraft materials and processes.

7404. *AIRPLANE DESIGN*. Spring term. Credit one hour. Orientation (continued).

7405. AERO-ELASTIC PROBLEMS. Spring term. Credit three hours. Prerequisites, 7101, 7102. Preregistration required.

Flutter, divergences, and aileron reversal, control-surface vibration at high speeds.

7801. RESEARCH IN AERONAUTICAL ENGINEERING. (Credit to be arranged.) Prerequisites, admission to the Graduate School of Aeronautical Engineering and approval of the Director.

Independent research in a field of aeronautical science. Such research must be under the guidance of a member of the staff, and must be of a scientific character.

7901. AERONAUTICAL ENGINEERING COLLOQUIUM. Each term. Credit one hour. Prerequisite, admission to the Graduate School of Aeronautical Engineering.

Lectures by staff members, graduate students, personnel of Cornell Aeronautical Laboratory, and visiting scientists on topics of interest in aeronautical science, especially in connection with new research.

7902. ADVANCED SEMINAR IN AERONAUTICS. Each term. Credit two hours. Prerequisite, approval of the Director.

Same as 7901, but devoted to topics of advanced scientific interest.

## AGRICULTURAL ENGINEERING

See above under AGRICULTURE.

## AUTOMOTIVE ENGINEERING

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 3741, 3743, and 3750 suitable as a foundation.

[3741. AUTOMOTIVE ENGINEERING. Fall term. Credit three hours. Prerequisite, 3337. Not given in 1949–1950.]

[3743. AUTOMOTIVE ENGINEERING. Spring term. Credit two hours. Prerequisite, 3741. Not given in 1949–1950.]

[3750. ADVANCED AUTOMOTIVE ENGINEERING. Each term. Credit two to five hours as arranged. Permission of instructor required for registration. Not given in 1949–1950.]

## CHEMICAL AND METALLURGICAL ENGINEERING

Professors J. L. GREGG, P. E. KYLE, C. W. MASON, F. H. RHODES, C. C. WINDING; Assistant Professors M. S. BURTON, J. C. SMITH, R. L. VON BERG, H. F. WIEGANDT.

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
METALLURGY	METALLURGICAL ENGINEERING

For undergraduate courses which often meet needs of graduate students, see the Announcement of the College of Engineering, School of Chemical and Metallurgical Engineering, courses 1255, 1256, 5203, 5204, 5303, 5304, 5353, 5354, 5501, 6110, 6113, 6114, 6501. Preregistration is required for these courses.

5103. CHEMICAL ENGINEERING THERMODYNAMICS. Fall term. Credit three hours. Prerequisite course, Chemistry 405b. Assistant Professor Von BERG. For undergraduates and graduates.

Lectures. The development of the fundamental principles of thermodynamics, with special reference to their applications in chemical engineering processes.

5104. CHEMICAL ENGINEERING THERMODYNAMICS. Spring term. Credit two hours. Prerequisite course, Chemical Engineering 5103. Assistant Professor Von BERG. For undergraduates and graduates. Lectures. Continuation of course 5103.

5503. CHEMICAL ENGINEERING COMPUTATIONS. Fall term. Credit two hours. Conferences and lectures. Prerequisite course 5303. Professor WINDING. For undergraduates and graduates.

Advanced problems in chemical engineering unit operations.

5504. CHEMICAL ENGINEERING COMPUTATIONS. Spring term. Credit two hours. Conferences and lectures. Prerequisite course 5304. Professor WINDING. For undergraduates and graduates.

Continuation of course 5503.

5505. ADVANCED PROBLEMS IN HEAT TRANSFER. Fall term. Credit three hours. Conferences and lectures. Prerequisite courses 5503 and 5504. Professors RHODES and WINDING and Assistant Professor SMITH. Primarily for graduates.

Heat transfer to fluids in streamline flow, heat transmission under unsteadystate conditions, heat transfer in mixed-flow exchangers, and other special problems in heat flow.

5506. ADVANCED PROBLEMS IN DIFFUSIONAL OPERATIONS. Spring term. Credit three hours. Conferences and lectures. Prerequisite courses 5503 and 5504. Professors RHODES and WINDING, and Assistant Professor SMITH. Primarily for graduates.

Advanced and special topics in distillation, gas absorption, liquid-liquid extraction, crystallization, and drying.

5603. CHEMICAL ENGINEERING EQUIPMENT DESIGN. Fall term. Two hours credit. Lectures. Prerequisite course 5504. Assistant Professor SMITH.

Details of design of chemical engineering equipment.

5604. CHEMICAL ENGINEERING EQUIPMENT DESIGN. Spring term. Two hours credit. Lectures. Prerequisite course 5504. Assistant Professors SMITH and Von BERG. For undergraduates and graduates. Continuation of course 5603.

5605. CHEMICAL ENGINEERING PLANT DESIGN. Fall term. Two hours credit. Professors RHODES and WINDING and Assistant Professors SMITH, VON BERG, and WIEGANDT. For undergraduates and graduates.

Individual problems in the design of complete chemical plants, with estimation of costs of construction and operation.

5606. CHEMICAL ENGINEERING PLANT DESIGN. Spring term. Two hours

credit. Professors Rhodes and WINDING and Assistant Professors SMITH, VON BERG, and WIEGANDT. For undergraduates and graduates. Continuation of course 5605.

5701. *PLANT INSPECTIONS*. Spring term. One hour credit. Prerequisite course 5504. Professors RHODES and WINDING. For undergraduates and graduates. Preregistration required.

Supervised inspection trips to representative chemical manufacturing plants. A critical and comprehensive report is required.

5711. *LIBRARY USE AND PATENTS*. Spring term. One hour credit. Professors RHODES and MASON. Primarily for undergraduates.

5741. *PETROLEUM REFINING*. Fall term. Three hours credit. Lectures. Prerequisite course 5304. Professor WINDING. For undergraduates and graduates.

Processes and equipment used in refining petroleum.

5742. SYNTHETIC RESINS AND PLASTICS. Spring term. Three hours credit. Lectures. Prerequisite or parallel course 5304. Professor WINDING. For undergraduates and graduates.

Polymerization reactions; manufacture and properties of synthetic resins, plastics, and rubbers.

5743. OPERATION CONTROL IN CHEMICAL PLANTS. Fall term. Three hours credit. Lectures. Prerequisite or parallel course 5304. Professor RHODES. For undergraduates and graduates.

Basic principles of instrumentation and automatic control as applied in process industries. Brief survey of principles of statistical quality control.

5851. CHEMICAL MICROSCOPY. Either term. Three hours credit. Lectures and laboratory. Prerequisite or parallel course Chemistry 404 and Physics 17 or 18 or special permission. Professor MASON and assistants. For undergraduates and graduates. Preregistration required.

The use of microscopes and their accessories in chemical and technical investigations.

5853. MICROSCOPICAL QUALITATIVE ANALYSIS (INORGANIC). Either term. Credit two or more hours. Laboratory practice. Prerequisite course Chemical Engineering 5851. Professor MASON. For undergraduates and graduates. Preregistration required.

The analysis, by microscopical methods, of inorganic substances containing the more common elements.

5854. MICROSCOPICAL METHODS IN ORGANIC CHEMISTRY. Either term. Credit two or more hours. Laboratory practice. Prerequisite course Chemical Engineering 5851 and special permission. Professor MASON. For undergraduates and graduates. Preregistration required.

Application of microscopical methods in the examination of organic substances.

5859. ADVANCED CHEMICAL MICROSCOPY. Either term. Credit one or more hours. Laboratory practice. Prerequisite course 5851 and special permission. Professor MASON and assistants. For undergraduates and graduates. Preregistration required.

Special methods and special applications of chemical microscopy.

6203. SLAG-METAL-ATMOSPHERE REACTIONS. Fall term. Credit three hours. Prerequisite courses, Engineering 1256, Chemistry 404, and Metallurgical Calculations, Engineering 6501. Mr. GREGG. Lectures.

Theory of the reactions involved in the reduction and refining of metals, carburization and decarburization, slag control, furnace-atmosphere generation, and related topics.

6253. UNIT PROCESSES IN METALLURGY. Fall term. Credit three hours.

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Prerequisite or parallel course Slag-Metal-Atmosphere Reactions, Engineering 6203. Mr. GREGG. One lecture and one laboratory period each week, with reports.

Experimental study of important processes in metallurgy, including ore dressing, temperature measurements, generation and control of furnace atmospheres, furnace design and performance, smelting and refining operations and electrode position.

6254. UNIT PROCESSES IN METALLURGY. Spring term. Credit two hours. Prerequisite course, Unit Processes in Metallurgy, Engineering 6253. Mr. GREGG. One lecture and one laboratory period each week with reports. Continuation of course 6253.

6311. PHYSICAL METALLURGY. Fall term. Credit three hours. Prerequisite course, Introductory Metallography, Engineering 6811. Mr. MASON. Lectures.

Detailed discussion of plastic deformation, recrystallization and grain growth, diffusion in alloys, precipitation from solid solution, and transformation mechanisms in heat treatment.

[6323. ADVANCED FERROUS METALLURGY. Fall term. Credit three hours. Prerequisite course, Physical Metallurgy, Engineering 6311. Lectures.

Discussion, at an advanced level, of alloy steels, cast irons and heat treatment. Not offered in 1949-1950.]

[6324. ADVANCED NON-FERROUS METALLURGY. Spring term. Credit

three hours. Prerequisite course, Physical Metallurgy, Engineering 6311. Lectures. Detailed discussions of advanced topics in non-ferrous metallurgy. Not offered in 1949–1950.]

6351. PHYSICAL METALLURGY LABORATORY. Fall term. Credit three hours. Parallel course Physical Metallurgy, Engineering 6311. Messrs. MASON and BURTON. Laboratory periods and conferences.

Experiments to illustrate the important phenomena of physical metallurgy and special techniques for their investigation.

[6602. METALLURGICAL DESIGN. Spring term. Credit three hours. Prerequisite course, Physical Metallurgy, Engineering 6311, or special permission. Lectures.

The application of metallurgical principles to the study of the performance of metal parts in service. Includes metallurgical consideration in the choice of metals for various types of service, factory governing the choice of methods of fabrication of metal parts and equipment, and a study of metal failures and their causes and remedies. Not offered in 1949–1950.]

6701. PLANT INSPECTIONS. Spring term. Credit one hour.

A series of supervised inspection trips to manufacturing plants representing various metallurgical engineering industries. Each student is required to submit a comprehensive report. Preregistration required.

6811. INTRODUCTORY METALLOGRAPHY. Spring term. Credit three hours. Prerequisite courses, Engineering 1255 or 1222. Messrs. MASON and BURTON. One lecture and two laboratory periods each week.

Microstructures of alloys, as related to composition, thermal history, and physical properties. Preparation of specimens; principles and use of metallographic microscopes.

[6953, 6954. SENIOR PROJECT. Two terms. Credit three hours each term. Prerequisite course, Unit Processes in Metallurgy, Engineering 6254.

Research on an original problem in Metallurgical Engineering. Not offered in 1949–1950.]

## DESCRIPTIVE GEOMETRY AND DRAWING

## IN CIVIL ENGINEERING

#### Professor H. T. JENKINS.

## 2004. ADVANCED DRAWING. Credit three hours. Associate Professor JENKINS.

Perspective drawings, rendered in pencil, ink, and washes, of buildings, concrete bridges, dams, and other engineer work; 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, S. F. CLEARY; Associate Professor W. E. MORDOFF; Assistant Professor T. J. BAIRD.

For undergraduate courses which often meet the needs of graduate students, see the *Announcement of the College of Engineering*, courses 3111, 3112, 3116. Preregistration required.

## ELECTRICAL ENGINEERING

Professors C. R. BURROWS, W. C. BALLARD, L. A. BURCKMYER, JR., R. F. CHAMBER-LAIN, A. B. CREDLE, H. B. HANSTEEN, M. G. MALTI, H. F. MAYER, M. S. MC-ILROY, T. MCLEAN, W. E. MESERVE, B. K. NORTHROP, H. G. SMITH, E. M. STRONG, J. G. TARBOUX, S. W. ZIMMERMAN; Associate Professors W. W. COTNER, C. L. COTTRELL, W. H. ERICKSON, C. E. INGALLS, W. R. JONES; Assistant Professors P. D. ANKRUM, A. E. DAVIES, M. J. KELLY, R. E. OSBORN, S. L. SCHAUSS, and C. L. SEEGER.

The School of Electrical Engineering has the following laboratories suitable for graduate work:

ADVANCED ELECTRICAL MACHINERY LABORATORY

ELECTRICAL MEASUREMENTS AND STANDARDIZATION LABORATORY

BASIC ELECTRONICS LABORATORY

**RADIO AND COMMUNICATIONS LABORATORY** 

INDUSTRIAL ELECTRONICS LABORATORY

ELECTRONICS APPARATUS AND PROJECT LABORATORY

SERVOMECHANISMS LABORATORY

HIGH-VACUUM AND TUBE-CONSTRUCTION LABORATORY

Special equipment for experimental research is provided through a fully equipped and manned machine shop.

Undergraduate Courses: For undergraduate courses which meet needs of certain graduate students, see the Announcement of the College of Engineering, SCHOOL OF ELECTRICAL ENGINEERING, courses 4112, 4121, 4122, 4126, 4131, 4211, 4216, 4221, 4226, and 4611.

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. Adequate work in advanced Physics and Mathematics is required of candidates for the Ph.D. degree in Electrical Engineering, even though these sciences may not be specified as minor subjects.

#### ELECTRIC POWER SYSTEM ENGINEERING

4326. POWER LABORATORY. Available in both terms. Credit two hours. Prerequisites, 4226 and 4311. Professor BURCKMYER. One lecture and one lecturelaboratory period each week.

A study of alternating current magnetization in selected transformers; tworeaction theory of salient-pole synchronous machines under transient and steadystate conditions; commutating alternating-current motors; and analysis of transmission-line faults by symmetrical components.

[4334. ECONOMICS OF PUBLIC UTILITIES. Credit two hours. Prerequisite, a course in Economics. Professor McILROY. Not given in 1949–1950. Scheduled for spring term, 1951.]

4361. POWER SYSTEMS. Available in both terms. Credit three hours. Prerequisite, 4221. Professor TARBOUX. Two lectures and one computing period each week.

The function and the form of the electrical apparatus included in modern power systems are studied. 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 classroom discussions.

4362. TRANSMISSION OF ELECTRIC ENERGY. Available in both terms. Credit three hours. Prerequisites, 4311 and 4361. Professor TARBOUX. Two lectures and one computing period each week.

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  $\pi$  and T networks; development of circle diagrams to facilitate calculations of performance.

4363. *STABILITY OF ELECTRIC POWER SYSTEMS*. Spring term only. Credit two hours. Professor TARBOUX. Two lectures each week.

The conditions of stability of synchronous machines and of electric power systems under both steady and transient loads are investigated by mathematical analysis.

4364. *PROTECTION AND RELAYING ON POWER CIRCUITS*. Fall term only. Credit two hours. Professor TARBOUX. Two lectures each week.

The principles of the operation of typical relays and of the application of relaying systems are considered. The course includes a study of telemetering and supervisory-control equipment.

4365. SYMMETRICAL COMPONENTS. Fall term only. Credit three hours. Prerequisites, 4311, 4321, and 4361. Professor McIlroy. Three lectures each week.

The fundamental concept of symmetrical components; and application in analysis of transmission lines, transformers, synchronous machines, power networks, three-phase and single-phase induction motors, and other motors with asymmetrical windings.

4871. HIGH VOLTAGE PHENOMENA. Spring term only. Credit three hours. Prerequisite, 4862. Professor ZIMMERMAN. Two lectures and one computing period each week.

A study of problems encountered in normal operation of power systems at high voltage; of abnormal conditions imposed by lightning; and of laboratory devices for high-voltage testing under actual or simulated conditions.

#### TOPICS SUGGESTED FOR ADVANCED WORK

ELECTRIC POWER GENERATION

ELECTRIC POWER-SYSTEM STABILITY AND REGULATION

ELECTRIC POWER TRANSMISSION AND DISTRIBUTION

ELECTRICAL CONTROL AND RELAYING

HIGH-VOLTAGE PHENOMENA

SYMMETRICAL COMPONENTS

ECONOMICS OF PUBLIC UTILITIES

## ELECTRIC POWER UTILIZATION

4321. ELECTRICAL MACHINE THEORY. Available in both terms. Credit two hours. Prerequisite, 4221. Assistant Professor Osborn. Two recitations each week.

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.

4341. MOTOR CONTROL. Fall term only. Credit two hours. Prerequisites, 4211, 4216, 4221, and 4226. Professor Meserve. One lecture and one recitation each week.

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 contractors; interpretation of controller diagrams.

4342. APPLICATION OF MOTORS. Spring term only. Credit three hours. Prerequisites, 4326 and 4341. Professor Meserve. One lecture, one recitation, and one computing period each week.

Characteristics of motors and requirements of typical loads are analyzed and correlated so that the motor selected for the load is of the proper 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.

4343. AIRCRAFT AND MARINE ELECTRIC POWER AND CONTROL SYSTEMS. Spring term only. Credit two hours. Prerequisites, 4321 and 4341. Professor Meserve. Two recitations each week.

A study of modern electrical systems for aircraft, with consideration of factors influencing performance, reliability, and weight; relative advantages of a-c and d-c systems.

A study of main drives for electrical propulsion of ships; design of power distribution systems; and selection of motors and control equipment. 4351. LOW-FREQUENCY HEATING AND INDUSTRIAL DISTRIBUTION SYSTEMS. Spring term only. Credit three hours. Must be preceded or accompanied by 4311. Professor Northrop. Two lectures and one computing period each week.

A study of the construction, characteristics, and application of all forms of industrial low-frequency electrical heating apparatus, especially arc furnaces and induction furnaces; and the design of electric-power distribution systems in industrial plants.

4411. *ELECTRONIC CONTROL EQUIPMENT*. Available in both terms. Credit three hours. Prerequisite, 4122. Professor NORTHROP. Two lectures and one laboratory period each week.

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.

[4415. *ELECTRONIC CONTROLS*. Credit three hours. Prerequisite, 4421. Professor Northrop. Not given in 1949–1950.]

[4421. *ELECTRONIC POWER CONVERTERS*. Credit three hours. Prerequisite, 4411. Professor Northrop. Not given in 1949–1950. Scheduled for fall term, 1950–1951.]

[4422. ELECTRONIC INVERTERS. Credit three hours. Prerequisite, 4421. Professor NORTHROP. Not given in 1949–1950. Scheduled for spring term, 1951.]

4451. *HIGH FREQUENCY HEATING*. Fall term only. Credit three hours. Prerequisite, 4421. Professor NORTHROP. Two lectures and one laboratory period each week.

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 types usual for these purposes.

4711. SERVOMECHANISMS: AUTOMATIC CONTROL SYSTEMS. Fall term only. Credit three hours. Prerequisites, 4121, 4126, 4216, and 4221. Professor MESERVE. Two lecture-recitations and one laboratory or computing period each week.

A study of the principles of servomechanisms and regulating systems, from the classical differential-equation approach; applications in industrial control problems. Open ended and closed loop controls; differential devices; and followup links. Analysis of factors affecting error, damping, and speed of response. Transfer-function analysis, including criteria for stability.

4712. ADVANCED SERVOMECHANISMS. Spring term only. Credit three hours. Prerequisite, 4711. Professor MESERVE. Two lecture-recitations and one laboratory or computing period each week.

Servomechanism theory, from the point of view of Laplace transform analysis. Synthesis of systems; use of stability criteria to predetermine performance; and laboratory tests for comparison of observed and predicted performance of servo systems.

## TOPICS SUGGESTED FOR ADVANCED WORK

ELECTRONIC CONTROLS ELECTRONIC METERING ELECTRONIC POWER CONVERTERS HIGH-FREQUENCY HEATING LOW-FREQUENCY HEATING MOTOR APPLICATIONS AND CONTROL SERVOMECHANISMS

## COMMUNICATION ENGINEERING

4511. RADIO AND COMMUNICATION THEORY. Available in both terms. Credit three hours. Prerequisite, 4122. Professor CREDLE. Two lectures and one recitation or computing period each week.

Studies of the various components of radio receivers and broadcast transmitters. The topics are: feed-back amplifiers, video amplifiers, mixer circuits, detectors, reactance-tube circuits, discriminator circuits, and circuit noise.

4512. *RADIO AND COMMUNICATION THEORY*. Available in both terms. Credit three hours. Must be preceded or accompanied by 4511. Professor McLEAN. Two lectures and one recitation each week.

A study of communication circuits with distributed constants and of production and propagation of electro-magnetic radiation.

The topics included are: transmission-line theory and applications; impedance matching; ultra-high-frequency generation; introduction to vector analysis and electromagnetic theory; propagation phenomena; and antenna characteristics and radiation.

4513. COMMUNICATION NETWORKS. Fall term only. Credit three hours. Must be preceded or accompanied by 4122. Professor McLEAN. Three recitations each week.

Analysis of two-terminal networks, reciprocal structures, ideal reactance structures, balancing networks, and four-terminal transmission networks; study of filter characteristics and of design of amplitude- and delay-equalizers; general equivalence theorems, and analogies between lumped networks and smooth lines.

4516. *RADIO AND COMMUNICATION LABORATORY*. Available in both terms. Credit three hours. Must be preceded or accompanied by 4511. Associate Professor INGALLS. One recitation and one laboratory period each week.

This course consists of a series of experiments closely paralleling the work of course 4511.

4517. *RADIO AND COMMUNICATION LABORATORY*. Available in both terms. Credit three hours. Must be preceded or accompanied by 4512. Professor MCLEAN. One recitation and one laboratory period each week.

This course consists of a series of experiments closely paralleling the work of the accompanying course.

4521. *RADIO BROADCASTING*. Spring term only. Credit three hours. Prerequisite, 4511. Must be preceded or accompanied by 4512. Professor SMITH. Two lectures and one lecture-laboratory or computing period each week.

The engineering aspects of radio broadcasting, under the following topics: studio equipment, transmitting equipment, and problems of operation; determination of coverage; station interference, allocation of channels; network interconnections; purpose and policy of governmental regulatory bodies. Practical knowledge is gained through inspection of the University's Station WHCU and other nearby stations.

[4522. TELEPHONE AND TELEGRAPH SYSTEMS. Credit two hours. Prerequisite, 4131. Professor McLEAN. Not given in 1949–1950. Scheduled for fall term, 1950–1951.]

4526. DESIGN AND CONSTRUCTION OF VACUUM TUBES. Spring term only. Credit three hours. Prerequisite, 4511. Professor BALLARD. Two lecturerecitations and one laboratory period each week.

Study of the design of electron tubes and prediction of performance, under the following topics: conformal transformation of the electric field; auxiliary grids and focusing structures; equivalent diode; conduction of electricity through gases. The laboratory work includes the construction and testing of simple tubes.

[4531. TELEVISION SYSTEMS. Credit three hours. Prerequisites, 4511 and 4516. Associate Professor INGALLS. Not given in 1949–1950. Scheduled for spring term, 1951.]

[4541. APPLIED ACOUSTICS. Credit two hours. Professor McLean. Not given in 1949–1950.]

4551. *RADIO AIDS TO NAVIGATION*. Spring term only. Credit two hours. Prerequisite, 4131. Professor McLEAN. Two recitations each week.

Principles of directive antennas, with applications in direction finders and radio beacons; atmospheric effects, and other limitations on accuracy of directional determinations; study of medium-frequency pulsed transit-time systems and high-frequency return-signal systems.

4561. *ULTRA-HIGH-FREQUENCY SYSTEMS*. Fall term only. Credit two hours. Must be preceded or accompanied by 4565. Associate Professor INGALLS. One recitation and one laboratory period each week.

Theoretical and experimental study of ultra-high-frequency generators such as magnetrons and klystrons; and of ultra-high-frequency transmission systems, wave guides, coaxial lines, radiators, cavity resonators, and measuring devices.

4563. PULSE TECHNIQUE IN COMMUNICATION AND RADAR. Fall term only. Credit three hours. Prerequisites, 4512, 4516, and 4517. Professor MAYER. Three recitations each week.

Frequency analysis of pulses and related signals; principles of pulse generation, transmission, and reception; consideration of modulation systems; applications in radar, long-range navigation (Loran), and moving-target indication (MTI).

4565. *ELECTROMAGNETIC WAVES*. Fall term only. Credit three hours. Prerequisites, 4512 and 4517. Professor BALLARD. Three lecture-recitations each week.

This course is a study of the fundamental Maxwell's Equations and of their application in electrical engineering problems. The topics considered include: wave propagation in free space; reflection, refraction, and guided propagation in wave guides; cavity resonators, horns, and other radiators.

4566. *ELECTROMAGNETIC WAVES*. Spring term only. Credit three hours. Prerequisite, 4565. Professor BOOKER. Three lecture-recitations each week.

This course is a continuation of course 4565. It includes a study of radio-wave , propagation over considerable distances, radiation from doublet antennas, power transfer between antennas, propagation over plane and spherical earth, ionospheric propagation, guided propagation in atmospheric ducts, and kindred topics.

4571. ADVANCED COMMUNICATION NETWORKS. Spring term only. Credit three hours. Prerequisite, 4513. Professor Воокек. Three recitations each week.

Study of transmission lines under dissipative conditions and with non-ideal terminations; combination of networks, and solution of linear network problems, by matrix methods; Foster's reactance theorem; Brune's method of synthesis of impedance functions.

#### TOPICS SUGGESTED FOR ADVANCED WORK

ACOUSTICAL ENGINEERING

ANALYSIS OF COMMUNICATION NETWORKS

CARRIER SYSTEMS

COMMUNICATION-SYSTEM ENGINEERING

DESIGN AND CONSTRUCTION OF VACUUM TUBES

ECONOMICS OF COMMUNICATION SERVICES

MICROWAVE THEORY AND TECHNIQUES

RADIO AIDS TO NAVIGATION

RADIO ENGINEERING

RADIO TRANSMITTERS AND RECEIVERS

**RADIO-WAVE PROPAGATION** 

**TELEVISION SYSTEMS** 

WIRE TRANSMISSION

#### GENERAL

4035. *OPERATIONAL ANALYSIS.* Fall term only. Credit three hours. Prerequisite, 4311. Professor MALTI. Two recitations and one computing period each week.

Among the topics of the course are: functions of real and of complex variables; Laplace and Fourier transforms; generalized expansion theorems for differential equations and difference equations.

4036. *OPERATIONAL ANALYSIS*. Spring term only. Credit three hours. Prerequisite, 4035. Professor MALTI. Two recitations and one computing period each week.

This course is a continuation of course 4035. It includes the operational analysis of ladder networks and of transients in circuits with lumped and with distributed parameters.

4311. ADVANCED CIRCUIT ANALYSIS. Available in both terms. Credit three hours. Prerequisites, 4221 and Mathematics 201 or 608. Professor MALTI. Two lectures and one computing period each week.

A treatment of typical electric circuits, as follows: physical meaning of the parameters by which circuits are described; single-energy transients; doubleenergy transients; ladder networks as approximate equivalents of circuits having distributed parameters; introduction to use of symmetrical components.

[4331. ELECTRICAL DESIGN ECONOMICS. Credit three hours. Prerequisites, 4211 and 4221. Professor TARBOUX. Not given in 1949–1950. Scheduled for fall term, 1950–1951.]

4386. *ELECTRICAL MEASUREMENTS*. Available upon sufficient demand. Credit two hours or more. Prerequisites, 4311 and 4326. Professor BURCKMYER.

The course emphasizes the development of electrical apparatus and methods for specialized measuring purposes. Topics of investigation will be selected in accordance with the major interests of those enrolled.

4612. ILLUMINATION ENGINEERING, Spring term only. Credit three

hours. Prerequisite, 4611. Professor STRONG. Two recitations and one lecturelaboratory period each week.

This course extends the study of some of the topics introduced in the prerequisite course. Computation of light-flux distribution and study of more difficult lighting problems are pursued.

4615. *ILLUMINATION SEMINAR*. Available upon sufficient demand. Credit two hours. Prerequisite, 4611. Professor STRONG. One two-hour period each week.

Reports on selected topics of current interest in illumination engineering are presented and discussed.

Special attention is called to the following courses listed under other fields: PHYSICS 215, PSYCHOLOGY 211, SPEECH AND DRAMA 437.

#### TOPICS SUGGESTED FOR ADVANCED WORK

ALTERNATING-CURRENT CIRCUIT ANALYSIS

ELECTRICAL-MACHINE THEORY AND OPERATION

PROPERTIES OF SOLID DIELECTRICS

RESEARCH IN MAGNETIC MATERIALS

ELECTRICAL MEASURING AND TESTING

ILLUMINATION AND COLOR

ILLUMINATION DISTRIBUTION IN INTERIORS

ILLUMINATION AND VISION

ILLUMINATION MEASUREMENTS

SPECIAL LIGHTING PROBLEMS

## ENGINEERING PHYSICS

Professors LLOYD P. SMITH, C. R. BURROWS, A. B. CREDLE, G. E. GRANTHAM, D. F. GUNDER, M. KAC, W. R. SEARS; Associate Professors D. R. CORSON, T. R. CUY-KENDALL, P. L. HARTMAN, H. S. SACK.

The aim of graduate work in Engineering Physics is to undertake concentrated work on an advanced level in a field of specialization which may cross conventional subject matter boundaries as well as to deepen and to enlarge the general scientific and engineering background of the student. For this reason the minor subject or subjects should be chosen in approved fields outside of Engineering Physics.

The thesis can be done in any field represented by the members of the Engineering Physics Faculty, or, if the student's special committee approves, in other fields that can be considered part of engineering physics. The course work in Engineering Physics will be chosen from the graduate courses offered in the various schools of the College of Engineering or in the Departments of Physics, Chemistry, or Mathematics of the College of Arts and Sciences. The members of the student's committee in charge of Engineering Physics will advise the student in the choice of these courses.

8090. INFORMAL STUDY IN ENGINEERING PHYSICS. Either term. Laboratory or theoretical work in any branch of Engineering Physics under the direction of a member of the staff. Hours to be arranged.

## HEAT-POWER ENGINEERING

Professors C. O. MACKEY, V. R. GAGE, P. F. MARTINUZZI; Associate Professors W. C. ANDRAE, R. E. CLARK, D. DROPKIN, F. S. ERDMAN, H. N. FAIRCHILD, N. R. GAY, L. L. OTTO, E. B. WATSON; Assistant Professors I. KATZ, C. R. OTTO, D. G. SHEPHERD, W. J. SKINNER, T. B. TRACY, E. R. WATT.

As prerequisite for graduate study in this field, 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 assigned work to make up the deficiency.

Opportunities for analytical work include: original investigations in engineering thermodynamics; interpretive studies of available data; investigations in power plant economics; design, selection, and arrangement of apparatus to meet specific requirements.

The laboratories and shops of the Sibley School of Mechanical Engineering are available for carrying on experimental and laboratory work in this field. In these laboratories there is equipment for the advanced study of internal combustion engines, gas turbines, steam engines, steam turbines, pumps, compressors, fans, steam generating units, heat transfer, refrigeration, air conditioning, and engineering instruments.

Students who contemplate doing laboratory work in this field should communicate with the department in advance of beginning work in order to arrange for the use of equipment.

For undergraduate courses which often meet needs of graduate students, see the Announcement of the College of Engineering, Department of HEAT-POWER ENGINEERING, courses 3501, 3502, 3503, 3504, 3505, 3506, 3507.

3551. STEAM TURBINES. Fall term. Credit two hours. Prerequisite, 3501. Associate Professor CLARK.

Mechanical and thermal considerations underlying the action of steam in turbines; calculations involved in turbine design; adaptability to special conditions of service.

3563. ADVANCED THERMODYNAMICS. Spring term. Credit three hours. Prerequisite, 3501. Associate Professor GAY.

The Carnot principle; temperature scales; entropy; experimental determination and correlation of properties of state; equations of state; kinetic theory; mixtures of gases.

3590. GAS-TURBINE PLANTS. Either term. Credit two hours. Prerequisite, 3501. Professor MARTINUZZI.

A fundamental study of the various cycles and apparatus involved in the modern gas-turbine plant. Performance and suitability of this power plant for various applications.

3591. PRINCIPLES OF TURBO-MACHINERY. Either term. Credit three hours. Prerequisites, 2331, 3501. Assistant Professor SHEPHERD.

A study of the transfer of energy between a fluid and a rotor; the underlying similarity of pumps, fans, compressors, steam turbines, and gas turbines.

3651. *HEAT-POWER RESEARCH*. Either term. Credit depends upon actual work as arranged with Department.

Advanced analytical and experimental investigations.

3653. TEMPERATURE MEASURING INSTRUMENTS. Spring term. Credit two hours. Associate Professor Dropkin.
The theory, construction, calibration, and application of temperature measuring devices.

3654. DIMENSIONAL ANALYSIS. Fall term. Credit one hour. Associate Professor ANDRAE.

Engineering use of dimensional analysis and principles of similitude with emphasis on application to experimental work.

3655. GRAPHICAL COMPUTATION AND REPRESENTATION. Fall term. Credit two hours. Professor MACKEY.

Design of slide rules, network charts, and alignment charts; derivation of empirical equations to fit experimental data.

3656. ADVANCED AIR CONDITIONING. Fall term. Credit three hours. Prerequisite, 3588. Professor MACKEY.

Selected problems in the study of air conditioning principles and apparatus.

3660. AIRCRAFT POWER PLANTS. Either term. Credit three hours. Prerequisite, 3581. Assistant Professor KATZ.

Operating principles and mechanical and thermal characteristics of reciprocating and rotating types of aircraft power plants.

3661. AIRCRAFT ENGINE DESIGN. Either term. Credit three hours. Prerequisites, 3660, 3581, 3337. Assistant Professor KATZ.

Engine design principles and pertinent thermodynamic calculations. Design of engine components with respect to functions and loads.

3670. AUTOMATIC CONTROL ENGINEERING. Either term. Credit three hours. Prerequisite or parallel course, 3502 and 2331. Assistant Professor C. R. Отто.

Study of automatic controllers commonly used in current industrial practice with special reference to construction, installation, and available control patterns. Control problems in processes and plants.

3680. DIESEL ENGINES. Each term. Credit three hours. Prerequisites, 3501, 3581. Associate Professor WATSON.

Engine construction, diesel fuel characteristics, combustion phenomena, fuel injection systems, and engine performance characteristics. Study of induction systems, scavenging, and supercharging of diesel engines.

#### TOPICS SUGGESTED FOR ADVANCED WORK

Advanced Engineering Thermodynamics Aircraft Power Plants Air Conditioning Combustion Engines Compressors and Pumps Flow of Fluids Fuels, Combustion, Burners, Furnaces Heat Transfer Instruments and Controls Refrigeration Steam Engineering

## HIGHWAY ENGINEERING

Professor D. J. BELCHER, Associate Professor T. D. LEWIS, Assistant Professor R. J. HODGE.

The laboratories for the examination of non-bituminous and bituminous materials and their utilization, soils, sub-grade 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.

For undergraduate courses which often meet needs of graduate students, see the Announcement of the College of Engineering, School of CIVIL ENGINEERING, courses 2610, 2612, 2613, 2620, 2621. (For graduate credit, one hour additional work is required in 2612 and 2613.)

2614. ADVANCED HIGHWAY ENGINEERING. Spring term. Credit three hours. Prerequisite 2610. Messrs. BELCHER and LEWIS.

Part I. Soils and subgrades. Surveying sampling, compaction, and stabilization practices. Special problems in excavation. Part II. Design and construction of base and surface courses for flexible pavements. Part III. Design and construction of rigid pavements. Part IV. Highway planning. Urban route selection, geometrical design; design of regional systems of highways, freeways, and parkways.

2617. *AIRPORTS*. Fall term. Credit three hours. Prerequisite, course 2610. Assistant Professor HODGE. The location, design, construction, and maintenance of airports. Two recitations and one computing period a week.

2618. LOW COST ROADS. Either term. Credit three hours. Prerequisite, course 2610, or its equivalent. Professor BELCHER.

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 structure; 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.

2641. HIGHWAY ENGINEERING DESIGN. Either term. Prerequisites, courses 2610 and 2614, or equivalent. Mr. LEWIS.

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 layouts and methods of executing work.

2642. HIGHWAY ENGINEERING RESEARCH. Either term. Prerequisites, courses 2610 and 2614, or equivalent. Messrs. BELCHER and LEWIS.

The field of economics of highway engineering offers a wide variety of problems. Laboratory investigations of subgrade soil, subgrade stabilization, and the effects of modifications in design of bituminous and nonbituminous mixtures provide a wide range of topics for research. Advanced work in Engineering Interpretation of Aerial Photographs and Traffic Engineering also fall into this research category.

## 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 requirements) 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.

For major work in Experimental (or Theoretical) Hydraulics the thesis requirements 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.

Associate Professors BOGEMA, PRIEST, and REID.

2303. ADVANCED HYDRAULICS. Fall term. Prerequisites 2302 (or 2351). Associate Professor BOGEMA. Three recitations a week as arranged. Credit three hours.

This course involves more detailed and extended theory and application than the first course. Problems considered include barometric leveling, fluids subject to acceleration, hydraulic similitude, water hammer, open channel flow, and hydraulic jump.

2304. HYDRAULIC MEASUREMENTS. Fall term. Prerequisites 2302 (or 2351). Associate Professor REID. One lecture and two laboratory periods a week as arranged. Credit three hours.

Experiments involving current meters and floats in canal or river; Pitot tubes; water meters, weirs, characteristics in detail of orifices, nozzles, Venturi meters, pipes, the determination of efficiency, capacity, and characteristics of hydraulic machinery.

2305. HYDRODYNAMICS. Spring term. Prerequisites 2302 (or 2351) and Differential Equations. Associate Professor PRIEST. Three recitations a week as arranged. Credit three hours.

Physical properties of fluids, equations of motion, circulation, irrotational motion, conformal transformation, laboratory methods for determining flow nets, pressure distribution on submerged surfaces, vorticity, equations of viscous flow, separation, drag, turbulence, dimensional analysis and similitude.

2306. PUMPS AND TURBINES. Spring term. Prerequisites 2302 (or 2351). Associate Professor BOGEMA. Two recitations and one laboratory or computation period a week. Credit three hours.

Theory and characteristics of the hydraulic ram; reciprocating and centrifugal pumps; impulse, reaction, and propellor type turbines; selection and testing of hydraulic machinery.

2307. FLOW OF LIQUIDS IN OPEN CHANNELS. Fall term. Prerequisites, 2302 (or 2351). Associate Professor PRIEST. Two lectures and one computation period a week. Credit three hours.

Uniform flow, gradually varied flow, rapidly varied flow, hydraulic jump, waves, transitions, bends, obstructions, steep slopes, spillways, energy dissipation, and hydraulic models.

2308. *HYDRAULIC MODELS*. Spring term. Prerequisites 2302 (or 2351). Associate Professor REID. One lecture and two laboratory or computation periods a week. Credit three hours.

Theory and practical use of models in designing hydraulic structures.

2342. HYDRAULIC RESEARCH. Either term. Prerequisites 2302 (or 2351). Associate Professors BOGEMA, PRIEST, and REID. Credit as arranged.

The subject and scope of the investigations should be selected by conference at the beginning of the term, if not previously arranged. Written reports are required, but the text need not be typewritten in thesis style.

2343. HYDRAULIC SEMINAR. Either term. Associate Professors BOGEMA, PRIEST, and REID. Credit as arranged.

Open to specially selected seniors or graduate students. Abstraction and discussion, of technical papers and publications in the hydraulic field.

## HYDRAULIC ENGINEERING

#### Associate Professor D. E. DONLEY.

For undergraduate courses which often meet the need of graduate students, see *Announcement of the College of Engineering*, Department of HYDRAULICS, courses 2401 and 2402. Preregistration is required for both courses.

2403. HYDRAULIC STRUCTURES. Fall term. Prerequisite Course 2401. Associate Professor DONLEY. Time to be arranged. Treats the design, use, and selection of various types of structures required in hydraulic engineering such as dams, canals, channels, etc. Brief reports on structures used in various constructed projects are presented by students.

2404. WATER POWER. Fall term. Prerequisite course 2401. Associate Professor DONLEY. Time to be arranged. Principally a study of streamflow and the development of such flow for hydro-electric power, including location of project, selection of structures and equipment, and determination of power to be produced.

2405. DESIGN OF CONCRETE DAMS. Spring term. Prerequisites courses 2401, 2715, 2725. Associate Professor DONLEY. Time to be arranged. Theory of design of concrete dams with special emphasis on the design of typical sections of high gravity type dam and of a hollow slab and buttress dam. Two computing periods a week required.

2406. *FLOOD CONTROL*. Spring term. Prerequisite Course 2401. Associate Professor DONLEY. Time to be arranged. Analysis of flood control problem including flood damage, methods for controlling floods, selection of structures required and methods of operating such structures under flood conditions.

2407. *PUMPING PLANTS*. Either term. Prerequisites Courses 2401 and 2406. Associate Professor DONLEY. Time to be arranged. Investigation of pumping equipment and plants required for flood control or drainage projects. Selection of location, capacity of plant, method of operation, and costs of operation considered.

2408. *HARBOR ENGINEERING*. Spring term. Prerequisites Courses 2402 and 2725. Associate Professor DONLEY. Time to be arranged. A study of harbor construction including hydrographic survey, design of channels, breakwaters, and slips, selection of dredging equipment and determination of cost of such improvements.

2409. PORTS AND TERMINALS. Spring term. Prerequisite Course 2408. Associate Professor DonLey. Time to be arranged. Design, construction, and opera-

tion of ocean, river, and lake ports, including structures required, methods of operation, land transportation facilities, and the layout of port areas.

2441. HYDRAULIC ENGINEERING DESIGN. Either term. Prerequisites Courses 2401, 2404 and 2406. Associate Professor DONLEY. Time to be arranged. Development of a selected site for multiple purpose use, including coordination of the available storage for flood control, water power, navigation, water supply and irrigation. Determination of benefits and allocation of costs.

2442. *HYDRAULIC ENGINEERING RESEARCH*. Either term. Prerequisites Courses 2401 and additional courses in selected field. Time to be arranged. Subject and scope of investigations selected after conference with student.

2443. *HYDRAULIC ENGINEERING SEMINAR*. Either term. Prerequisites to be arranged. Associate Professor DONLEY. Time to be arranged. Abstraction and discussion of selected technical papers and publications in the hydraulic engineering field.

## INDUSTRIAL AND ENGINEERING ADMINISTRATION

Professors H. J. LOBERG, C. I. MILLARD; Associate Professors A. SCHULTZ, JR., K. C. WHITE; Assistant Professors M. W. SAMPSON, C. R. SCOTT, B. W. SAUNDERS.

Graduate training in this department has two objectives: (1) to develop exceptional abilities in specific fields of Industrial and Engineering Administration, (2) to develop balanced training in the factors that are related to this specialization. The emphasis is on the development of initiative and self-reliance that go with individual study and the practical application of methods to working solutions. Aspects of economy and potential dollar return are stressed wherever feasible. Much of the work requires the integration of a knowledge of processes and process tools, product design, materials, methods, design of tools, jigs and fixtures, inspection, cost data, and market needs. Other projects might be wholly concerned with the development of systems or techniques by the application of basic principles of any of the above fields.

For undergraduate courses which often meet needs of graduate students, see the Announcement of the College of Engineering, Department of INDUSTRIAL & ENGINEERING ADMINISTRATION, COURSES 3231, 3235, 3241, 3232, 3270, 3262, 3263, 3265, 3250, 3272, 3254, 3261, 3252. Preregistration is required for all courses.

3281. BUSINESS AND INDUSTRIAL RESEARCH. Credit one hour for each forty hours of actual work. Professor LOBERG 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.

3282. ADVANCED INDUSTRIAL ENGINEERING. Each term. Credit one hour for forty hours of actual work. Open to a limited number of seniors and graduates. Professor MILLARD and Associate Professor WHITE.

Special problems and investigations which are carried on under the direction of members of the department staff.

3242. STATISTICAL QUALITY CONTROL. Credit three hours. Prerequisite, 3241 or equivalent. Associate Professor Schultz.

Study of basic statistical applications in the field of industrial production and inspection. Various sampling, control, and inspection techniques are studied with special reference to practical applications. Underlying assumptions and limitations are discussed.

3271. INDUSTRIAL MARKETING RESEARCH. Credit three hours. Prerequisite, 3270. Professor LOBERG.

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Techniques of market research applied to specific problems related to industrial goods.

3290. SPECIAL INVESTIGATIONS IN INDUSTRIAL AND ENGINEERING ADMINISTRATION. Credit as arranged. Offered to qualified students individually or in small groups. Involves the study, under direction, of special problems in the field of Industrial and Engineering Administration.

#### TOPICS SUGGESTED FOR ADVANCED WORK

MOTION AND MICRO-MOTION ANALYSIS

PRACTICAL ECONOMIC AND PRODUCTION INVESTIGATIONS IN NEAR-BY INDUSTRIES ECONOMIC CONTROL OF QUALITY IN PRODUCTION

INDUSTRIAL MARKETING STUDIES

STATISTICAL ASPECTS OF QUALITY CONTROL

INDUSTRIAL APPLICATIONS OF STATISTICS

COST CONTROL THROUGH UNIT COSTS

PLANT LAYOUT AND MATERIALS HANDLING PROBLEMS

ENGINEERING ECONOMY STUDIES

ESTABLISHMENT OF MOTION AND TIME STANDARDS

PROBLEMS IN PRODUCTION AND MANAGEMENT CONTROL

PERSONNEL STUDIES - JOB EVALUATION AND MERIT RATING

## MACHINE DESIGN

Professors A. H. BURR, P. H. BLACK, and F. S. ROGERS; Associate Professors G. B. DUBOIS and R. T. HINKLE; Assistant Professors H. H. MABIE, F. SALTZ, and W. A. WHEELER, JR.

Opportunity is provided for graduate work in the application of theory and the results of experimental investigations to the design of machines and machine members, and provision is made for original work, under guidance, in the design and development of complete machines, and in the analysis and experimental investigation of machines and their components.

The College of Engineering Library and the Department have an excellent collection of books and periodicals related to machine design and analysis. There is a unique collection of mechanism models and machinery components. Photoelastic equipment, vibration and strain indicating instruments, balancing machines, and other apparatus are available for experimental investigations.

For undergraduate courses which may meet the needs of graduate students see the Announcement of the College of Engineering, Department of MACHINE DE-SIGN, courses 3352, 3353, and 3354. For these courses preregistration is required.

3361. ADVANCED MACHINE ANALYSIS. Fall term. Credit three hours. Prerequisite, 3337 or 3353 or equivalent. Professor BLACK or BURR. Three lecturediscussion periods a week. Preregistration required.

Advanced problems in the design and analysis of machine members; stressconcentration, wear, lubrication, creep, thermal stresses, rotating disks, shrinkfits, shaft deflections graphically, critical speeds, vibration mountings, and damping devices.

3366. ADVANCED KINEMATICS. Spring term. Credit three hours. Prerequisite, 3352 or equivalent. Professor Rogers. Two lecture-discussion periods and one design period a week. Preregistration required.

Advanced graphical and semi-graphical treatment of velocities and accelerations. Further treatment of Coriolis' acceleration. Advanced analysis and design of cams, gears, and unique linkages. Synthesis of mechanism. [3367. ADVANCED DYNAMICS AND VIBRATIONS OF MACHINERY. Credit three hours. Prerequisites, 1155 and 3352. Not given in 1949–1950.]

3370. SPECIAL INVESTIGATIONS IN MACHINE DESIGN. Each term. Credit arranged.

Individual work or work in small groups under guidance in the design and development of a complete machine, in the analysis or experimental investigation of a machine or component of a machine, or studies in a special field of machine design.

3371. MACHINERY DEVELOPMENT LABORATORY. Fall term. Credit two hours. Prerequisite, 3337 or 3353. Professor BURR. One lecture and one laboratory period a week. Preregistration required.

Tests to determine design data and performance or modifications of machinery and machinery members, utilizing balancing machines, photoelastic apparatus, torque meters, and the measurement of wear, temperature, vibration, and strain.

3373. CREATIVE DESIGN. Fall term. Credit two hours. Prerequisite, 3338 or 3354. Professor DuBois. Two design periods a week. Preregistration required.

The development of improved designs by successive steps. Use of simple rules and sketches to stimulate ideas. Selection from resulting designs by comparisons of performance, cost of manufacture, and maintenance.

3375. *MACHINERY SURVEY*. Spring term. Credit three hours. Prerequisite, 3337 or 3353. Professor BURR. Three lecture-recitations a week. Preregistration required.

 study of the design features of industrial machinery such as power transmission equipment, automatic and semi-automatic machinery, and machinery for hoisting and conveying.

## TOPICS SUGGESTED FOR ADVANCED WORK

DESIGN AND DEVELOPMENT OF A SPECIAL MACHINE

BEARINGS AND LUBRICATION

SPECIAL GEAR TEETH, CAMS, OR LINKAGES

VIBRATION, NOISE, OR IMPACT IN A MACHINE

PHOTOELASTIC OR OTHER EXPERIMENTAL STRESS ANALYSIS OF A MACHINE COMPONENT

BALANCING OF ROTATION COMPONENTS

JIGS AND FIXTURE DESIGN

## MATERIALS PROCESSING

Associate Professors ERIK K. HENRIKSEN and ROGER L. GEER.

A general survey on an advanced background is given of the principal features of cutting tools, work and tool holding devices, and the machine tools, illustrated by the assignment of projects to be worked out in the laboratory, which also provides facilities for individual work on the measuring of performance and efficiency of tools and machines, testing and inspecting of equipment, experimental investigation of new methods, introduction of improvements, and participation in research projects.

3411. CUTTING TOOLS. Either term. Credit three hours. Prerequisite, 3403 or equivalent; desirable, 6110 or 1221 or equivalent. Associate Professors GEER and HENRIKSEN. Two lecture periods and one laboratory period a week.

The action of the cutting tool. Chip formation and built-up edge. Grain dis-

#### ENGINEERING

tortion, work hardening, and surface stresses. Chip pressure and its measurement. Tool wear and tool life, Woxen's Tool-like equation, Ernst-Merchant's forcediagram. Cutting fluids, their performance and application. Machinability of metals. Principal features of cutting tool; angles, nose radii, chip breakers, shear cutting, vibration, and chatter. Current types of single-point and multiple cutting tools. Tool grinding and maintenance.

3413. *MACHINE TOOLS*. Either term. Credit three hours. Prerequisite 3351 or equivalent. Associate Professors GEER and HENRIKSEN. One lecture period and two laboratory periods a week.

Classification of machine tools, dimensional capacities, current sizes and some exceptions from established practice. General practice for machine tool speeds and feeds, the arithmetical and the geometrical progression, limitations thereof. Mechanical, hydraulic, and electric drives for machine tools, performance, efficiency and fields of application. Problems of strength and rigidity in machine tools. Prevention of vibration and chatter. Machine tool slides and ways. Some principal elements of machine tools. Machine tool lubrication, testing, and manufacturing methods. Present trend in development. Obsolescence and modernization, care and maintenance.

## TOPICS SUGGESTED FOR ADVANCED WORK

FORCE MEASUREMENT ON TOOLS

TOOL WEAR AND TOOL LIFE

EFFECT OF CUTTING CONDITIONS ON WORK HARDENING AND SURFACE QUALITY CUTTING FLUIDS

TOOL LAY-OUT

PREVENTION OF CHATTER

PRECISION AND RIGIDITY PROBLEMS IN MACHINE TOOLS

Relative Performance of Mechanical, Hydraulic, and Electric Drives in Machine Tools

MODERNIZATION OF MACHINE TOOLS

## MANAGEMENT ENGINEERING

## IN CIVIL ENGINEERING

Professors R. Y. THATCHER; Associate Professors 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 2901.

Graduate students who have not had a course in engineering economics will take course 2903.

2901. CONSTRUCTION METHODS. Either term. Credit three hours.

2902. ENGINEERING LAW. Either term. Credit three hours.

2903. ECONOMICS OF ENGINEERING. Either term. Credit three hours.

2904. *PUBLIC ADMINISTRATION*. Required in fifth year. Either term. Credit three hours. Lectures and recitations three hours a week. Associate Professor CRANDALL.

A course to acquaint the prospective city engineer, superintendent of public works, city manager, or executive engineer in charge of various government bureaus or departments with the administrative problems he must face in addition to strictly technical engineering duties. Budgets, controlling legislation, civil service regulations, city planning, and public administration practices are included.

2905. VALUATION ENGINEERING. Credit three hours. Prerequisites 2901 and 2902. May be taken concurrently with course 2902. Associate Professor CRAN-DALL. 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.

2906. *ADVANCED ENGINEERING LAW*. Credit three hours. Prerequisite, 2902. Professor THATCHER. Lectures and recitations, three hours a week.

Some of the topics treated in course 2902 are here enlarged upon and extended, particularly laws relating to the various phases of construction contracts, employer-employee relationship, workman's compensation, mechanic's liens, patents, copyrights, trademarks, and insurance. Among other subjects covered are surety ship, 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.

2941. 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

Professors D. F. GUNDER, J. O. JEFFERY, J. R. MOYNIHAN; Associate Professors H. S. SACK, F. O. SLATE; Assistant Professors G. W. EHRHART, F. W. OCVIRK, W. J. PURCELL, J. R. YOUNG.

The Department of Engineering Materials offers work in both theoretical and experimental procedures for evaluating the properties of engineering materials. All graduate students are urged to acquire fundamental training in both of these phases. In addition to the courses listed below many of those listed under the departments of Mechanics, Metallurgy and Physics should be considered as appropriate and necessary supplements in an adequate training in the field of Materials Engineering. Adequate laboratory facilities are available for investigations in metals, concrete, cement, concrete aggregate, timber, plastics, fuels, lubricants, and miscellaneous materials. Preregistration is required in all courses. All courses are open to graduates or qualified undergraduates unless otherwise specified.

For undergraduate courses which often meet needs of graduate students, see the *Announcement of the College of Engineering*, Department of MATERIALS OF ENGINEERING, 1211, 1212, 1221, 1222, 1231, 1232, 1255, 1256.

1214. ENGINEERING RESEARCH IN MATERIALS. Either or both terms. Credit one hour for forty hours of actual work. Prerequisites, 1225 and 1226 or their equivalent. Associate Professor SLATE.

#### ENGINEERING

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.

1215. MATERIALS SEMINAR. Elective. Open to specially selected seniors or graduate students. Abstraction and discussion of technical papers and publications in the materials field. One one-hour period for each credit hour.

1251. ENGINEERING MATERIALS RESEARCH. Each term. Prerequisites, 1231, 1232. Professors MOYNIHAN and JEFFERY. 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.

1252. APPLIED PHYSICAL METALLURGY. Alternate terms. Prerequisite, 1231. Professors JEFFREY or MOYNIHAN. 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.

1253. PHYSICS OF ENGINEERING MATERIALS. Any term. Open to graduate students by permission. Associate Professor SACK, Engineering Physics.

This course offers opportunity for individual research in the field of physical properties of engineering materials and applications of physical methods to production control.

1261. *PLASTIC BEHAVIOR OF SOLIDS*. Fall term. Primarily for graduate students. Undergraduates with the consent of the instructor. Associate Professor SACK.

Phenomenological classification of plastic behavior; experimental procedures. Conditions for plastic flow; stress distribution and displacements, boundaries between plastically and elastically strained regions. Physical concepts of plasticity; single crystals and dislocations; relaxation phenomena; grain boundaries; mobility of molecules in plastics and elastomers; phenomena at transition points; chemical reactions.

#### TOPICS SUGGESTED FOR ADVANCED WORK

APPLIED PHYSICAL METALLURGY

CONTROL OF PROPERTIES OF ENGINEERING MATERIALS

PROPERTIES OF ENGINEERING MATERIALS, METALLIC OR NON-METALLIC

PHYSICS OF ENGINEERING MATERIALS

FUELS

INSULATING MATERIALS

LUBRICATION

**RADIOGRAPHIC EXAMINATION OF METALS AND ALLOYS** 

PROPERTIES OF PLASTICS

PROPERTIES OF LUBRICANTS

THERMAL QUALITIES OF QUENCHING LIQUIDS

LOW TEMPERATURE BEHAVIOR OF ENGINEERING MATERIALS

HEAT TREATMENT AND ISOTHERMAL QUENCHING

### MECHANICS

### MECHANICS

# Professors H. D. CONWAY, W. R. CORNELL, D. F. GUNDER; Associate Professors E. V. HOWELL, H. C. PERKINS; Assistant Professors C. B. MANSKY, F. W. OCVIRK.

The Department of Mechanics endeavors to serve a two-fold purpose in the field of graduate study. It offers training for men who intend to make teaching and academic research their field and for men who intend to devote their attention to industrial research. It is believed that both these groups are best served by a broad fundamental training and, although the work in this department is devoted primarily to the mechanics of particles and rigid bodies and of deformable solids, all students are encouraged to take work also in the fields of the mechanics of liquids and gases and in the related fields of Materials, Physics and Mathematics. Opportunity is provided for graduate students interested in teaching to participate in the teaching program in the University. Opportunity is likewise provided for those primarily interested in industrial research to participate in projects in this field. Candidates planning to complete a master's degree in one year must have had Mechanics 1154 and 1155 or the equivalent upon entering. Preregistration is required in all courses. All courses are open to graduates or qualified undergraduates unless otherwise indicated.

For undergraduate courses which often meet needs of graduate students, see the *Announcement of the College of Engineering*, Department of MECHANICS, courses, 1134, 1145, 1151, 1152, 1153, 1154, 1156, for all of which preregistration is required.

1140. *ADVANCED MECHANICS*. Prerequisites, 1137 and 1138. Associate Professor Howell. Three recitations a week. Fall and spring.

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.

1162. *MECHANICS OF VIBRATIONS*. Fall term. Prerequisite 1155 or equivalent. Elective for graduates and qualified undergraduates. Professor Conway.

Investigation of typical mechanical vibrations. Free and forced vibrations with one or more degrees of freedom; principles of isolation, transmission and prevention. Vibration of elastic bodies.

1163. APPLIED ELASTICITY. Spring term. Prerequisites, 1155 or a knowledge of elementary differential equations, and permission of the instructor. Professor CONWAY. Hours arranged.

General analysis of stress and strain. Airey's stress functions in cartesian and polar coordinates, trigonometric and strain energy methods; torsion of bars of arbitrary section, the membrane analogy, the Griffith-Taylor graphical method, effects of grooves, torsion of thin tubes.

1164. APPLIED ELASTICITY. Fall term. Prerequisites, 1170 or a knowledge of elementary Fourier's series and permission of the instructor. Professor CON-WAY. M W F 2.

Continuation of 1163, stress in thick cylinders and disks due to pressure, heating, and rotation; beams on elastic foundations; revision of Castigliano's theorem and virtual displacements, application to frameworks and rings, closed rings under hydrostatic pressure.

1165. THEORY OF ELASTIC STABILITY. Spring term. Prerequisites, 1154, 1155, or equivalents. Professor CONWAY.

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.

1167. THEORY OF PLATES AND SHELLS. Spring term. Prerequisite 1155 or knowledge of elementary differential equations and permission of instructor. Professor CONWAY.

History; differential equations of plates; plates with various shapes, loadings, and temperature stresses. Membrane and strain energy methods. Large deflection theory. Analysis of cylindrical, conical, ellipsoidal, and toroidal shells.

1168. ANALOGIES IN THE SOLUTION OF BOUNDARY VALUE PROB-LEMS OF ENGINEERING. Spring term. Prerequisite, permission of the instructor. Associate Professor CUYKENDALL.

Elementary theory of photoelasticity; the membrane, electrical potential, and hydrodynamic analogies; X-ray diffraction and other methods of stress valuation.

1170. ADVANCED MECHANICS. Spring term. Prerequisite, 1155 and permission of the instructor. Professor GUNDER.

The formulation and solution of problems in engineering mechanics by vector methods, Lagrange's equation, generalized coordinates, Fourier's series. Conservative systems. Text: Karman and Biot, *Mathematical Methods in Engineering* and supplementary material.

1171. *ADVANCED MECHANICS*. Fall term. Professor GUNDER. Continuation of 1170: non-conservative system, energy methods, impact loads, operational methods. Text: same as 1170.

1172. SELECTED TOPICS IN ADVANCED MECHANICS. Offered as required. Special studies in selected topics.

1181. ANALYSIS OF CURRENT LITERATURE IN APPLIED MECHANICS. Fall term. Open to graduate students only. Registration by permission of instructor only. Professor GUNDER.

Special training in the critical analysis and interpretation of technical papers currently appearing in the field of applied mechanics. Evaluation of assumptions, procedures, and conclusions of such papers. The preparation of critical discussions.

## TOPICS SUGGESTED FOR ADVANCED WORK

THEORY OF ELASTICITY

ELASTIC STABILITY

VIBRATION

FLUID MOTION

PHOTO-ELASTIC STRESS ANALYSIS

## RAILROAD ENGINEERING

Associate Professor J. E. PERRY.

2602. TRANSPORTATION. Both terms. Credit three hours. Associate Professor PERRY. Lectures and recitations three hours a week, as scheduled.

A course covering travel and transport agencies with special reference to their facilities, ownership, financing, regulation and co-ordination.

2603. *RAILROAD MAINTENANCE OF WAY*. Credit three hours. Prerequisite, course 2110. Associate Professor PERRY. Lectures and recitations three hours a week. Hours to be arranged.

The course includes the general principles and purposes underlying track design and maintenance. An intensive study is made of the materials, equipment,

and methods used in maintaining the permanent way of the American railroads under various conditions of traffic and climate.

2604. RAILROAD OPERATION AND MANAGEMENT. Credit three hours. Prerequisite, course 2110. Associate Professor PERRY. Lectures and recitations three hours a week. Hours to be arranged.

Subjects treated under organization: general principles underlying organization; the principal departments of the railway service; departmental and divisional systems of organization, with examples on various roads. Freight traffic, freight houses, classification yards, car service rules, accounting, etc., are among the topics considered under operation.

2641. 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 economic location of railroads, different types of structures, turntables, engine houses, track layouts, and terminal design.

2642. RAILROAD ENGINEERING RESEARCH. Any term. Credit three or more hours.

Special problems in 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 the application of electricity in transportation in the School of Electrical Engineering.

## SANITARY ENGINEERING

Professor H. M. GIFFT; Assistant Professors R. G. BOND and C. D. GATES.

For undergraduate courses which often meet the needs of graduate students, see the *Announcement of the College of Engineering*, School of CIVIL ENGINEERING, courses 2501, 2502, 2503.

2504. SANITARY BIOLOGY. Either term. Assistant Professor GATES. Three credit hours, one lecture and two laboratory periods.

A study of the fundamentals of biological and bacteriological methods, with application of these methods and fundamentals to engineering, with emphasis on water, sewage, and waste polluted streams.

2506. ADVANCED WATER SUPPLY. Spring term. Prerequisite 2502. Professor GIFFT. Three credit hours, two recitations and one computing or laboratory period.

A comprehensive study of principles and methods involved in the design, construction, and operation of water supply and treatment facilities including reference to and inspection of typical existing plants.

2507. ADVANCED SEWERAGE WORKS. Fall term. Prerequisite 2503. Professor GIFFT. Three credit hours, two recitations and one computing or laboratory period.

A comprehensive study of principles and methods involved in the design, construction, and operation of sewerage and wastes treatment works, including reference to and inspection of typical existing plants.

2508. INDUSTRIAL WASTES. Either term. Prerequisite 2503. Professor GIFFT. Three credit hours, three lecture-recitation periods.

A study of the production of wastes from industrial processes and their methods of treatment, disposal, elimination, or by-product recovery.

2509. PUBLIC HEALTH. Spring term. Assistant Professor BOND. Three credit hours. Three lecture-recitation periods.

Organization and functioning of federal, state, local health departments, public health activities, including vital statistics, communicable disease control, public health laboratory, health education, environmental sanitation. Course content adjusted to needs of students enrolled.

2510. ENVIRONMENTAL SANITATION. Fall term. Assistant Professor BOND. Three credit hours, three lecture-recitation periods.

Public health engineering standards and practices in sanitation programs, private water supply and waste disposal, industrial hygiene, milk and food sanitation, air disinfection, insect and rodent control, housing, swimming pool design.

2511. WATER AND SEWAGE ANALYSIS. Either term. Assistant Professor GATES. Three credit hours. One lecture and two laboratory periods.

A study of laboratory methods for the analysis of water and sewage and the underlying physical and chemical principles; the application of these methods and principles to water and sewage treatment.

2541. SANITARY ENGINEERING DESIGN. Either term. Prerequisites 2502 or 2503. Professor GIFFT. Three or more credit hours, as arranged.

Practical problems in design of sanitary engineering facilities, such as separate or combined sewerage systems; municiple, institutional, or industrial water or waste treatment plants or problems related thereto.

2542. SANITARY ENGINEERING RESEARCH. Either term. Professor GIFFT, Assistant Professors BOND and GATES. Three or more credit hours, as arranged.

2543. SANITARY ENGINEERING SEMINAR. Either term. Professor GIFFT, Assistant Professors BOND and GATES. One or more credit hours, as arranged.

Abstraction and discussion of technical papers and publications in the Sanitary Engineering and Public Health fields.

## STRUCTURAL ENGINEERING

Professor GEORGE WINTER; Associate Professors E. N. BURROWS, B. K. HOUGH, R. M. MAINS; Assistant Professor G. P. FISHER.

Preregistration is required for all courses in Structural Engineering.

For undergraduate courses which often meet needs of graduate students, see the Announcement of the College of Engineering, School of CIVIL ENGINEERING, courses 2704, 2720, 2725, for which preregistration is required.

2706. STEEL BUILDINGS. Either term. Prerequisite 2703. Professor Burrows. Three credit hours.

Design of steel frame building with traveling crane of the type used for power house, shop, or warehouse construction. Maximum stresses by combination of various loads. The design includes columns, column footings, crane runways, bridge crane, girts, location, and size of windows. Detail drawings.

2707. STEEL BRIDGES. Either term. Prerequisite 2703. Professor BURROWS. Three credit hours.

Design of a truss bridge with cantilever sidewalks, or of a three-hinged spandrel-braced arch bridge. Determination of deflection, amount of camber, and thickness of wedges on erection bents.

2708. INVESTIGATION AND RATING OF EXISTING STEEL STRUC-TURES. Either term. Prerequisite 2703. Professor Burrows. Three credit hours. Measurement of span and length of members of an existing steel bridge or other structure to determine size and weight of shapes and reduced sections due to corrosion. Determination of deflection and stresses in individual members and safe capacity or rating of structure as governed by the weakest member.

2709. ADVANCED STRUCTURAL ANALYSIS. Spring term. Prerequisite 2704. Professor MAINS. Three credit hours.

Critical comparison of fundamental methods for the solution of statically indeterminate structures and extension to more involved problems. Column analogy, members of variable cross-section, secondary stresses, wind stresses, Vierendeel trusses. Use of influence lines, numerical methods, and model analysis for design. Design problems.

2710. STRENGTH OF STRUCTURES. Fall term. Prerequisite or parallel 2704. Professor WINTER. Three credit hours.

Analysis of two- and three-dimensional stress and strain. Theories of failure of ductile and brittle materials. Energy methods applied to bending, shear, buckling, and impact. Structural materials under load, strain hardening, residual stresses, hysteresis, stress concentration, alternating stress. Design for fatigue. Stresses beyond the elastic limit. Plastic or ultimate design of steel and reinforced concrete structures. Critical discussion of current design specifications.

2711. BUCKLING OF STRUCTURES. Spring term. Prerequisite 2710 and differential equations. Professor WINTER. Three credit hours.

Analysis and design involving elastic stability. Determination of buckling loads and maximum stresses of columns with or without initial crookedness and eccentricity. Solid and open web columns with variable cross-section. Beam columns. Lateral strength of unbraced beams. Buckling loads and ultimate strength of thin, compressed plates. Design of thin-walled steel structures. Critical discussion of current design specifications.

2712. TANKS, BINS, AND ROOFS. Spring term. Prerequisite 2715, 2704, and differential equations. Professor WINTER. Credit three hours.

Analysis and design of domes, tanks, reservoirs, bunkers, bins, and long-span roofs in reinforced concrete (plain and prestressed). Methods of analysis include theory of plates and shells, advanced beam theory, hipped plate construction.

2716. ADVANCED REINFORCED CONCRETE DESIGN. Either term. Prerequisite 2715. Professor MAINS and FISHER. Credit three hours.

Comparative design of large retaining walls. Multiple footings. Flat slab construction. Special floor systems. Elements of arch analysis with application to a simple design.

2717. *REINFORCED CONCRETE BRIDGES*. Either term. Prerequisite 2715 and 2704. Professor FISHER. Three credit hours.

Analysis and design of reinforced concrete bridges such as continuous slab, deck and trough girder, and rigid frame bridges, and of culverts.

2723. LONG SPAN BRIDGES. By arrangement. Prerequisite 2709, Differential Equations. Professor WINTER. Three credit hours.

Theory and design of suspension bridges and other, special bridge systems.

2726. SOILS ENGINEERING THEORY. First term. Prerequisite 2725. Professor Hough. Three credit hours.

Principles of mechanics relating to typical soils engineering problems and the fundamental physical and chemical characteristics of soil. Distribution of stresses in semi-infinite soil masses and the Mohr theory of rupture. Composition, structure, and stress-strain characteristics of soil. Settlement of structures, the stability of earth slopes and of embankment foundations. Flow of water through soil, and effect of seepage on stability of structures. Lateral earth pressure theory. 2727. APPLIED SOILS ENGINEERING. Second term. Prerequisite 2726. Professor Hough. Three credit hours.

Applications of Soils Engineering Theory to practical problems. Subsurface investigations, determinations of physical and chemical soil characteristics by test, analysis of actual designs of structures for prediction of settlement, stability, rate of seepage or other service requirements, methods for inspection and control of earth works construction and stabilization. Two lectures and one long period a week.

2741. STRUCTURAL ENGINEERING DESIGN. Either term, by arrangement. Professors WINTER, BURROWS, MAINS, FISHER. The student may select the design of any structure of particular interest to him, provided he has the required preparation.

2742. STRUCTURAL ENGINEERING RESEARCH. Either term, by arrangement. Professors WINTER, MAINS, FISHER. Supervised analytical or experimental research in any field of structural engineering of interest to the student.

2743. *STRUCTURAL ENGINEERING SEMINAR*. Either term, by arrangement. One to six hours credit. Abstraction and discussion of technical papers and publications, or original research in the field of structures.

## TOPOGRAPHIC AND GEODETIC ENGINEERING

Professor P. H. UNDERWOOD; 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.

2104. TOPOGRAPHIC SURVEYING AND MAPPING. Elective for upperclassmen and graduate students. Three hours credit. Prerequisite course 2103. Professor UNDERWOOD. Methods of making topographic surveys for mapping to large scales. The use of the plane table. Special problems, such as three-point. Mapping practice, such as construction of a map of a portion of the area covered by field work in course 2103.

2105. *LEAST SQUARES*. Adjustment of Observation. Elective for upperclassmen and graduate students. Three hours credit. Prerequisite, Calculus and Physics. Professor UNDERWOOD. The course is designed for students who have experimental investigations in view, or who are interested in geodesy. The fundamental principles of least squares, with applications to the adjustment of observations. Applications to geodetic surveying, astronomy, etc. Derivation of empirical formulae.

2106. ADVANCED TOPOGRAPHIC SURVEYING. Elective for upperclassmen and graduate students. Credit two hours. Prerequisite, course 2103. Professor UNDERWOOD. Economics of surveying methods. Surveys for special purposes. Earthwork on a large scale. Surveys of lines of communication, topographic reconnaissance, photographic surveying.

2107. GEODESY AND GEODETIC LABORATORY. Elective for upperclassmen and graduate students. Prerequisites, courses 2102 and 2103. Credit three hours. Professor UNDERWOOD. A course for consideration of special problems in geodetic work. Subject to arrangement, to meet the needs of students electing the course.

2108. PHOTOGRAPHIC AND AERIAL SURVEYING. Elective for upperclassmen and graduate students. Prerequisite, course 2102. Three hours credit. Professor UNDERWOOD. The principles of photographic surveying; surveys with camera station on the ground; aerial surveys and making maps from such surveys; ground control.

2109. MAP PROJECTIONS AND MAPPING. Elective for upperclassmen and graduate students. Credit three hours. Professor UNDERWOOD. The theory of map projections. Construction of projections. Plane coordinate systems. Map reproduction. Practice in topographic surveying, and in mapping.

2142. (a) *GEODETIC ASTRONOMY*. Prerequisites, courses Astronomy 186 and 2105. Investigation of instrumental errors; variations of latitude and azimuth; and all questions relating to work of the highest precision connected with astronomical problems and geodetic operations.

(b) *GEODETIC ENGINEERING RESEARCH*. Prerequisites will depend upon the line of work to be pursued. Special problems in least squares, reduction of triangulation, and photographic surveying.

2143. SEMINAR IN GEODESY. One to six hours credit. Elective. Open to specially selected seniors or graduate students. Abstraction and discussion of technical papers and publications in the geodetic field.

## DESCRIPTIVE GEOMETRY AND DRAWING IN CIVIL ENGINEERING

For undergraduate courses which often meet needs of graduate students, see the *Announcement of the College of Engineering*, School of CIVIL ENGINEERING, courses 2001 and 2002.

2004. ADVANCED DRAWING. Either term. Prerequisite courses, Engineering 2002, or equivalent. Professor JENKINS. Credit and hours to be arranged.

Problems in concrete, structural, topographical, highway, and sanitary drafting; engineering drawings, rendered in color or perspective, to enable the student to supplement ordinary working drawings with artistic representations so portrayed as to be readily intelligible to non-technical persons.

# 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.

## Preregistration of graduate students required in all courses.

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 Plan A.

# CHILD DEVELOPMENT AND FAMILY RELATIONSHIPS

Professors Robert Dalton, URIE BRONFENBRENNER, LEMO ROCKWOOD, ETHEL WAR-ING; Associate Professors Mary Ford, Katherine Reeves, Russell Smart; and Mr. Harold Feldman.

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

Child Development and Family Relationships 1, 2, 3, 4

Child Development 2, 3, 4

Child Guidance 2, 3, 4

Family Relations 2, 3, 4

Marriage 3, 4

Family Counseling 3, 4

As a basis for graduate work in Child Development and Family Relationships elementary courses in psychology, sociology and/or child development and family relationships are required. As a background for advanced work some experience in one of the following areas is also desirable: teaching or other experience with young children, school children, adolescents, or adults; social or clinical work; or extension teaching or administration.

In addition to course work the department offers opportunities for field work with families and with young children. Laboratory experience is provided in the department nursery school, in public nursery schools, play groups in the settlement houses, and in other organized groups.

## Preregistration required in all courses.

For undergraduate courses which often meet needs of graduate students, see the Announcement of the College of Home Economics, Department of CHILD DE-VELOPMENT AND FAMILY RELATIONSHIPS, courses 120, 140, 150, 215.

[303. HISTORY AND PHILOSOPHY OF EARLY CHILDHOOD EDUCA-TION. Fall. Credit three hours. Not offered in 1949–1950.]

305. METHODS OF CHILD STUDY. Spring. Credit two hours. Primarily for seniors and graduate students. Limited to twelve students. Prerequisite, twelve or more credit hours in Child Development and Family Relationships and/or Psychology and Child Development and Family Relationships 330, or permission of the instructor. Associate Professor FORD, T Th 9. Room G 22. 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 OF CHILD GUIDANCE. Fall and spring. Credit three hours. Weekly small group discussions. Professor WARING. M W F 8. Room 124.

Guidance procedures are studied as they reveal basic personal relationships between adults and children. Students share their records of observation in the nursery school, discuss them in small groups, and apply their learnings to varied conditions.

[315. CHILD DEVELOPMENT. Advanced course. Spring. Credit three hours. Not offered in 1949–1950.]

[325. EXCEPTIONAL CHILDREN IN THE FAMILY. Fall. Credit three hours. Not offered in 1949–1950.]

330. PARTICIPATION IN NURSERY SCHOOL. Fall and spring. Credit three hours. Open to qualified upperclass and graduate students. Number of students limited. Permission of the instructor required. Prerequisite for Home Economics Education students, Child Development and Family Relationships 310. For all other students, Child Development and Family Relationships 140 is recommended (but not required) as a preceding or parallel course. Assistant Professors HARRIS and BARRETT, and Miss MARSH.

Four laboratory hours in blocks of two, three, or four morning hours (9–1), plus an occasional 2 o'clock hour. Discussions, T 3–4:30, Th 3–4. Room 121.

Experience with children in the nursery school situation, supplemented by readings and discussions.

331. ADVANCED PARTICIPATION. Fall and spring. Credit three hours. Prerequisite, Child Development and Family Relationships 310 and 330a. Number of students limited. Permission of the instructor required. Assistant Professors HARRIS and BARRETT, and Miss MARSH.

Six laboratory hours in blocks of two, three, or four morning hours (preferably at least one 3-hour block). Discussion, T 3 plus an arranged hour. Room 121.

Opportunity to assist in the teaching program with an age group different from that in course 330.

332. SPECIALIZED PARTICIPATION. Fall and spring. Credit and hours to be arranged. Prerequisite, Child Development and Family Relationships 330a and permission of the instructor. Associate Professor Reeves, Assistant Professors HARRIS and BARRETT, and Miss MARSH.

Opportunity to assist in the city child care center or cooperative schools or to pursue a special interest in some aspect of the nursery school program.

360. DYNAMICS OF PERSONALITY. Fall. Credit three hours. Open to juniors, seniors, and graduate students. Prerequisite: one course in Child Development and Family Relationships or Psychology. Limited to forty-five students. Professor DALTON. M W F 11. Room 124.

A study of the development of the personality in the American culture. Special attention will be given to some of the basic determinants of personality; the development of control and structure in the individual; unconscious processes as they influence behavior; and some of the directive forces in behavior.

370. MARRIAGE. Spring. Credit three hours. Permission to register for course must be obtained from Professor Rockwood. Each section limited to 45 students. Final assignment to a specific section is made by the instructor in order to insure as equal a distribution as possible of men and women and different college groups in each section. Professors Rockwood and SMART. M W F 10 or 11. Room 121.

This course is designed to meet the needs of students who plan to marry within the near future. The focus of attention is upon the husband-wife relationship, the experiences that precede it and the adjustments growing out of it. Topics considered are: psychological readiness for marriage; health and hereditary factors related to marriage; courtship and engagement; marriage interaction; sex life in marriage; parenthood; family administration; family crises and ways of meeting them; family and marriage counseling.

373. THE INFANT AND HIS FAMILY IN OUR CULTURE. Spring. Credit three hours. Open to juniors, seniors, and graduate students. Limited to twenty students. Associate Professor SMART. T Th S 9. Room 3M11.

Study of the literature on the development of infants and its implications for the provision of optimal environmental conditions. Prenatal development is considered for the light it throws on development during the first two years. The family is seen as the mediator between the needs of the infant and the demands of the culture.

403. SPECIAL PROBLEMS FOR GRADUATE STUDENTS. Fall and spring. Credit and hours to be arranged. Department STAFF.

For graduate students recommended by their chairmen and approved by the head of the department and the instructor in charge for independent, advanced work.

[405. SEMINAR - RESEARCH METHODS. Fall. Credit two hours. Not offered in 1949-1950.]

407. THESIS AND RESEARCH. Fall and spring. Credit and hours to be arranged. Registration by permission of the instructor. Professor WARING, Associate Professors FORD and SMART, Mr. FELDMAN and ————.

415. SEMINAR IN CHILD DEVELOPMENT. Spring. Credit three hours. Open to graduate students by permission of the instructor. Limited to twenty students. Prerequisite: Child Development and Family Relationships 360, or equivalent. Professor DALTON. Th 2-4:30. Room G-22.

Critical discussion of selected theoretical, clinical, and research literature in child development. Emphasis will be placed upon understanding the process of development of the personality structure.

[420. PROSEMINAR IN CHILD DEVELOPMENT AND FAMILY RELA-TIONSHIPS. Fall. Credit three hours. Not offered in 1949–1950.]

[440. SEMINAR – THE FAMILY. Throughout the year. Credit two hours. Not offered in 1949–1950.]

450. SEMINAR – 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-22.

460. FAMILY RELATIONSHIPS AND FAMILY DEVELOPMENT. Fall. Credit three hours. Professor Rockwood. T Th 11-12:30. Room 121.

This course is concerned with the dynamics of family interaction throughout the cycle of family life. The topics which receive major consideration are: the problems that the cultural pattern presents to the individual and to the family and those that the individual and the family present to the culture in successive stages of the family cycle; family crises and ways of meeting them; means for strengthening family life.

475. FAMILY LIFE EDUCATION AT THE COLLEGE AND SECONDARY

SCHOOL LEVELS. Spring. Credit three hours. Professor Rockwood. T and Th 11 to 12:30. Room 121.

This course considers developments in family life education in the past thirty years; philosophy and emphasis in programs of family life education at the college and secondary school levels; the teacher as counselor; professional preparation.

[480. PERSONAL COUNSELING. Spring. Credit three hours. Not offered in 1949–1950.]

## ECONOMICS OF THE HOUSEHOLD AND HOUSEHOLD MANAGEMENT

Professor HELEN CANON; Associate Professors ELLA M. CUSHMAN, MABEL ROLLINS, LUCILLE WILLIAMSON, and MARY KOLL HEINER; 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, sociology.

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, sociology, psychology, physics, chemistry, and bacteriology are also useful.

### Preregistration of graduate students required in all courses.

For undergraduate courses which often meet needs of graduate students, and in which provision is made for separate discussion hours with graduate students, see the *Announcement of the College of Home Economics*, Department of Eco-NOMICS OF THE HOUSEHOLD AND HOUSEHOLD MANAGEMENT, courses 130, 260, 310, 320, 330.

400. *REVIEW OF RESEARCH IN HOME MANAGEMENT*. Fall. Credit two hours. Prerequisite or parallel, Economics of the Household 310. The instructor should be consulted before registering. Professor CANON. Th 2–4. Room 108.

Evaluation of results and methods of research in management.

403. SPECIAL PROBLEMS FOR GRADUATE STUDENTS. Fall and spring. Credit and hours to be arranged. Department staff.

For graduate students recommended by their chairmen and approved by the head of the department and the instructor in charge for independent, advanced work.

407. THESIS AND RESEARCH. Fall and spring. Registration with permission of the instructor. Professor CANON; Associate Professors CUSHMAN, ROLLINS, WILLIAMSON, and HEINER, and Assistant Professor AIKIN.

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. Prerequisite, Economics of the Household 330 or the equivalent. 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. SEMINAR. Fall and spring. For graduate students. Department Staff. T 4–5:15. Room 114.

## FOOD AND NUTRITION AND INSTITUTION MANAGEMENT

- Food and Nutrition: Professors J. K. LOOSLI, CATHERINE PERSONIUS, L. A. MAY-NARD, FAITH FENTON, HAZEL HAUCK, C. M. MCCAY, MARION PFUND, GRACE STEININGER; Associate Professors ALICE BRIANT, CHARLOTTE YOUNG; Assistant Professor FRANCES JOHNSTON.
- Institution Management: Professor Katharine Harris; Associate Professors Mar-Ion Neidert, Dorothy Proud; Assistant Professors Helen Ripley, Marion Wood.

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 Management 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.

Advanced work in institution management requires undergraduate courses in this subject and/or food and nutrition with some administrative experience in the field of managerial dietetics.

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, Professor MAYNARD.

Preregistration of graduate students is required in all courses.

## FOOD AND NUTRITION

For undergraduate courses which often meet needs of graduate students, see the *Announcement* of the College of *Home Economics*, Department of FOOD AND NUTRITION, courses, 103, 190, 214, 215, 225, 230, 240, 250, 260.

305. FOOD DEMONSTRATIONS. Fall and spring. Credit one hour. Prerequi-

sites, Food and Nutrition 103, 215, or 225. Registration with permission. Associate Professor Foster. T Th 2:30-4. Room 275.

Emphasis on the purposes and techniques of demonstration 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 215 or 225, and 240 or 260, or the equivalent. Registration with permission. Professor PFUND. T Th S 8. Room 339.

The scientific principles necessary to the understanding of modern theory and practice in the field of food preparation. Historical and current literature is reviewed.

320. EXPERIMENTAL COOKERY. Spring. Credit three hours. Prerequisites, Food and Nutrition 215 or 225, and 240 or 260; Food and Nutrition 310 is recommended to precede this course. Registration with permission. Professor PERSONIUS. W F 8–11, or T Th 10–1. Room 426, 361.

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.

325. SEMINAR – FROZEN FOOD. Spring. Credit one hour. Sponsored jointly with the School of Nutrition. Primarily for graduate and senior students in Agriculture, Home Economics, Hotel Administration, and the School of Nutrition. Registration with permission. Professor FENTON in charge. Th 2. Room 339.

Lectures on each subject will be given by a staff member who is currently engaged in research in that area.

Selection and processing vegetables; selection and processing fruits; selection and processing meats; packaging materials and methods; freezing rates; freezing methods and equipment; storage; precooked or prepared foods; thawing and cooking; economic trends; patron and consumer desires; quality control.

330. *DIET THERAPY*. Fall. Credit three hours. Prerequisite, Food and Nutrition 230 or the equivalent. Registration with permission. Professor HAUCK. T Th 8, F 2. Room 426.

Diet in diseases such as fevers, gastro-intestinal disturbances, and diabetes.

340. FAMILY NUTRITION, WITH SPECIAL EMPHASIS ON CHILD FEED-ING. Fall and spring. Credit two hours. Prerequisite, Elementary Nutrition. Miss

-----. W F 8. Room 339. Special emphasis on the nutritional needs of the child. Relation of nutrition to physical growth and development.

341. LABORATORY IN FAMILY AND COMMUNITY NUTRITION. Fall. Credit one hour. Prerequisite or parallel, Food and Nutrition 340 or the equivalent. Miss ————. Th 11–1. Room 3M11.

Problems in community nutrition programs. Practice with low-cost diets and diets for various nationality groups; preparation of illustrative material.

342. CHILD FEEDING LABORATORY. Spring. Credit one hour. Prerequisite, 340 or equivalent. Miss ————. Th 10–12.

Laboratory experience in planning and preparing meals for families with children. Observation of and experience with feeding children in nursery schools.

360. SEMINAR IN FOOD AND NUTRITION. Fall. Credit one hour. Primarily for seniors; open to graduate students. Prerequisites, Elementary Nutrition and Food and Nutrition 215 or 225. Professor FENTON and Miss ————. Th 2. Room 3M11.

Study of historical and current literature.

[400. *READINGS IN NUTRITION*. Spring. Offered in alternate years. Credit two hours. Registration with permission of instructor. Professor HAUCK. T Th 11. Not given 1949–1950.]

Critical review of literature in the field of vitamin and mineral metabolism, with emphasis on the experimental data on which the principles of human nutrition are based.

401. *READINGS IN NUTRITION*. Spring. Credit two hours. Registration with permission of the instructor. Professor HAUCK. T Th 11. Room 301.

Critical review of literature on energy metabolism, proteins, fats, and carbohydrates with emphasis on experimental data on which the principles of human nutrition are based.

403. SPECIAL PROBLEMS FOR GRADUATE STUDENTS. Fall and spring. Credit and hours to be arranged. Department staff.

For graduate students recommended by their chairmen and approved by the head of the department and the instructor in charge for independent, advanced work.

407. THESIS AND RESEARCH. Fall and spring. Credit and hours to be arranged. Registration with permission of the instructor. Professors PERSONIUS, MAYNARD, FENTON, HAUCK, MCCAY, PFUND, and STEININGER; Associate Professors BRIANT, LOOSLI, and YOUNG; Assistant Professor JOHNSTON.

420. ADVANCED SEMINAR IN NUTRITION. Fall. Credit one hour. Assistant Professor JOHNSTON and Department Staff. T 4. Room 301.

421. ADVANCED SEMINAR IN FOOD. Spring. Credit one hour. Associate Professor BRIANT and Department Staff. T 4. Room 301.

440. NUTRITION OF GROWTH AND DEVELOPMENT. Spring. Credit two hours. Prerequisite, 230 or equivalent. Miss -----. T Th 8. Room 301.

Relation of nutrition to growth and development from the prenatal period to adulthood. A study of research literature.

*Note:* See FOOD SCIENCE AND TECHNOLOGY for graduate research in biochemistry and bacteriology, particularly as applied to food problems. Attention is also called to the courses offered in other departments of the University, listed in the *Announcement of the School of Nutrition*.

## INSTITUTION MANAGEMENT

## Preregistration of graduate students required in all courses.

For undergraduate courses which often meet needs of graduate students, see the Announcement of the College of Home Economics, Department of INSTITUTION MANAGEMENT, courses 220, 230, 240, 300.

\$10. CATERING. Fall and spring terms. Credit, three hours. Prerequisite courses 220, 240 and 230. Assistant Professor RIPLEY and Miss —————. Lecture and discussion S 9–10. Laboratory W 2–7:30. Special catering assignments require 15 to 20 hours in addition to the scheduled laboratory.

Practice in the organization of work and the preparation and service of food for dinners and special catering projects.

320. ORGANIZATION AND ADMINISTRATION. Spring term. Credit, four hours. Prerequisite, courses 100, 230 and 240 or their equivalent. Professor HARRIS. Lectures and discussion, M and F 2–4.

A study of administrative problems and current practices in food service operation. Emphasis is given to kitchen planning and the selection of equipment.

330. QUANTITY FOOD PREPARATION AND CATERING, ADVANCED

COURSES. Fall and spring terms. Five credit hours. Prerequisite, courses 220, 230 and 240. Assistant Professor RIPLEY. Lecture and discussion, S 9–10. Laboratory T and Th 8:30–2. Special catering assignments require 25 to 30 hours in addition to the scheduled laboratories.

Practice in the organization of work, making menus, calculating costs, preparing food and supervising service for luncheons and special catering projects as assigned.

350. INSTITUTION PRACTICE. Fall and spring terms. Credit, three hours. Prerequisite, courses 220, 230 and 240. Professor HARRIS and cooperators. Conference hour, alternate weeks, to be arranged. Practice assignments require approximately eleven hours each week.

Practice work in the various food service units on the campus or in the community.

403. SPECIAL PROBLEMS FOR GRADUATE STUDENTS. Fall and spring terms. Credit and hours to be arranged. Departmental Staff.

For graduate students recommended by their chairmen and approved by the instructor in charge for independent, advanced work.

407. THESIS AND RESEARCH. Fall and spring terms. Registration with permission of the instructor. Professor HARRIS.

410. SEMINAR IN INSTITUTION ORGANIZATION AND ADMINISTRA-TION PROBLEMS. Spring term. Credit one hour. For graduate students with adequate training in institution management. Professor HARRIS and Departmental Staff.

## HOME ECONOMICS EDUCATION

Professor MARGARET HUTCHINS; Associate Professors HELEN HOEFER and IRENE PATTERSON, Assistant Professors SARA BLACKWELL, CAROLYN CRAWFORD, and HELEN MOSER.

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

Home Economics Education 1, 2, 3, 4

The types of advanced degrees for which graduate students in Home Economics Education may become candidates are:

1. The degrees of Master of Science (Plan A or Plan B)

2. The degree of Master of Science in Education

3. The degree of Doctor of Philosophy

4. The degree of Doctor of Education

As a basis for graduate work in Home Economics Education, undergraduate courses in Home Economics and Education are desirable. Some experience with children and adults, such as teaching in extension and in schools, is advisable. The department offers opportunities for field experience in extension and school programs, at all age levels.

#### Preregistration of graduate students is required in all courses.

For undergraduate courses which often meet needs of graduate students, see the Announcement of the College of Home Economics, Department of HOME ECONOMICS EDUCATION, courses 320, 321, 330, 331.

403. SPECIAL PROBLEMS FOR GRADUATE STUDENTS. Fall and spring terms. DEPARTMENT STAFF. Credit and hours to be arranged.

For graduate students recommended by their chairmen and approved by the instructor in charge for independent advanced work.

407. THESIS AND RESEARCH. Fall and spring terms. Registration with permission of the chairman of the graduate committee and the instructor. Professor HUTCHINS, Associate Professors HOEFER and PATTERSON, Assistant Professors BLACKWELL, CRAWFORD, and MOSER. Credit and hours to be arranged.

435. METHODS AND MATERIALS IN TEACHING HOME ECONOMICS. Fall term. Credit two hours. Professor HUTCHINS. T 4-6. Room 121.

Provides opportunity for graduate study of methods of teaching home economics and for observation in the field. Designed for secondary school teachers, extension workers, college teachers, supervisors and other leaders. Estimated cost of field trips, \$3.

437. ADULT EDUCATION. Fall and spring terms. Credit two or three hours. Associate Professor PATTERSON. M 4 and other hours to be arranged. Room 124.

Planned for administrators, supervisors, extension agents, and teachers. Attention is focused on finding educational needs, planning programs and learning experiences for adults, leadership, promotion, philosophy, and evaluation in adult education. Opportunity is provided for participation in adult education activities. Time must be planned for observation. Estimated cost of transportation, \$3 to \$5.

438. TEACHING HOMEMAKING TO ADULTS. Fall and spring terms. Credit two or three hours. Associate Professor PATTERSON. T 10 and other hours to be arranged. Room 124.

Planned for students specializing in adult homemaking education. An advanced course which usually follows Adult Education 437. Experienced students may register by permission of instructor without 437.

Provides opportunity for experimentation with teaching materials and methods for adults. Attention is given to discussion, demonstrations, home visits, use of the radio, films, recordings, and other procedures for group and non-group teaching. Opportunity is provided for observation of and participation in adult programs. Estimated cost of transportation, \$3 to \$5.

449. CURRICULUM PLANNING IN HOME ECONOMICS. Spring term. Credit two or three hours. Field work is required. Assistant Professor BLACK-WELL. S 10. Room 124.

Design for students with teaching experience in schools, colleges, and the extension service. Provides opportunities for evaluation of home economics curricula and for development of curriculum materials.

Courses in general education and child development are desirable bases for this course. Estimated cost of field trips, \$3.

459. EVALUATION. Fall term. Credit two hours. Assistant Professor BLACK-WELL. Hours to be arranged. Room 121.

Designed to acquaint secondary school and college teachers, extension workers and educational research workers with techniques in appraising student progress and in over-all appraisal of educational programs. Provides opportunities for work on individual problems concerning construction and use of evaluation instruments.

[469. ADMINISTRATION OF HOME ECONOMICS. Spring term. Credit two hours. Professor HUTCHINS. Not given in 1949–1950.]

[479. RESEARCH IN HOME ECONOMICS EDUCATION. Credit two hours. Not given in 1949–1950.]

480. SEMINAR IN HOME ECONOMICS EDUCATION. Spring term. Credit one hour. DEPARTMENT STAFF. W 4-6. Room 124.

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## TEXTILES AND CLOTHING

[481. SUPERVISION IN HOME ECONOMICS EDUCATION. Credit two hours. Not given in 1949–1950.]

## TEXTILES AND CLOTHING AND HOUSING AND DESIGN

Textiles and Clothing: Professor BEULAH BLACKMORE; Associate Professors MURIEL BRASIE, ELSIE FROST MCMURRY, MARGARET HUMPHREY, and RUTH SCOTT.

Housing and Design: Professors VIRGINIA TRUE, NANCY M. ROMAN, and GLENN BEYER; Associate Professors DORA W. ERWAY and MABEL WILKERSON, Assistant Professor HELEN J. CADY.

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

Textiles and Clothing and Housing and Design 2, 3, 4

Graduate work for the Master's degree is offered in Textiles and Clothing and Housing and Design. Emphasis may be placed upon either Textiles and Clothing or Housing and Design.

## TEXTILES AND CLOTHING

## Preregistration of graduate students required in all courses.

The work in Textiles and Clothing may emphasize either the economic, sociological, educational, technical, or art aspects of the subject.

For undergraduate courses which often meet needs of graduate students, see the Announcement of the College of Home Economics, Department of TEXTILES AND CLOTHING, courses 100, 101, 110, 120, 130, 200, 205, 210.

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. Miss WHITE. W F 8–10. Room 353.

A laboratory course concerned with the chemistry involved in the study of fabrics.

310. HOUSEHOLD TEXTILES. Fall. 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.

320. PROBLEMS IN BUYING CLOTHING. Fall and spring terms. Credit three hours. For juniors, seniors, and graduate students. Associate Professor BRASIE. M W F 11.

This course offers further opportunities to study the problems and processes involved in clothing merchandizing and consumer education and to do independent work to meet individual needs in this field.

330. HISTORY OF COSTUME. Spring. Credit three hours. For upperclassmen and graduate students. Associate Professor McMurry. M W F 2. Room 216.

A course aimed to develop appreciation of costume as an expression of the life of the people, and of historic costume as a basis for designing stage and modern civil costume.

340. ADVANCED DRESSMAKING. Fall. Credit three hours. Prerequisite, Textiles and Clothing 200 or the equivalent. For upperclassmen and graduate students. Registration limited to sixteen students. Associate Professor HUM-PHREY. T Th 9–12. Room 234. Estimated cost of materials, \$20 to \$35. A course in advanced construction methods. Emphasis in this course will be given to finishing details and the handling of unusual fabrics and designs.

345. TAILORING. Spring. Credit three hours. Prerequisite, Textiles and Clothing 200 or the equivalent. For upperclassmen and graduate students. Registration limited to sixteen students. Associate Professor HUMPHREY. T Th 9–12. Room 234.

A course in custom tailoring which offers the opportunity of developing discriminating judgment in the selection of designs, suitable fabrics, and quality of construction detail. Materials provided by student after consulting the instructor. Estimated cost of materials, \$25 to \$50.

350. TEXTILES: ADVANCED COURSE. Fall and spring. Credit two hours. Prerequisite, Textiles and Clothing 130 or 310 or the equivalent. Miss WHITE. W F 11-1. Room 278.

A study of textiles with reference to raw materials. Methods and significance of physical testing. Development of a special problem selected by the student to meet individual interests. Estimated cost of materials, \$5 to \$15.

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 McMURRY. T Th 2-4:45. Room 217.

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 fabrics; use of historic and contemporary design sources; draping; sketching.

403. SPECIAL PROBLEMS FOR GRADUATE STUDENTS. Fall and spring. Credit and hours to be arranged. Department staff.

For graduate students recommended by their chairmen and approved by the head of the department and the instructor in charge for independent, advanced work.

407. THESIS AND RESEARCH. Fall and spring. Registration with permission of the instructor. Professor BLACKMORE, Associate Professors BRASIE, MCMURRY, HUMPHREY, and Scott.

410. SEMINAR 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. SEMINAR IN TEXTILES AND CLOTHING. Spring. One hour by arrangement. For graduate students. Room 216. Department staff.]

## HOUSING AND DESIGN

## Preregistration of graduate students required in all courses.

Before entering upon advanced work in Housing and Design 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.

For undergradaute courses which often meet needs of graduate students, see the Announcement of the College of Home Economics, Department of HOUSING AND DESIGN, courses 100, 110, 130, 160, 170, 200, 216, 220, 235.

305. FASHION ILLUSTRATION. Spring term. Credit three hours. Prerequisites, Housing and Design 100 and Architecture 340 or the equivalent. Clothing courses desirable. Miss STRAIGHT. M W 10–1. Room 3M14.

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Requirements of knowledge and skills for fashion illustrator. Layouts for fashion advertisements, techniques for reproduction processes in newspaper and magazine fashion illustration, fashion styles, presentation of work. Minimum materials, \$7.

320. HISTORIC FURNITURE AND INTERIOR DESIGN. Fall term. Credit two hours. Prerequisite, Housing and Design 220. Associate Professor WILKERSON. T Th 11. Room 317.

Developments of furniture and interior design through major historic periods to present, showing recurrence of structural forms adapted and modified and reflecting economic, political, and social aspects of the time.

325. FURNISHINGS: SPECIAL EMPHASIS ON DESIGN OF FURNITURE AND BACKGROUND. Spring term. Three credit hours. Prerequisite, Housing and Design 220. Limited to fifteen students. Associate Professor WILKERSON or Miss RENSHAW. Lecture W-2 Room 317. Laboratory M F 2-4. Room 408.

Built-in storage; planning, designing, working drawings; selection of form and scale; color; fabrics; evaluation of design quality of upholstered furniture; corrective design through adjustment of form and color.

350. SEMINAR IN FURNISHINGS. Fall term. One credit hour. Primarily for upperclassmen and graduate students. Department staff. F 4. Room 317.

400. SEMINAR IN CURRENT HOUSING PROBLEMS. Spring term. Credit three hours. Registration by permission of staff based upon student's training, experience, and interest. Professor BEYER and outside speakers. M 4–6. Room 3M11.

Seminar-discussion, lectures, reåding, reports. Typical problems discussed: social and economic aspects of housing, family needs and functional space requirements, influence of environment analysis and evaluation of housing data.

403. SPECIAL PROBLEMS FOR GRADUATE STUDENTS. Fall and spring terms. Credit and hours to be arranged. Department staff.

For graduate students recommended by their chairmen and approved by the head of the department in charge for independent, advanced work.

[405. GRADUATE COURSE IN HOUSE FURNISHINGS FOR EXTENSION WORKERS. Spring term. Credit six hours. Prerequisite, undergraduate courses in Furnishings, and/or experience in extension furnishings work. Registration by permission of the instructor. \_\_\_\_\_. M W F 8–12. Room 322. Not given in 1949–1950.]

For prospective or experienced Extension furnishings specialists or agents. Selection, arrangement, buying home furnishings for color, design, quality; upholstering, refinishing; lighting; paint, wall paper; slipcovers. Students prepare demonstration material for extension work. Minimum cost of materials, \$25.

407. THESIS AND RESEARCH. Fall and spring terms. Registration with permission of the instructor. Professors TRUE, ROMAN, and BEYER, Associate Professors ERWAY and WILKERSON, Assistant Professor CADY.

# HOTEL ADMINISTRATION

# Professors M. B. MEEK, F. H. RANDOLPH, LOUIS TOTH, JOHN COURTNEY, C. I. SAYLES, C. E. CLADEL, and D. E. LUNDBERG.

## 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 to students who have completed the undergraduate requirements of this department. 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.

## Preregistration of graduate students required in all courses.

For undergraduate courses which often meet needs of graduate students, see the Announcement of the Department of Hotel Administration, courses 81, 82, 114, 181, 182, 183, 184, 187, 240, 282, 283, 288, 340, 261, 262, 264.

HOTEL PLANNING (Hotel Engineering 265). Fall term, to be repeated in the spring term. Credit three hours. Open to seniors and graduate students. Discussion, T Th 9–11:30. 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). Fall term. Credit three hours. Lectures, M W F 10. East Roberts 222. Laboratory sections as assigned in alternate weeks. Associate Professor SAYLES.

HOTEL ACCOUNTING PROBLEMS (Hotel Accounting 185). Spring term. Credit two hours. Prerequisite, Hotel Accounting 182 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.

INTERPRETATION OF HOTEL FINANCIAL STATEMENTS (Hotel Accounting 186). Spring term. Credit two hours. Prerequisite, Hotel Accounting 182 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.

PROBLEMS IN ANALYSIS AND INTERPRETATION (Hotel Accounting 189). Fall term, to be repeated in the spring term. Credit two hours. Registration limited. Assistant Professor COURTNEY. Martha Van Rensselaer G-1.

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.

SEMINAR IN HOTEL ADMINISTRATION (Hotel Administration 153). Fall term, to be repeated in the spring term. Credit two hours. Registration limited. Professor MEEK.

A course devoted to the study of specific problems arising in the management of hotels.

PERSONNEL ADMINISTRATION IN HOTELS (Hotel Administration 119). Fall term, to be repeated in spring term. Credit three hours. Prerequisite, Hotel Administration 114 or its equivalent. Assistant Professor LUNDBERG.

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.

SEMINAR IN PERSONNEL ADMINISTRATION (Hotel Administration 219). Spring term. Credit two hours. Prerequisite, 119. Assistant Professor LUND-BERG.

An analysis of current problems in personnel administration.

# INDUSTRIAL AND LABOR RELATIONS

Professors M. P. CATHERWOOD, LEONARD P. ADAMS, C. KENNETH BEACH, EARL BROOKS, JOHN M. BROPHY, TEMPLE BURLING, M. GARDNER CLARK, LYNN EMER-SON, MARTEN S. ESTEY, ROBERT H. FERGUSON, DAVID HYATT, VERNON H. JENSEN, ALEXANDER H. LEIGHTON, PHILIP J. MCCARTHY, JOHN W. MCCONNELL, JEAN T. MCKELVEY, MARY MARQUARDT, PHILOMENA MARQUARDT, ROYAL E. MONTCOM-ERY, J. E. MORTON, MAURICE F. NEUFELD, ARNOLD TOLLES, WILLIAM F. WHYTE, BERTRAM F. WILLCOX, and A. L. WINSOR.

The New York State School of Industrial and Labor Relations in conjunction with other Schools and Departments of the University offers the following areas of specialization at the graduate level: Collective Bargaining, Mediation, and Arbitration; Economic and Social Statistics; Human Relations in Industry; Industrial Education; Industrial and Labor Legislation and Social Security; Labor Market Economics and Analysis; Labor Union History, Organization, and Management; and Personnel Management. Admission to graduate standing is determined by the Graduate School.

The School offers an opportunity for candidacy for the degrees of Master of Science in Industrial and Labor Relations (M.S. in I.L.R.) and Ph.D. In general, undergraduate specialization substantially equivalent to that offered by the School is a prerequisite for admission to the Graduate School. An applicant's work experience and other relevant activities will also be taken into account. Subject to the over-all limitation of the number of students which the School may admit, graduates of accredited institutions who are without the necessary undergraduate specialization, may apply for admission as special students.

Students interested in receiving the degree of Master of Science in Education may become candidates for this degree with specialization in Industrial Education.

A minimum of two terms of residence for the Master's and six terms of residence for the Ph.D. degrees are required by the Graduate School. Under appropriate circumstances, and with the approval of the candidate's Special Committee and of the Dean of the Graduate School, residence credit can be earned during the summer. Most candidates will require between one and two years to complete the degree of Master of Science in Industrial and Labor Relations, depending on the extent to which their prior training has provided specialization equivalent to that offered by the undergraduate program of the School, the amount of time spent on outside work, the academic work load, and similar factors.

In addition to courses available in the School, courses may be selected in other divisions of the University. A wide range of specialization within the field of Industrial and Labor Relations is possible. Details as to courses, thesis and examination requirements and other procedural matters may be determined by the applicant upon admission to graduate standing.

A candidate for the M.S. and Ph.D. degrees works under the direction of a Special Committee composed of two or three members of the faculty. For the Ph.D. degree, one major and two minor subjects, must be selected. Each of the areas of specialization listed below except Industrial and Labor Problems, may be selected by a candidate as either a major or a minor subject. The specific courses to be taken by a candidate for a graduate degree will be arranged with the approval of the candidate's Special Committee.

Candidates are expected to remove any substantial deficiencies in their knowledge of the courses required of undergraduates of the School of Industrial and Labor Relations. Unless his Special Committee determines that the candidate has had adequate preparation in the subjects listed below, each candidate for the degree of Master of Science in Industrial and Labor Relations is required to complete at least one course in each of at least six of the subjects listed as available for a major. The candidate for the Master's degree will normally complete additional courses in such of the above and other fields as advised by his special committee. In addition, a thesis is required.

The Industrial and Labor Relations Division of the Graduate School is currently revising and restating the requirements for the degree Master of Science in Industrial Relations. The revised statement is expected to be available in mimeograph form early in the second term of the academic year 1948–1949.

The candidate for the Ph.D., in addition to meeting the course work requirements for the Master's degree, will complete such additional courses offered in the School and elsewhere in the University as required by his Special Committee and, as his program progresses, will spend an increasing proportion of his time in graduate seminars and in research relating to his thesis.

A more complete statement of the general university requirements for each degree will be found elsewhere in this Announcement.

Graduate assistantships are awarded annually to a limited number of graduate students qualified to assist in the research and instruction carried on by the School.

Funds granted to Cornell University by the Carnegie Corporation permit the appointment of two fellows in Industrial Psychiatry. The purpose of the fellowships is to provide an opportunity for trained psychiatrists to study at the New York State School of Industrial and Labor Relations and to apply psychiatric knowledge and methods to the problems of industry in concrete plant situations. Holders of the fellowship may also register in the Graduate School of Cornell University as candidates for advanced degrees in Industrial and Labor Relations. The fellowships are granted for a period of two years. Applicants must hold an M.D. degree, and have completed a minimum of one years' interneship in psychiatry. Inquiries should be addressed to the School of Industrial and Labor Relations, but application for admission to the Graduate School must be sent to the office of the Graduate School.

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

Collective Bargaining, Mediation, and Arbitration 1, 2, 3, 4

Economic and Social Statistics 1, 2, 3, 4

Human Relations in Industry 1, 2, 3, 4

Industrial Education 1, 2, 3, 4

Industrial and Labor Legislation and Social Security 1, 2, 3, 4

Labor Market Economics and Analysis 1, 2, 3, 4

Labor Union History, Organization, and Operation 1, 2, 3, 4

Personnel Management 1, 2, 3, 4

Industrial and Labor Problems 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, current developments, and issues 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, (1), (3), and (5) are required.

*Economic and Social Statistics.* For a major in this subject the candidate must show: (1) good command of the principles of statistical reasoning; (2) proficiency in the use of statistical methods and in the processing of statistical data; (3) qualified skill in the application of proper statistical tools of analysis to a specific topic in economics or social studies, including a thorough knowledge of statistical sources; (4) knowledge of differential and integral calculus.

For a minor, (1), (2), and (3) are required, the level being less advanced than for a major.

HUMAN RELATIONS IN INDUSTRY. For a major in this subject, the candidate must present: (1) comprehensive knowledge of industrial psychology, the relevant materials of anthropology and sociology as applied to industry, especially the fundamentals of individual and group behavior, and the growth of institutions; (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; (5) knowledge of educational and research techniques in industrial and labor relations.

For a minor, (1), (2) and (3) are required.

INDUSTRIAL EDUCATION. For a major in this subject, the candidate must show: (1) comprehensive understanding of industrial education programs in public institutions, private institutions, and industry; (2) ability to develop analyses for instructional purposes and prepare an educational or training program based upon analyses; (3) understanding of economic, social, and scientific factors which may modify industrial education programs; (4) understanding of instructional methods and their application in learning situations; (5) ability to apply administrative and supervisory principles to industrial education programs; (6) adequate knowledge of sources of information in this field.

For a minor, (1), (2) and (3) are required.

INDUSTRIAL AND LABOR LEGISLATION AND SOCIAL SECURITY. For a major in this subject, the candidate must show: (1) familiarity with the sources and nature of insecurity; (2) a comprehensive knowledge of the origin, development, constitutionality and administration of legislation in such fields as minimum wage, hours, protection of women and children, discrimination, health and safety, workmen's compensation and social insurance; (3) a knowledge of the effects of labor, industry, and the community to meet these problems on a voluntary basis; (4) familiarity with one special field of legislation, and the administrative and legal experience in that field; (5) knowledge of the past and current proposals for improving and extending legislation.

For a minor (1), (2), and (5) are required.

LABOR MARKET ECONOMICS AND ANALYSIS. For a major in this subject, the can-

<sup>\*</sup> Field experience or interneship may be included as part of the research program under the direction of the student's special committee.

didate must show: (1) comprehensive knowledge of the factors governing labor supply and demand; (2) thorough understanding of basic economic processes, especially in relation to employment, national income, production, wages, prices, and profits; (3) qualified skill in analysing some specific labor market relationship such as manpower requirements, labor force composition, labor mobility, wage determination, wage differentials, changes in wage structures, productivity, labor costs or consumer incomes and expenditures; (4) competence in the use and application of quantitative methods; (5) knowledge of the history and the literature related to the subject.

For a minor (1), (2) and (4) are required. When this subject is elected as a major, Labor Economics may not be elected as a minor.

LABOR UNION HISTORY, ORGANIZATION, AND MANAGEMENT. 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) comprehensive knowledge of the organizational structure, problems, and management of American labor unions; (3) specific knowledge of the organizational structure, problems, and management of two labor unions in different types of industries; (4) understanding of the economic and social policies and practices of labor unions in their relation to union organization and management problems and techniques; (5) familiarity with the types of union leadership and rank and file behavior; (6) detailed knowledge of the bibliography and sources of information in this field.

For a minor (1), (3), and (4) 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) knowledge of labor and industrial legislation and social security; (3) knowledge of labor union organization and activity and collective bargaining techniques; (4) acquaintance with current methods and procedures in such fields as job rating and evaluation, systems of wage payment and administration, time and motion study, industrial training and education; (5) a knowledge of industrial psychology, especially testing, placement, and the fundamentals of individual and group behavior.

For a minor, (1), (2) and (3) are required.

INDUSTRIAL AND LABOR PROBLEMS. (Offered as a minor only to graduate students with a major in a field of study other than Industrial and Labor Relations.) A candidate for an advanced degree must have a general understanding of the subject matter in the field of Industrial and Labor Relations. In order to fulfill this requirement, the candidate will complete three to five courses or an aggregate of ten to fifteen hours of credit in accordance with the program approved by his special committee.

## GRADUATE SEMINARS AND COURSES

For undergraduate courses which often meet the needs of graduate students, see the Announcement of the New York State School of Industrial and Labor Relations.

101. COLLECTIVE BARGAINING – ROLE OF GOVERNMENT IN LABOR RELATIONS. Fall term.

Consideration of the "right to bargain" and the handling of controversy. Special attention is given to the developments under the National Labor Relations Act, Taft-Hartley Act, and under other major federal and state legislation. The principles and procedures of mediation and arbitration are studied and evaluated.

# 102. COLLECTIVE BARGAINING - CONTRACTUAL RELATIONS. Spring term.

Analysis of the substantive issues in labor-management relations and the techniques used in drafting and administering the collective agreement.

#### 103. BASIC STATISTICS. Fall term.

For graduate students who have not taken a course in Statistics or who wish to take a refresher course. Emphasis will be placed on discussion of technical aspects of statistical analysis, and on initiative in selecting and applying statistical methods to individual research problems. The subjects ordinarily covered will include analysis of frequency distributions, time series (including index numbers), correlation analysis, and analysis of variance.

### 104. HUMAN RELATIONS IN INDUSTRY. Fall term.

Training in methods of interviewing, observation, and analysis of human relations in industry data. Students are required to spend approximately one day a week in the field.

# 105. PERSONALITY STUDY AND INTENSIVE INTERVIEWING. Spring term.

For graduate students majoring in human relations or closely related fields, particularly those interested in research. Training will be given in methods of interviewing and in making personality studies. One weekly seminar and one afternoon a week to be spent in field work.

#### 106. PROTECTIVE LABOR LEGISLATION. Fall term.

A study of the historical origin, legislative development, administration, and problems related to the following types of legislation: fair employment practices, minimum wage and maximum hour laws, child labor, women employees, industrial health and safety, industrial housing. The obligations and responsibilities of unions and management are discussed. Reading and discussion of original documents and government reports, research reports, and projects form the basis of the course.

#### 107. SOCIAL SECURITY. Spring term.

A study of the sources of insecurity inherent in modern industrial society and of the public and private programs designed to provide essential services or protection against reduction of income arising from industrial accident, sickness, old age, and unemployment. Attention is given to the basic principles of social insurance and the influence of social insurance upon the operation of our economy. The administration and the interrelationships of private and public plans will also be discussed. The course is conducted as a seminar with readings of original documents, research reports, discussions, and occasional lectures providing the subject matter for consideration.

## 108 and 109. LABOR MARKET ECONOMICS. Spring and fall term.

Application of source materials and interpretation of wage and employment information. During each semester, the seminar will concentrate on the study of one specific topic within such areas as: wage trends, employment levels, wages as costs, wage-price relationships, occupational wage differences, occupational inter-plant and inter-area wage differences. This course is offered throughout the year, but students may be admitted either the first or second term.

#### 110. HISTORY AND GOVERNMENT OF LABOR UNIONS. Fall term.

A detailed consideration, through research on specific international unions by individual students, of the relationship between the history and government of
unions and collective bargaining, personnel management, government agencies and policies, and the institutional setting of problems in human relations.

111. PERSONNEL ADMINISTRATION. Spring term.

A seminar in personnel administration. Special studies will be made of organization of personnel departments: plans and procedures for employing, training, paying, rating, and separating employees; programs of employee safety and services; disciplinary actions, incentives, grievances; and other phases of personnel administration.

113. ECONOMIC AND SOCIAL STATISTICS. Spring term.

An analytical appraisal of statistical sources; methods, presentation, and interpretation in the field of industrial and labor relations. Each seminar will be given over to the study of one specific topic, such as: design of complex experiments and sampling in economics, advanced theory and analysis of index numbers, time series, etc.

130. SUPERVISION OF INDUSTRIAL EDUCATION. Fall term. Credit two hours.

The nature and purpose of supervision; fundamental principles of supervision; objectives; the planning and organization of a supervisory program; relationships of the supervisor to administrators and teachers; techniques and methods of supervision; the supervisor's responsibility for appraising the adequacy of equipment, materials and supplies; measurement and evaluation of student and teacher achievement.

131. CURRENT PROBLEMS IN INDUSTRIAL EDUCATION. Credit two hours. Spring term.

A graduate seminar dealing with problems of special importance in the field of industrial education at the present time. Problems in technical institute education, work-experience training for youth, integration of industrial and general education, training for semi-skilled occupations, area schools, and current legislation affecting industrial education will be discussed.

132. ADMINISTRATION OF INDUSTRIAL EDUCATION. Graduate; credit two hours. Spring term.

A study of administrative practices in industrial and technical schools. Discussion will include such aspects as the relationships of the industrial school administrator to other school officers; advisory committees and their functions; public relations, plant and equipment, budgetary procedures, staff personnel relations; teacher selection; student personnel procedures; and evening school organization and administration.

133. TRAINING PROBLEMS IN BUSINESS AND INDUSTRY. Spring term. Credit two hours.

A graduate seminar dealing with problems of current interest in training departments in business and industry. The topics discussed will include such problems as shifting emphases on kinds of programs and levels of workers to be served, patterns of administration and operation of training programs, recent developments in training techniques, and evaluation methods and procedures.

199. SPECIAL STUDIES.

Directed research in special problems.

# LAW

Professors R. S. STEVENS, L. P. WILSON, G. J. THOMPSON, H. E. WHITESIDE, G. H. ROBINSON, W. H. FARNHAM, J. W. MACDONALD, A. J. KEEFFE, SHERMAN PEER, A. E. SUTHERLAND, B. F. WILLCOX, ARTHUR LARSON, HARROP FREEMAN, L. W. MORSE, W. H. SHANNON; Associate Professor R. B. SCHLESINGER; Assistant Professor W. D. CURTISS.

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, 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.

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 of admission to the Graduate School as stated above, p. 8, 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, Business and Public Administration, Industrial and Labor Relations, 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 the Announcement of the Cornell Law School.

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

Jurisprudence 1, 2, 3, 4	Procedure 1, 2, 3, 4
Legal History 1, 2, 3, 4	Public Law 1, 2, 3, 4
Private 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 philosophy, history, government, business, labor, and finance.

Candidates for either of the graduate degrees in law must be in residence not less than one academic year.

### LAW

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 the 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, Comparative 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.

# 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 MALCOLM E. MILLER; Assistant Professor ROBERT E. HABEL.

The personnel and equipment of the department are adequate to provide instruction in any branch of anatomy pertaining to the common domestic species.

For undergraduate courses which often meet needs of graduate students, see the *Announcement of the Veterinary College*, Department of ANATOMY, courses 1, 2, 3 and 4. No preregistration is required.

In certain instances courses 211 and 212 Comparative Anatomy will be accepted in place of the courses in Anatomy.

6. ANATOMY. Fall and spring terms. Prerequisites, courses 1, 2, 3 and 4 or Comparative Anatomy 211 and 212 or their equivalents. Professor M. E. MILLER and Assistant Professor R. E. HABEL. Hours to be arranged. Preregistration not required.

The equipment and space in the department are adequate for work on the large herbivores. Dissections and models of many of the regions and systems of the cow, dog, and horse are available for study. Reference reading material can be found in The Flower Library. Students who plan to do their major graduate work in Anatomy will be expected to be undergraduate majors in comparative anatomy or to be graduate veterinarians. Candidates for an advanced degree taking minor work in the department will be assigned a project or in certain cases will take course work.

## PHYSIOLOGY

Professors H. H. DUKES, J. A. DYE, R. W. DOUGHERTY; Assistant Professor CARO-LYN F. SPRAGUE.

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 fields. The Flower Library, in James Law Hall, provides a good collection of periodicals and books on physiology and related subjects. These may be supplemented by the many works on physiology in other libraries of the University.

Graduate students who plan to do their major work in 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 if they are qualified, or they may pursue work in the regularly scheduled courses of the department.

For undergraduate courses which often meet needs of graduate students, see the Announcement of the New York State Veterinary College, Department of PHYSIOLOGY, courses 303, 10, 11, 12, 13, 14. For courses 11 and 14, preregistration is required.

16. ADVANCED EXPERIMENTAL PHYSIOLOGY. Spring term. Credit three hours. Prerequisites, Physiology 12 or 13, or its equivalent, and Physiology 14, or its equivalent. Professors DUKES, DYE, and DOUGHERTY. Laboratory, F 9–1. A conference hour to be arranged. Preregistration required.

305. ENDOCRINOLOGY AND METABOLISM. Fall term. Credit three hours. Prerequisite, six or more hours each of biology and chemistry. Professor Dye. M W F 8.

18. *RESEARCH*. Throughout the year. Professors DUKES, DYE, DOUGHERTY, and SPRAGUE.

## ANIMAL PATHOLOGY, BACTERIOLOGY, AND IMMUNOLOGY

#### (See also BACTERIOLOGY, above)

## Professors Peter Olafson, W. A. Hagan, P. P. Levine, J. A. Baker.

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 are 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. Three hours. Spring term.

42. Infectious Diseases. Three hours. Fall term.

46. Diseases of Poultry. Three hours. Spring term.

48. Food Quality Control. Six hours. Fall term.

149. Pathogenic Bacteriology. Four hours. Spring term. Preregistration required.

152. ADVANCED WORK IN PATHOLOGY AND BACTERIOLOGY. For students who have completed the undergraduate courses in pathology and bacteriology. Professors OLAFSON, HAGAN, LEVINE, and BAKER. Special problems or assignments will be given. Hours to be arranged. 153. Hematology. Spring term. One hour.

154. SEMINAR. 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, D. W. BAKER, and J. H. WHITLOCK.

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. Spring term. Three hours.

62a. Parasites Laboratory. Spring term. One hour.

63. APPLIED PARASITOLOGY. Spring term. Associate Professor BAKER.

Special problems with the parasites of animals.

64. ADVANCED WORK IN ANIMAL PARASITOLOGY. Associate Professor BAKER and Assistant Professor WHITLOCK.

## VETERINARY THERAPEUTICS AND DISEASES OF SMALL ANIMALS

Professors E. P. LEONARD and H. C. STEPHENSON.

The laboratories of the department are well equipped for research in veterinary therapeutics and 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 and Pharmacy. Spring term. Six hours.

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.

## VETERINARY MEDICINE, AMBULATORY CLINIC, AND OBSTETRICS INCLUDING DISEASES OF THE GENITAL ORGANS

Professors M. G. FINCHER, J. M. MURPHY, and S. J. ROBERTS.

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 VETERINARY SURGERY

infections 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.

50. Diseases of Large Animals. Fall term. Five hours.

50. Diseases of Large Animals. Spring term. Three hours.

51. Obstetrics and Diseases of the Genital Organs. Spring term. Five hours.

52. Diseases of Large Animals. Fall term. Two hours.

52. Diseases of Large Animals. Spring term. Four hours.

58. *RESEARCH IN DISEASES OF LARGE ANIMALS*. Hours to be arranged. Credit from two to five hours. Professors FINCHER, MURPHY, and ROBERTS.

59. RESEARCH IN OBSTETRICS AND DISEASES OF THE GENITAL ORGANS, Professors FINCHER and ROBERTS.

## VETERINARY SURGERY

Professors J. N. FROST and A. M. MILLS.

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. Spring term. Five hours. Professor MILLS.

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 must apply 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.

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, C. V. MORRILL, G. N. PAPANICOLAOU, W. A. GEOHEGAN, J. MACLEOD, C. BERRY, and G. J. NOBACK.

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.

### PATHOLOGY

## BACTERIOLOGY AND IMMUNOLOGY

#### Professors JAMES M. NEILL, JOHN Y. SUGG, 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, D. B. MELVILLE, J. R. RACHELE, R. W. BONSNES, G. B. BROWN, C. G. MACKENZIE, and *Doctors* J. G. PIERCE and J. E. WILSON.

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, John M. Pearce, Charles T. Olcott, and Aaron Kellner.

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 invesigations 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.

## THE MEDICAL SCIENCES

### PHARMACOLOGY

Professors McKeen Cattell, HARRY GOLD, OSCAR BODANSKY, WALTER F. RIKER, IR., and FREDERICK S. PHILIPS.

Facilities are available for advanced work and research in both the chemical and pharmacodynamic aspects of pharmacology. Special opportunities are offered for work in the pharmacology of muscle-nerve, enzyme systems, the circulation, the autonomic nerves, and toxicology. 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.

Arrangements will be made for individuals or groups to participate in original investigations in ward patients and in ambulatory patients of the clinics. There are special opportunities for work on digitalis, the mercurial diuretics, cinchona alakaloids, and other problems related to the pharmacology of cardiovascular disorders.

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, James D. Hardy, and Robert M. Bird.

Graduate and research training is provided for students who wish to prepare themselves for teaching and research in the physiological 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 department is especially well equipped for the study of metabolism and heat exchanges in man and in animals as available equipment includes the large human calorimeter of the Russell Sage Institute of Pathology and a constant temperature chamber capable of any desired temperature ( $-70^{\circ}$  C to  $+80^{\circ}$ , C) and humidity (0 to 100%). There is also an automatically recording infra-red spectrophotometer of the latest type for studying problems in intermediary metabolism and a well-equipped electronics laboratory for the study of bioelectric potentials. The laboratory is also well equipped for the study of certain problems in the special senses, particularly temperature and pain.

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 PARASITOLOGY

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 D. B. HAND, A. W. AVENS, F. P. BOYLE, R. F. BROOKS, D. C. CARPENTER, J. C. HENING, A. W. HOFER, R. W. HOLLEY, G. J. HUCKER, Z. I. KERTESZ, F. A. LEE, G. L. MACK, J. C. MOYER, G. W. PEARCE, C. S. PEDERSON, and W. B. ROBINSON.

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 processing; food bacteriology; the composition and nutritive value of fruit and vegetable varieties; insecticides and fungicides; protein chemistry; pectin and pectic enzyme; plant pigments and enzymes.

Graduate research may be undertaken leading to degrees of Master of Science and Ph.D. in biochemistry and bacteriology. Research problems may be selected from the following fields:

THE CHEMISTRY OF FRUITS AND VEGETABLES. Professors Avens, BOYLE, HAND, HOLLEY, and KERTESZ.

THE PROCESSING OF FRUITS AND VEGETABLES. Professors HAND, HENING, LEE, MOYER, PEDERSON, and ROBINSON.

CLEANING AND STERILIZING TECHNOLOGY. Professors BROOKS and HUCKER.

COMPOSITION AND NUTRITIVE VALUES OF FOODS. Professors Avens, BROOKS, HAND, LEE, MOYER, and ROBINSON.

FOOD POISONING. Professor HUCKER.

## POMOLOGY

FOOD AND FERMENTATION BACTERIOLOGY. Professors BROOKS, HOFER, HUCKER, and PEDERSON.

INSECTICIDES AND FUNGICIDES. Professors Avens, Mack, and Pearce. PROTEIN CHEMISTRY. Professor Carpenter.

THE CHEMISTRY OF PECTIN AND PECTIC ENZYMES. Professor Kertesz. PIGMENTS, VITAMINS, ENZYMES, AND HORMONES. Professors Boyle, HAND, HOLLEY, KERTESZ, and ROBINSON.

## ENTOMOLOGY

Professors P. J. CHAPMAN, G. E. R. HERVEY, F. G. MUNDINGER, F. L. GAMBRELL, L. A. CARRUTH, E. H. GLASS, J. A. ADAMS, R. W. DEAN, and E. F. TASCHENBERG.

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, and biological control of insects.

 $FRUIT\ INSECTS.$  Professors Chapman, Glass, Mundinger, Dean, and Taschenberg.

VEGETABLE INSECTS. Professor HERVEY and CARRUTH.

INSECT PESTS OF NURSERY AND ORNAMENTAL PLANTS. Professor GAMBRELL.

BIOLOGICAL CONTROL OF INSECTS. Professor ADAMS.

## PLANT PATHOLOGY

Professors O. A. REINKING, J. M. HAMILTON, D. H. PALMITER, W. T. SCHROEDER, A. J. BRAUN, R. E. FOSTER, and H. C. YOUNG, JR.

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, BRAUN, and YOUNG.

DISEASES OF VEGETABLES. Professors Schroeder, Foster, and Reinking.

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, GEORGE H. HOWE, GEORGE L. SLATE, JOHN C. CAIN, JOHN EINSET, N. J. SHAULIS, O. F. CURTIS, JR., and DAVID R. RODNEY.

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, Slate, and Howe.

ROOTSTOCK PROBLEMS, INCLUDING STOCK AND SCION RELA-TIONS. Professors Curtis and RODNEY.

FERTILIZATION AND NUTRITIONAL STUDIES WITH TREES. Professors Heinicke, CAIN, and SHAULIS.

ORCHARD SOIL TECHNOLOGY. Professors HEINICKE, CAIN, and SHAULIS. CYTOLOGY. Professor EINSET.

PHYSIOLOGY OF FRUIT PLANTS. Professors HEINICKE, CAIN, and CURTIS.

### SEED INVESTIGATIONS

Professors M. T. MUNN, R. E. CLARK, 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, CLARK, and CROSIER.

## VEGETABLE CROPS

Professors C. B. SAYRE, C. H. DEARBORN, W. T. TAPLEY, and M. T. VITTUM.

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, nutrient solutions for transplants, improved methods of plant growing, studies of canning crop rotations and cropping systems, and factors affecting maturity and quality of vegetables for canning and freezing. Most of these studies can be undertaken best 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 VITTUM.

VARIETY STUDIES OF VEGETABLES. Professor TAPLEY.

VEGETABLE BREEDING PROBLEMS. Professors DEARBORN and TAPLEY.

VEGETABLE CANNING CROP RESEARCH PROBLEMS. Professor SAYRE.

CANNING CROP ROTATIONS AND SOIL MANAGEMENT. Professor VITTUM.

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## FELLOWS AND GRADUATE SCHOLARS IN 1948–1949

## **RESIDENT DOCTORS**

A. N. M. Mumtaz Uddin Choudhury, Ph.D., Cornell, 1949 (Spring Term) André Gilles. (Spring Term)

Ross Buschlen Harvey, Ph.D., McGill University, 1940.

Arne S. Johansson, Ph.D., University of Oslo, 1947.

Padmanabhan Subbarao Krishnan, Ph.D., Cornell 1947. (Spring Term)

John E. Leffler, Ph.D., Harvard University, 1948. (Spring Term)

C. K. Narayanan Nair, Ph.D., Cornell, 1949. (Spring Term)

Ruknuddin Quraishi, B.A., Madras University, 1931; M.A., Columbia University, 1947; Ph.D., Cornell, 1948.

# ENDOWED AND UNIVERSITY FELLOWS

The Anna Cora Smith Fellowship in Home Economics: Mary Elizabeth Lush, B.S., Iowa State College, 1946.

The Charles Bull Earle Memorial Fellowships in Mechanical and Electrical Engineering: Phillip W. Barnhart, B.S. in Electrical Engineering, University of Tennessee, 1948. Peter F. Gundelfinger, B.E.E., Rensselaer Polytechnic Institute, 1948. Yorgi Tavukcu, B.S., Robert College, 1947.

The Clinton DeWitt Smith Fellowships in Agriculture: John Smith Titus, B.S., Michigan State, 1946. Lyle E. Nelson, B.S., North Dakota Agricultural College, 1948.

The Cornell Fellowship in English: Richard Kenneth Redfern, B.S., University of Illinois, 1937; A.M., Cornell, 1947.

The DuPont Fellowship in Chemistry: Richard T. Carroll, B.S., Bates College, 1942.

The Edgar J. Meyer Memorial Fellowship in Engineering Research: Chi-Chuan Chang, B.S., National Central University, 1944.

The Erastus Brooks Fellowships in Mathematics: James Blake Wilson, B.S., University of Florida, 1948. Jerome Blackman, B.S., Massachusetts Institute of Technology, 1948.

The Fellowship in American History: William Cary Birdsall, B.S., Union College, 1942; A.M., Albany State Teachers College, 1947.

The Fellowships in Greek and Latin: Daniel Spiegel, B.A., University of Minnesota, 1940. Dorothy Evelyn Grosser, A.B., Hunter College, 1947.

The Fellowship in Political Economy: Philip William Vetterling, B.A., M.S., Massachusetts State College, 1947, 1948.

The George C. Boldt Fellowships in History: Marie Boas, A.B., 1940; A.M., 1942, Radcliffe College. Bryce Dale Lyon, A.B., Baldwin-Wallace College, 1942.

The Glasgow Exchange Fellowship: Herbert Hillman, B.A., Swarthmore College, 1947.

The Goldwin Smith Fellowships in Botany, Geology, or Physical Geography: Donald Gowing, B.A., Cornell, 1949. (Spring Term). Elliott F. Dressner, B.A., Dartmouth College, 1942; B.S. Mining Engineering, Missouri School of Mines, 1948.

The Henry Strong Denison Fellowships in Agriculture: Richard Griswold Warner, B.S., M.S., Ohio State University, 1947, 1948. Kwang-seng Wang, B.S., M.S., University of Nanking, 1943, 1946.

The McGraw Fellowships in Civil Engineering: Jamshid Amouzegar, B.C.E., Cornell, 1945; M.S. in C.E., University of Washington, 1947. Robert Ting Chuck, B.S., Michigan State College, 1948.

The Martin Sampson Teaching Fellowship: Dorothy Ruth Baisch, A.B., University of Buffalo, 1937; A.M., Cornell, 1946.

The President White Fellowship in Modern History: Ray Clayton Roberts, Jr., B.A., University of Washington, 1947.

The President White Fellowships in Physics: Henry Graham Jones, B.A., Cambridge University, 1948. Harold L. Brode, A.B., University of California, 1947.

The President White Fellowship in Political and Social Science: Roy Pierce, B.A., Cornell, 1948.

The Sage Fellowship in Chemistry: Samuel Stimpson Jones, B.S., Hampden-Sydney College, 1943.

The Schuyler Fellowships in Animal Biology: John C. Martin, B.A., Queens University, 1948. Clarence E. White, B.S., West Virginia University, 1948.

The Sibley Fellowships in Mechanical and Electrical Engineering: Sherwood Gebhart Holt, B.M.E., Cornell, 1943; M.M.E., Cornell, 1947 (Spring Term). Arne Normann, B.S., Missouri School of Mines, 1948.

The Sigma Xi Fellowship: Edward Franklin Barnett, B.S., Stanford University, 1948.

The Simon Henry Gage Fellowship in Animal Biology: Frances Lowell Burnett, A.B., Smith College, 1935.

The Susan Linn Sage Fellowships in Philosophy: Yu-wen Han, B.A., National Peking University, 1938. William E. Kennick, A.B., Oberlin College, 1945. John Ogden Nelson, A.B., Princeton University, 1939. Bernard Wand, A.B., Queens University, 1943. Robert P. Ziff, (Spring Term).

The Susan Linn Sage Fellowship in Psychology: Estelita L. Saldanha, B.S. in Education, M.A., University of Nebraska, 1947.

The University Fellowship in Agriculture: August E. Kehr, B.S., Cornell, 1946.

The University Fellowships in Architecture, Landscape Architecture, Fine Arts, and Regional and City Planning: John F. Hopkins, B.F.A., Cornell, 1948. Lloyd Orton, Diploma of Architectural Design, University of Melbourne, 1946.

The University Fellowship in Germanic Languages: James Maurice Spillane, A.B., Hobart College, 1947.

The University Fellowship in Romance Languages: William John Grupp, B.A., University of Toronto, 1946; A.M., Cornell, 1947.

## SPECIAL TEMPORARY FELLOWS

Allied Chemical and Dye Fellowships in Chemistry: Morton E. Milberg, B.S., Rutgers University, 1946. Mathias H. Weiden, B.S., Manhattan College, 1946.

American Cyanamid Graduate Scholarship in Mechanical Engineering: Daniel W. Milburn (Fall Term only), B.S. in M.E., Cornell, 1946.

Dairy Products Industrial Research Fellowship: Alan Tobie, B. S., University of Connecticut, 1948.

### SCHOLARS

Eastman Kodak Company Fellowship: Paul V. Hough, B.A. Swarthmore College, 1945.

Merrell Company Fellowship: James B. Buchanan, B.A., M.A., University of British Columbia, 1944, 1946.

Pittsburgh Consolidation Coal Company Fellowship: Edwin N. Lightfoot, Jr., B.Chem. Eng., Cornell, 1947.

DuPont Post-Graduate Fellowship in Mechanical Engineering: Robert W. Perry, Jr., B.M.E., 1943, M.M.E., 1947, Cornell.

DuPont Fellowship in Chemical Engineering: Norbert Joseph Foecking, B.S., Case School of Applied Sciences, 1945.

DuPont Postdoctoral Fellowship in Chemistry: John E. Leffler, B. S., Ph.D., Harvard, 1943, 1948.

Procter and Gamble Fellowship: Richard M. Hagen, B.Chem. Eng., University of Minnesota, 1943.

S. C. Johnson and Son Fellowship in Chemical Engineering: James Gillin, Jr., B.Chem. Eng., Cornell, 1947.

Shell Fellowship in Chemical Engineering: William R. Millard, B.S., in Chem. Eng., M.S., in Chem. Eng., University of Missouri, 1941, 1947.

Shell Fellowship in Geology: William K. Gealey, A.B., University of California, 1939.

Standard Oil Company of Ohio Fellowship in Chemistry: Charles B. Tennant, B.S., Hamilton College, 1943.

Standard Oil Company of Indiana Fellowship in Chemical Engineering: Ernest Sherman Cramer, B.S. in Chem. Eng., Bucknell University, 1938; M.Chem. Eng., Syracuse University, 1940.

The Texas Company Fellowship: Bernard Villars Baus, B.Chem. Eng., Tulane University, 1945.

United States Rubber Company Postgraduate Fellowship in Chemistry: Edward C. Taylor, Jr., A.B., Cornell, 1946.

Westinghouse Fellowship in Mechanical Engineering: Albert August Emil Bock, B.S. in M.E., Cornell, 1948.

## SCHOLARS

The Allen Seymour Olmstead Scholarships: Anne Ruth King, B.A., Hunter College, 1943; A.M., Cornell, 1944. Liang Huang, B.S. in Chemistry, St. John's University, 1942.

The Comstock Graduate Scholarships in Entomology: Douglas A. Ross, B.S. in Agriculture, Ontario Agricultural College, 1939; M.S., Cornell, 1947. Clarence E. White, B.S., West Virginia University, 1948.

The Comstock Graduate Scholarships in Nature Study: Theodore E. Eckert, A.B., New York State Teachers College at Albany, 1934; M.S., Cornell, 1948. Harold Ewen, B.A., College of the City of New York, 1945. Ina Pauline James, B.S., Memphis State College, 1938; M.S., Cornell, 1947.

The Graduate Scholarship in Civil Engineering: Li Chow, B.S., Chiao-Tung University, 1938; M.S. in Engineering, Cornell, 1946.

The Graduate Scholarship in Greek and Latin: Marie Ann Giuriceo, A.B., Hunter College, 1946; A.M., Cornell, 1948.

The Graduate Scholarships in History: James Whetstone, B.A., St. John's College, 1948. Irene Neu, B.A., Marietta College, 1944; A.M., Cornell, 1945.

The Graduate Scholarship in Veterinary Medicine: Eric Wynn Jones, Veterinary Surgeon, Royal Veterinary College, London, England, 1946.

The Phi Kappa Phi Scholarship: Nancy Hall Kane, B.S., Cornell, 1946.

The Susan Linn Sage Scholarship in Philosophy: John Mansley Robinson, A.B., Middlebury College, 1945.

## TUITION SCHOLARS

Giorgio Ausenda, B.E.E., Cornell, 1948.

Nancy C. Barone, B.S., Cornell, 1944.

Kuo-chung Chao, A.B., University of Shanghai, 1939; A.M., Colorado State College, 1947.

Chandra M. Chatterjee, B.A., M.A., Lucknow University, 1927, 1929.

Tseng Tung Cheng, B.S., Tsing Hua University, 1937; M.S., Cornell University, 1947.

Doris Lorraine Cox, B.S., Syracuse University, 1946.

Albert A. Dorland, B.A., University of Western Ontario, 1944.

Sang Cheng Dwu, B.S. in E.E., La Universitato Utopia, Shanghai, China, 1945. Ruth Fenton, B.S. in Home Economics, Kansas State College of Agriculture

and Applied Science, 1946. Marie Van de Putte Gilles, "Conseillere Sociale rural", Institut Normal Su-

perieur de Economic Mengere et Agricole, Laken, Brussels, 1945.

Paul V. C. Hough, B.A., Swarthmore College, 1945.

Tsui-fun Huang, B.Sc., Lingnan University, 1944.

Esther Adelaide Jerald, B.S. in Ed., Mansfield State Teachers College, 1934.

Shirley Johnson, B.E., Cortland State Teacher College, 1944.

Leonard Ross Klein, B.A., University of Alabama, 1935; A.M., Cornell, 1948.

Dharam Vir Kohli, B.Sc. in Agriculture, University of the Punjab, 1934.

Te Jen Koo, B.Sc. in E.E., Chiao-tung University, 1946.

Lila A. Leichtling, B.A., Brooklyn College, 1948.

Hubert J.E. Lepargneur, Doctorat endroit, University of Caen, France, 1948. Ta Liang, B.Eng., National Tsing Hua University, 1937; M.C.E., Cornell, 1948. Crawford B. Lindsay, A.B., Talladega College, 1927; A.M., University of Michigan, 1931.

Yu-chen Liu, B.A., Cheeloo University, 1933; M.S., Oregon State College, 1939. Martha Jane Clark Mapes, B.S., Cornell University, 1948.

Sarojini S. Pawar, B.S., University of Bombay, 1945; M.S., Cornell, 1948.

Doretta M. Schlaphoff, B.S. in Home Ec., University of Nebraska, 1941; M.S., Michigan State College, 1943.

Barbara Schrier, B.A., Queens College, 1948.

Helen E. Sharp, B.S., Cornell University, 1948.

Helen Baker Stevans, B.E., Cornell, 1948.

Joyce E. Van Denburgh, B.F.A., Cornell, 1948.

Chi-hwei Wu, B.A., National Central University, China, 1937.

## ADVANCED DEGREES CONFERRED IN 1947–1948

## MASTERS OF ARTS

### CONFERRED SEPTEMBER 24, 1947

Glen Olaf Allen, A.B., American Literature, Dramatic Literature. Thesis: James Fenimore Cooper and Alexis de Tocqueville: A Comparison in Political Theory.

Charles Farrington Bond, B.A., Biological Sciences.

Helen Marie Callenius, A.B., English. Thesis: A Study of S.V. Benet's John Brown's Body.

Helen Gebbie Daly, A.B., Social Studies.

Martha Dunbar, A.B., Biological Sciences.

Charles Joseph Farrell, B.A., Social Studies.

George Cross Fetter, A.B., Education.

Thomas Gillies, B.Ed., English. Thesis: The Full-Fed River: Freedom and Responsibility in the European Novels of Henry James.

William John Grupp, B.A., Spanish Literature, German Literature. Thesis: Jacinto Benavente: The Development of a Dramatic Author.

Sylvia Harcstark, B.A., American Literature, Philosophy. Thesis: Literature in the Market Place: A Study of American Book-Publishing During the Nineteen-Twenties.

LeRoy William Hinze. B.A., Dramatic Production, Dramatic Literature. Thesis: The Relation of Theatre as an Art Form to Man as a Social Being.

Lily Hazel Marker Hoffman, A.B., English. Thesis: Lore of Cattaraugus County, New York.

Ya-Na Hsiung, B.A., Child Development and Family Relations, Child Development and Child Guidance. Thesis: A Study of the Family Life of Preschool Children in a Chinese Rural Town.

Edward Lawrence Kamarck, A.B., Playwrighting, Dramatic Literature. Thesis: Regional Playwrighting.

Alice Elizabeth Kennelly, B.S., English. Thesis: Kentucky, Land of Mountains and Bluegrass.

Kirk Krutsch, B.S. in Ed., Rural Sociology, American History. Thesis: A Proposal for Revision of the Secondary School Social Science Curriculum Designed to Prepare Students for Active Civic Participation.

George Louis Kustas, A.B., Greek, Latin. Thesis: Epic Reflections in the Fragments of Empedocles.

Anna Detweiler Leatherman, B.S. in Ed., B.A., Biological Sciences.

Constance Ratcliff Ludwig, B.A., Social Studies.

Louis Glaser Martsolf, B.F.A., Painting, History. Thesis: Tonal Relationships and the Presentation of Seven Paintings.

Elizabeth Hope Miller (now Quanstrom), A.B., English.

Rose Dolores Perta, B.A., Social Studies.

Winnifred Poland Pierce, B.A., American History, Modern European History. Thesis: General Washington and the Problems of Provincial New York.

Irene Lucille Pretzer, B.A., Organic Chemistry, Physical Chemistry. Thesis: A Study of Benzothiazoles Related to Antimalarials.

Helen Beaumont Ross, B.A., Nature Study.

Leila Raines Rubashkin, A.B., Algebra, Mathematical Analysis. Thesis: A Study of the Total Matric Algebra of Order n<sup>2</sup> Over a Field.

Bernard Shaw, B.A., Social Studies.

Emily Waite Skillings, A.B., American History, English History. Thesis: Tendencies Toward Independence in New England's Early Development.

Claire Alice Syner, A.B., Education. Thesis: An Evaluation of a Mathematics Test.

William Gregory Thomson, B.A., Latin Language and Literature.

Maxine Arnold Vogely, B.A., B.Ed., Educational Psychology, Guidance. Thesis: A Study of Factors Which Have Influenced Some Students in the New York State College of Home Economics to Choose, or Not to Choose, Home Economics Teaching in the Public Schools as a Vocation.

Phillida Wynne Whitby, A.B., French Literature, French Language. Thesis: The Conflict of Ideas in *Les Thibault* and Their Influence on the Lives of the Characters.

Joseph Anthony Withey, B.A., Dramatic Production, Dramatic Literature. Thesis: The Professional Theatre Critic of the New York Legitimate Theatre.

Margaret Williams Woodman, A.B., Economics.

#### CONFERRED FEBRUARY 4, 1948

Howard Percy Beebe, Jr., A.B., American Literature, 19th Century English Literature. Thesis: MacPherson's Ossian in Nineteenth-Century American Literature.

Marjorie Bell Chambers, A.B., English History, Modern European History. Thesis: Women's Role as Reflected in the British Parliamentary Debates of the Decade 1867–1877.

Denton Winslow Crocker, B.S., Biological Sciences.

Robert Fairchild Cushman, A.B., Constitutional Law, American Governmental Institutions. Thesis: Soldier Voting in 1944.

Edward Lane Davis, B.A., Political Theory, Economic History. Thesis: Workers' Control of Industry and the British Labor Party.

Stuart Eurman, B.A., Sociology.

Marie Ann Giuriceo, A.B., Latin Language and Literature, Greek Language and Literature. Thesis: Extracts from Albertus Magnus, *De Animalibus*, Book XXII: An English Translation.

Frank Parks Landis, A.B., Analytical Chemistry, Inorganic Chemistry. Thesis: The Conductometric Analysis of Nitric and Sulfuric Acid Mixtures.

Priscilla Alden Okie, A.B., Dramatic Production, Dramatic Literature. Thesis: Colonial Backdrops: A Survey of Four Theatre Towns of Early America.

Hazel Parker, B.S., Speech and Drama.

Nathaniel Mark Pastor, B.A., Playwriting, Dramatic Literature. Thesis: The Horses of the Sun: A Play with an Introduction.

### ROSTER OF DEGREES

Jack Wilcox Rollow, B.A., English Literature before 1700, Latin. Thesis: The Dragon Episodes in Beowulf.

Marjorie Anne Inglehart Smith, A.B., Dramatic Production, Dramatic Literature. Thesis: Dramatic Activity before 1800 in the Schools and Colleges of America.

### CONFERRED JUNE 14, 1948

Arthur David Ainsworth, B.A., Social Studies.

Frederick Mitchell Anderson, B.A., Philosophy of Religion, Philosophy. Thesis: Truth as Subjectivity in Kierkegaard.

Frances Lowell Burnett, A.B., Biological Sciences.

John Francis Cavanaugh, A.B., English.

Joyce Mary Colburn, B.A., American History, Far Eastern History. Thesis: The Watkins and Flint Purchase.

Frances Corn-Becker, A.B., Psychobiology, Psychology. Thesis: An Experimental Study Concerning the Factors of Conditioning Underlying Hypnosis.

Dorothy Ruth Rogers Crandall, B.A., Social Studies.

Barbara Osborne Cunningham, A.B., Economics.

Peter Lee Detmold, A.B., Social Studies.

Donald Paul Karl Dietrich, B.A., English.

Joseph O'Leon Eastlack, Jr., B.A., Social Studies.

John Vail Foy, A.B., English. Thesis: An Analysis of the Meaning and Structure of Symbolism in the Novels of Thomas Wolfe.

Beatrice Gertrude Gottlieb, A.B., English Literature Since 1700, Prose Fiction. Thesis: Form and Technique in the Novels of William Faulkner.

John Edward Hawes, A.B., Dramatic Production, Dramatic Literature. Thesis: Growth and Background of *Rip Van Winkle* – Washington Irving to Joseph Jefferson with Prompt Book.

Serena Ginsberg Hoffman, A.B., English. Thesis: The Reputation of *Moby Dick* as a Measure of Change in Literary Taste and Social Attitudes.

Barbara Raymond Hough, B.A., Biochemistry, Animal Physiology. Thesis: Acetylcholine and Nerve Action.

Mang Chi Huang, B.A., American Literature, Classical Period. Thesis: Walt Whitman and Woman.

Leo Edward Keenan, Jr., B.A., American Literature, English Literature to 1700. Thesis: Bliss Carman and Richard Hovey, Poets of Vagabondia.

Stuart Langdon Keill, A.B., Psychobiology, Neurology. Thesis: Observations on the Effect of Bilateral Frontal Lobectomy on the Behaviour of the Goat.

Vera Ellen Malton, A.B., Dramatic Production, Dramatic Literature. Thesis: Costume in England, France, and America from 1700 to 1840.

William John Mortimer, B.A., Social Studies.

Martha Oberling, A.B., French Literature, Education. Thesis: Is Pascal the Author of the Discours sur les Passions de l'Amour?

David Lockwood Olmsted, A.B., Foreign Languages. Thesis: Russian Noun Inflection.

Franklin Johnson Pegues, B.A., Medieval History, Modern European History. Thesis: The Year Books of Mediaeval England.

Charlotte Roscoe, A.B., English. Thesis: The Concepts of Individualism of Whitman and Thoreau.

Mary Harvey Ross, A.B., Mineralogy and Petrology, Paleontology. Thesis: Source and Correlation of the Deepkill Conglomerates.

Carolyn Litwin Rothschild, B.A., Home Economics.

George Seifert, A.B., Mathematics, Physics. Thesis: Topological and Geometric Methods in Non-Linear Mechanics.

Robert Francis Shaw, A.B., English Literature Since 1700, English History. Thesis: The Time-Sense and Its Effect on Some Elizabethan Writers.

Lloyd Dorman Smith, B.A., American History, American Government and Institutions. Thesis: Half a Century of Village Development: The Social and Economic Development of Bath, Geneva and Canandaigua, New York, 1786– 1836.

Margaret Denise Van Aken, A.B., Social Studies. Thesis: The Decision for Independence in New Hampshire.

Abe Wollock, B.A., Speech and Drama.

## MASTERS OF SCIENCE

#### CONFERRED SEPTEMBER 24, 1947

#### Joseph Adrien, B.S., Agronomy.

Franklin Hilliard Baldwin, A.B., Organic Chemistry, Analytical Chemistry. Thesis: I. Studies Related to the Structure of Ketene Dimer II. Investigation of Certain N-Halogen Derivatives as Reagents for Halogenation of the Allyl Position.

Elizabeth Dean Bastian, B.S., in Ed., Textiles and Clothing, Household Art. Thesis: A Critical Analysis of 13 Important Reference Works and a Selected Bibliography in the Field of Textiles and Clothing.

Charles Salmon Brand, B.S., Education.

Erly Dias Brandao, Perito Contado, Farm Management, Land Economics and Farm Finance. Thesis: Factors Affecting Profits on Dairy Farms in Madison County, New York, 1945–46.

Forest Wendell Buchanan, A.B., Biological Sciences.

Virginia Gaynelle Carnes, A.B., Home Economics.

Tseng-Tung Cheng, B.S., Applied Mathematics, Mathematical Analysis. Thesis: The Normal Approximation to the Poisson Distribution and a Proof of a Theorem of Ramanujan.

Dorothy Willey Cousens, B.S., Home Economics.

Euphemia Beatrice Deade, B.S., Nutrition, Biochemistry. Thesis: The Influence of the Diet on the Serum Iron Level of Eight Adolescent Girls.

Pauline Henrietta Emerson, B.A., Home Economics.

Shirley Ruth Glover, A.B., Education.

Leonard Christian Grubel, B.S., Education. Thesis: The Relationship of Soils and Physical Characteristics to the Teaching of Vocational Agriculture.

Ellen Elizabeth Hester, B.S., Foods, Economics of the Household, Thesis: Soft Meringues as Affected by Egg Quality, Cream of Tartar, Base upon Which Meringues Are Baked, and Baking Time and Temperature.

Julius Romanoff Hoffman, B.A., Insect Toxicology, Economic Entomology. Thesis: A Study of the Comparative Toxicities of Hexaethyl Tetraphosphate and Tetraethyl Pyrophosphate as Aerosols Against the Two Spotted Spider Mite, *Tetranychus Bimaculatus*, Harvey.

Marilyn Joan Horn, B.S., Education.

Rhea Hurst, B.S., Home Economics.

Charlotte Krevitsky Hurwitz, S.B., Home Economics.

Ina Pauline James, B.S., Nature Study.

Harold McHolmes Jones, B.S., Farm Equipment, Entomology. Thesis: Suggested Course of Instruction in Repair and Adjustment of Farm Machinery Common to Southern Farms.

Ruth Olive Lamont, B.S., Education.

Mary Stuart Lux, B.A., Neuroanatomy, Education. Thesis: A Study of Degeneration in the Medial Nucleus of the Thalamus.

Evelyn Louise Marion, B.S., Education.

Antoinette Elizabeth Mueller, A.B., B.S. in Ed., Home Economics.

Madhavrao Sooriajeerao Pawar, B.Sc., B.Ag., Plant Breeding, Plant Pathology. Thesis: A Review of Rice Genetics and Breeding Methods.

Daisy Da-si Pen, B.S., Insect Taxonomy, Insect Morphology. Thesis: A Key to the Chinese Groups and Species of Papilio.

Helen L. Ripley, A.B., B.S., Institution Foods, Economics of the Household. Thesis: A Review of Work Simplification in Institution Management, and its Application to Three Areas of Work in a College Cafeteria.

Ruth E. Pullen Ristich, B.S. in Ed., Home Economics.

Gavino Belleza Rotor, Jr., B.S.A., Floriculture and Ornamental Horticulture, Genetics. Thesis: A Review of Scientific Articles Relating to the Culture of Orchids.

Wilhelmina Jayne Hastings Satina, B.S., Home Economics.

Thomas Wesley Silk, B.S., B.S., Hotel Management, Accounting. Thesis: Financial Problems of a Typical Small Hotel in the United States.

Murray Spiegel, B.A., Theoretical Physics, Mathematics. Thesis: The Distribution of Mesons in Cosmic Rays.

Dorothy Elizabeth Stockburger, B.S., Economics of the Household and Household Management, Prices and Statistics. Thesis: Variations in the Dimensions of Packages of Ready-to-Eat Cereals.

Donald James Watson, B.S., Education. Thesis: Motion Pictures as a Visual Aid for Teaching Vocational Agriculture.

Jane Dissosway White, B.S., Mathematics.

George Ewart Yuan, B.S., Agricultural Engineering, Genetics. Thesis: Agricultural Engineering Material and Methods Pertinent to the Orient.

#### CONFERRED FEBRUARY 4, 1948

Donald Joseph Asher, A.B., Organic Chemistry, Inorganic Chemistry. Thesis: I Synthesis and Attempted Alkylation of Methyl 2–Ethyl-3–Methyl Butanoate. II Preparation of Some Pure Secondary and Tertiary Aliphatic Amines.

Lewis Moore Browning, Jr., B.Chem. Eng., Organic Chemistry, Inorganic Chemistry. Thesis: The Hofmann Degradation of Certain Alpha, Beta-Unsaturated Dicarboxamides. I. The Hofmann Degradation of Acetylene-Dicarboxamide. II. The Hofmann Degradation of Fumaramide. Emily Center Byrd, A.B., Analytical Chemistry, Physical Chemistry. A Study of the Colored Complex of Dinitrosoresorcinol and Cobalt.

Austin West Cameron, B.A., Biological Sciences.

Thomas Frank Carroll, A.B., Vegetable Crops, Plant Physiology. Thesis: The Influence of Environmental Factors and Cultural Practices on the Quality of Certain Vegetable Crops (A Review of the Literature).

Theodore Elwin Eckert, A.B., Biological Sciences.

Wayne Russell Evans, A.B., Experimental Physics, Theoretical Physics. Thesis: A Preliminary Investigation of the Production and Transport of Charge by a Mercury Vapor Stream.

Mary Maxwell Grainger, B.S., Economic Entomology, Insect Morphology. Thesis: The Absorption of Parathion through the Root System of Plants and its Effect upon Insects Infesting Them.

Kasimer Edward Hipolit, A.B., Education.

James Philip Holmquist, B.S., Physical Chemistry, Inorganic Chemistry. Thesis: Electro-Osmosis through Membranes of Graded Permeability.

Louise Williams Hubert, B.A., General Science.

Lillian Davenport Jones, B.S., Home Economics.

Daniel Franklin Langenwalter, B.S. in E.E., Electrical Communications, Physics. Thesis: Reactance Control of Induction Motors.

Maxine Ruth Stern Moore, A.B., Endocrinology, Comparative Physiology. Thesis: The Effect of Alloxan Diabetes on the Hyaluronidase Level of the Rat Testis.

Erskine Vance Morse, D.V.M., Veterinary Bacteriology, Veterinary Physiology. Thesis: A Study of *Corynebacterium renale* and Penicillin Therapy in the Treatment of Specific Pyelonephritis of Cattle.

Krishnapillay Madhaven Nair, B.A., M.Sc., Soils, Plant Physiology. Thesis: The Latitude between the pH Values of the Nodules and the Tissues of Leguminous Plants and the Relation of Certain Species of Legumes to Rhizobium.

Kurt Nathan, B.S., Agricultural Engineering, Agricultural Economics. Thesis: Factors Associated with the Operation of Different Size Combines.

Elizabeth Ann Otten, A.B., Organic Chemistry, Inorganic Chemistry. Thesis: A Study of Some Derivatives of Dimethylketene Dimer.

Mesud Ozuygur, High Agr. Engineer, Technical Agriculture.

Kenneth Carroll Parkes, B.S., Ornithology, Vertebrate Zoology. Thesis: A Survey of Published Colored Illustrations of North American Birds.

Tully Sanford Pennington, B.S. in Ed., Nature Study.

William Louis Perry, A.B., Biological Sciences.

Robert Maar Roecker, B.S., Biological Sciences.

Harold Garfield Russell, Jr., B.S., Medical Entomology, Insect Taxonomy. Thesis: The Prevalence of the American Dog Tick as Affected by Application of DDT in the Control of Mosquitoes.

John Miguel Sewell, B.S. in E.E., Experimental Physics, Theoretical Physics. Thesis: The Design and Construction of a Dynamic Condenser Electrometer.

Hsien Gieh Sie, B.S., Biochemistry, Organic Chemistry. Thesis: Studies on Cerebrosides.

Jerome Razny Tichy, B.S. in Chem., Organic Chemistry, Biochemistry. Thesis: The Preparation of Some Aliphatic Amines.

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Masami Uota, B.S. in Agr., Pomology, Plant Physiology. Thesis: Studies on the Controlled Atmosphere Storage of Vinifere Grapes.

Paul John Van DeMark, B.S. in Agr., Bacteriology, Biochemistry. Thesis: The Utilization of Malic Acid by Streptococcus *faecalis* 10C1.

Suzanne Porter Walker, A.B., Physics, Mathematics. Thesis: The Quadrupole Moment of Sb123.

Eleanor Hilda Weller, A.B., Physical Chemistry, Physics. Thesis: An Electron Diffraction Study of the Structure of Hexamethylcyclotrisiloxane.

Helen Shargel Wells, B.A., Parasitology, Histology and Embryology. Thesis: The Activity of Sodium-Oxy-Acetyl-Amino-Phenyl-Arsonate in Experimental Trichinosis.

#### CONFERRED JUNE 14, 1948

Howard Alton Alsdorf, B.S., Social Studies.

Ellen Loretta Anderson, B.S., Home Economics.

Kermet Hurd Applewhite, B.S., Economic Entomology, Medical Entomology. Thesis: A Review of the More Recent Literature on Repellents for Mosquitoes, Biting Flies and Other Arthropods Affecting Man.

Winston Craig Backstrand, B.A., Applied Physics, Theoretical Physics. Thesis: Theory of Diffraction of Medium Size Holes.

Richard Haven Backus, B.A., Biological Sciences.

Edward John Beckhorn, B.S., Bacteriology, Biochemistry. Thesis: The Production of Acetylmethylcarbinol from Pyruvic Acid by Leuconostoc Mesenteroides.

Elizabeth Washington Behnken, A.B., Biological Sciences.

Gladys Irene Bellinger, B.S. in Ed., Home Economics.

Dwight Hillis Berg, B.S. in Ed., Botany.

John Aaron Bistline, Jr., B.S., Experimental Physics, Theoretical Physics. Thesis: Some Properties of Boron Trifluoride in an Ionization Chamber.

George Edwin Bowden, B.S., Applied Mathematics, Mathematical Analysis. Thesis: A Graphical Study of the Sequential Probability Ratio Test.

Dale Everett Butz, B.S. in Agr., Marketing, Monetary Economics. Thesis: Prices, Utilization and Dealers' Spreads on Milk Delivered to Homes in Upstate Cities of New York.

John William Byrn, B.S., Biological Sciences.

Colin Edward Campbell, A.B., Plant Pathology, Plant Physiology. Thesis: Studies on Chrysanthemum Rust Caused by *Puccinia Chrysanthemi* Roze.

William Hyland Chambers, A.B., Experimental Physics, Theoretical Physics. Thesis: Multiple Geiger Counters for the Observation of Particle Tracks.

Richard Ford Cochran, B.S., Technical Agriculture. Thesis: A Study of the Alfa Laval Test for Butterfat in Milk.

Ruth Elinor Deacon, B.Sc. on H.Ec., Home Economics.

Catherine Grenci Fabricant, B.S., Pathogenic Bacteriology, Bacteriology. Thesis: Studies on Blood Levels of Penicillin in Domestic Fowls and the Effect of Penicillin on Poultry Pathogens in Vitro.

Ruth Frenchman, B.S., Nutrition, Biochemistry. Thesis: The Relation of Menstrual Iron Losses to the Iron Retention Required by Women.

Nicholas Thomas Gehshan, B.S. in Agr., Organic Chemistry, Bacteriology. Thesis: Synthesis of 4-Aminopteridine and Derivatives. Gladys Catherine Hagan, B.S. in Ed., Nutrition, Biochemistry. Thesis: Iron Losses in Perspiration.

Jennie Mae Heaton, B.S., Home Economics.

Thomas Hubert Herring, A.B., Experimental Physics, Theoretical Physics. Thesis: A Study of the Scintellation Method of Counting Alpha Particles.

Joseph Rose Holzinger, B.S., Mathematical Analysis, Applied Mathematics. Thesis: Inversion Formulas for the Laplace Transform.

Donald Grunert Huttleston, B.S., Plant Taxonomy, Zoology. Thesis: A Taxonomic Study of the Genus Arisaema in North America.

Mary Phyllis Kirkpatrick, B.S., Nutrition, Rural Sociology. Thesis: A Food Purchase Study of the Families of 38 Student Veterans at Cornell University.

Eunice Teal Kochheiser, B.S., Education.

Lola B. Lackey, B.S., Foods, Biochemistry. Thesis: The Quality of Chocolate Cakes Made with Different Types of Baking Powder and with Sweet and Sour Milk.

Alice Roana Latimer, B.S., Biological Sciences.

Rhea Jane Leishman, B.A., Biological Sciences.

Philip Lewin, B.S., Education.

Elizabeth Dulcibel Little, B.H.Sc., Home Economics.

Agnes Irene Lodwick, B.Sc. (H.Ec.), Home Economics.

Richard Pell March, B.S., Dairy Science, Marketing. Thesis: Farm Milk Coolers – Immersion and Spray Types.

Elsie Marco, B.S., Home Economics.

Wayne Elden Moore, B.S., Paleontology, Structural Geology. Thesis: Some Foraminifera from the Tully Limestone of Central New York.

Coral Kate Morris, B.S., (H.Ec.), Home Economics.

Mary Margaret Mustatia, B.S. in Ed., Education.

Roger Darwin Norton, A.B., Education.

Martha Eleanor Parce, B.A., Child Development and Family Relations, Personnel Administration. Thesis: A Study of the Choice and Use of Play Materials.

Arthur Hoyle Parkinson, B.Sc. (Hortic.), Vegetable Crops, Plant Physiology. Thesis: Germination and Growth of Cucumber and Bean as Affected by Age and Storage Conditions of Seed.

William Wallace Patton, Jr., A.B., Economic Geology, Structural Geology. Thesis: Geology of the Clayton Area, Custer County, Idaho.

Sarojini Suryajee Pawar, B.S., Vegetable Crops, Plant Physiology. Thesis: The Effects of Photoperiodism and Thermoperiodism on the Type of Growth of Certain Vegetable Crops.

Ruth Eleanor Pearce, B.S., Home Economics.

Rodolfo Plinio Peregrina, Ing. Agronomo, Soils, Field Crop Production. Thesis: The Seasonal Uptake of Nitrogen by the Corn Plant as Influenced by Fertilization.

Ralph Herbert Rushmer, A.B., Organic Chemistry, Microscopy. Thesis: The Mechanism of Ether Formation by the Sulfuric-Ether Process.

Seaward Alwyn Sand, A.B., Education.

Niranjan Singh Sekhon, B.Sc., M.Sc., Biochemistry and Bacteriology.

Janet Aileen Selke, B.A., Home Economics.

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Pranlal Shah, B.Sc., Agricultural Economics. Thesis: Increasing Supply of Milk for the Large Cities in India.

Kaare Halvdan Skodvin, Artivm, Agronom., Technical Agriculture. Thesis: Storage Disorders of the Apple.

Gale Clifford Sprague, B.S., Mathematics, Physics. Thesis: Some Methods for Estimating the Error of Poisson's Approximation to the Binomial Distribution.

Irvin Lorraine Tailleur, A.B., Economic Geology, Structural Geology. Thesis: Ore Deposits of the Clayton Area, Custer County, Idaho.

Alexander Howard Turner, B.Commerce, Marketing, Business Management. Thesis: Marketing of Grain Corn in Southwestern Ontario.

Jack Marshall Tyree, B.S. (Agr.), Education.

Pothery Uttaman, B.Sc. in Agr., M.Sc., Plant Breeding, Cytology. Thesis: Some Experimental Studies in Culturing Immature Embryos of Corn with Special Reference to its Use in Raising F<sub>1</sub>'s of Incompatible Crosses.

Mary Louise Van Alstine, B.F.A., Education.

Michael Waldner, B.S. in E.E., Physics, Mathematics. Thesis: The Brownian Motion of Strings, A Discussion of Rice's Method.

Vladimir Walters, B.S., Biological Sciences.

Mary Virginia Wilson, B.S., Textiles and Clothing and Household Art, Economics of the Household. Thesis: A Study of the Use of Motion Pictures and Sound Recordings as a Testing and Teaching Device in the Costume Shop, College of Home Economics, Cornell University.

Mary Veronica Zaehringer, B. S., Foods, Nutrition. Thesis: Thiamine Retention in Yeast Bread and Rolls Baked to Different Degrees of Brownness.

## MASTERS OF SCIENCE IN AGRICULTURE

## CONFERRED SEPTEMBER 24, 1947

Abdel Aziz Allouni, B.A., M.A., Rural Sociology, Field Crop Production and Agricultural Economics.

George Baham Barstow, B.S. Agr., Floriculture and Ornamental Horticulture, Plant Breeding, Thesis: Genetic Studies in Impatiens.

Warren William Burger, B.S., Agricultural Education, Farm Management. Thesis: An Analysis of Plan and Record Books Used in Conducting Supervised Farming Programs of Students of Vocational Agriculture.

Wallace Allen Chase, B.S., Farm Management, Prices and Statistics. Thesis: Grape Production Chautauqua County, New York. 1946 Cost and Returns.

Joseph Glenn Coombs, B.S. in Agr., Agricultural Education, Agricultural Economics. Thesis: The Status of Advisory Boards in Vocational Agriculture Departments of New York State.

Lloyd Howell Davis, B.S., Farm Management, Marketing. Thesis: Costs and Other Economic Considerations in the Mow Curing of Hay.

Ralph Allen Eastwood, B.S., Land Economics and Farm Finance, Prices and Statistics. Thesis: A Study of the Mortgageability of Owner-Operated Dairy Farms in Land Class III in Central and Western New York 1937–42.

Franklin Paul Eggert, B.S., Pomology.

Solomon Harold Fischer, B.Sc., Marketing, Prices and Statistics. Thesis: Consumer Demand for Eggs and Poultry, Syracuse, New York, June 1941.

Robert Hutchinson Foote, B.S., Animal Breeding, Animal Nutrition. Thesis:

The Effect of Sulfonamides and Other Bacterial Antagonists upon the Livability of Spermatozoa and upon the Control of Bacteria in Diluted Bull Semen.

Edward Wilbur Foss, B.S., Agricultural Engineering, Agricultural Education. Thesis: A Program in Agricultural Engineering for the Vocational Agriculture Teacher Trainee at the University of New Hampshire.

Chase Del Mar Kearl, B.S., Farm Management, Prices and Statistics. Thesis: Factors Affecting Costs and Returns in Dairying in New York, 1945–46.

James Augustus McFaul, B.S., Floriculture and Ornamental Horticulture, Extension Teaching. Thesis: The Role of Boron, Copper, Manganese, and Zinc in Plant Life.

Phillip Sterling Price, B.S., Agricultural Education, Vegetable Crops.

Frederick Gordon Proudfoot, B.Sc. (Agr.), Poultry Husbandry, Marketing. Thesis: Studies of Egg Size in the Fowl.

Rex Delbert Rehnberg, B.Sc. in Agr., Farm Management, Land Economics and Farm Finance. Thesis: Factors Affecting the Value of Real Estate of New York Dairy Farms.

Ishmael Samuel Reid, B.S. in Agr., Agricultural Education, Poultry Husbandry. Thesis: Determining Opportunties to Become Established in Farming for Outof-School Negro Youth in Marion County, South Carolina.

Hilton Bebb Richardson, B.S., Vegetable Crops, Agricultural Economics. Thesis: The Effect of Temperature on the Time From Planting to Maturity of Certain Vegetables.

Kenneth Leon Robinson, B.S., Farm Management, Marketing. Thesis: Costs and Efficiency in Spraying Apples 1946.

Green Berry Sanders, B.S., Agricultural Education.

Nathaniel Bautista Tablante, B.Sc. in Agr., Farm Management, Prices and Statistics. Thesis: An Economic Study of Potato Production on New York Cost Account Farms, 1914–1945.

Winfred Thomas, B.S. in Agr., Education.

Nandlal Pribdas Tolani, B.Sc. Agr., Agricultural Engineering, Agricultural Economics.

James Harlow Whitaker, B.S., Farm Structures, Agricultural Engineering. Thesis: A Study of Frozen Food Storage for the Farm.

Clarke Brayton Wood, B.S., Agricultural Education, Farm Management. Thesis: A Survey of Practices in the Selection and Admission of Prospective Pupils of Vocational Agriculture in Connecticut.

## CONFERRED FEBRUARY 4, 1948

Jay Lyle Blanchard, B.S., in Ed., Technical Agriculture. Thesis: A Review of Literature Pertaining to Easter Lilies.

Floyd Russell Blaser, B.S. in Agr., Animal Husbandry, Animal Nutrition. Thesis: Effect of Age, Level of Winter Feeding and Time of Grain Feeding on Outcome of Steers Fattened on Pasture.

Charles Wendell Carlson, B.S., Animal Nutrition, Animal Physiology. Thesis: The Determination of Folic Acid in Foods by Chick and Microbiological Assay.

Chih Chen, B.S. in Agronomy, Soils, Field Crop Production. Thesis: Soil and Water Conservation in the Loess Plateau of Northwest China.

Wendell George Earle, B.S. Agr., Farm Management, Poultry Husbandry. Thesis: A Time and Travel Study of Poultry House Chores in New York.

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Stanley Bert McCaleb, B.S., Soils, Land Economics and Farm Finance. Thesis: A Study of Physical and Chemical Properties of Normal Soils from High-lime Glacial Till in West-Central New York as Criteria for their Classification.

Albert Neil McLeod, B.S.A., Marketing, Farm Management. Thesis: An Analysis of Patron Usage of Mother Zero Locker Plant, Ithaca, New York, 1945–47.

Rodolfo Dahme Moreno, Ingeniero Agronomo, Technical Agriculture.

Edward Beach Mott, B.S., Agricultural Engineering, Agricultural Education. Thesis: A Study of Farm Shops as a Basis for Suggestions Relative to Most Suitable Types for Repair and Maintenance of Modern Farm Machines.

Edward Herschel Piper, B.S., Marketing, Farm Management. Thesis: A Study of Frozen-Food Locker Plants in New York, 1946.

Badrinarayan Shastry, B.Sc., Soils, Biochemistry. Thesis: A Study of Soil Fertility Problems in Cotton Production.

Will Marion Simmons, B.S. in Agr., Marketing, Public Administration and Finance. Thesis: Assessment of Property in Rural New York Towns.

Mokhlesur Rahman Talukder, B. S., Soils, Agricultural Economics. Thesis: A Study of the Soil and Climatic Requirements of Cigar and Cigarette Tobaccos.

Charles Lee Thompson, B.S. in Agr., Farm Management, Animal Nutrition. Thesis: Regional Trends in Beef Cattle Numbers, 1922 to 1946.

### CONFERRED JUNE 14, 1948

Gerald George Chapin, B.S. in Agr., Technical Agriculture.

Elijah Denton Chastain, Jr., B.S., Education.

Ambrose Buchanan Lewis, B.S., Technical Agriculture.

Tulsa Ram, L. V. P., Poultry Husbandry, Animal Breeding. Thesis: A Histopathologic Study of Chicks Deficient in Pantothenic Acid and its Requirement for Normal Growth and Health.

Henry Frank Stachniewicz, B.S., Education.

James Laurence Stackhouse, Jr., B.S., Agricultural Engineering, Farm Equipment. Thesis: A Study of Mechanical Dairy Barn Gutter Cleaners.

## MASTERS OF ARCHITECTURE

## CONFERRED JUNE 14, 1948

Julio Juan Ferrand-Cilloniz, B.Arch., Architectural Design, Painting. Thesis: "El salto del Fraile" Apartments La Herradura Beach-Lima-Peru.

Edmond Morgan MacCollin, B.Arch., Architectural Design, Hotel Management. Thesis: Proposed Hotel, Rome, N. Y.

## MASTERS OF REGIONAL PLANNING

## CONFERRED SEPTEMBER 24, 1947

Richard Lawrence Rathfon, B.S., City and Regional Planning, Landscape Design. Thesis: The Recreational Use of Water Fronts in Selected Metropolitan Areas.

John Thomas Via, Jr., B.S., Regional and City Planning, Landscape Architecture, Thesis: Roanoke Replanned.

Myer Wolfe, B.S., City Planning, Regional Planning. Thesis: The Current Toll Road Trend.

#### THE GRADUATE SCHOOL

### CONFERRED FEBRUARY 4, 1948

Richard LeRoy Brown, B.Arch., City Planning, Regional Planning. Thesis: Batavia: A Preliminary Study.

Frederick Adams McLaughlin, Jr., B.S., Regional Planning, City Planning. Thesis: A Plan for Northampton, Massachusetts.

Charles Billings Woodman, A.B., Regional and City Planning, Land Economics and Farm Finance. Thesis: Brunswick: A Survey and Plan.

#### CONFERRED JUNE 14, 1948

Arthur Edward Prack, Jr., B.Arch., Regional and City Planning, Architectural Design. Thesis: An Analysis of Land Use in the Major Cities of the United States.

## MASTER OF SCIENCE IN ENGINEERING

#### CONFERRED SEPTEMBER 24, 1947

Jagdish Chandra Kapur, B.S. in Eng., Heat Power Engineering, Administrative Engineering. Thesis: A Design for a Cold Storage Plant to Store One Thousand Tons of Mangoes and Also a Ten Ton Ice Plant.

Michael Siegfried Martus, B.S. (M.E.), Heat Power Engineering, Industrial Engineering. Thesis: Heat Pump Fundamentals. Application of Heat Transfer in the Earth to the Heat Pump.

Jack Hudson McMinn, B.S. in C.E., Structural Engineering, Air Conditioning, Illumination. Thesis: Design of a Multistoried Reinforced Concrete Building.

#### CONFERRED FEBRUARY 4, 1948

Tao Hung Chen, B.Eng., Hydraulics, Highway Engineering. Thesis: A Theoretical Study of Suspended-load Movements in Turbulent Streams.

George Francis Dixon, B.S., Structural Engineering, Soil Mechanics. Thesis: An Investigation of a Theory of Physical Chemical Behavior of Colloidal Clay under a Compressive Load.

Alexander Balazs Horvath, B.S. in C.E., Highway Engineering, Administrative Engineering. Thesis: The Effects of Various Chemical Admixtures on the California Bearing Ratio of Fine Grained and Granular Soils.

Vishwanath Vishnu Sarwate, B.S., M.Sc., Radio and Communications, Industrial Electronics. Thesis: Design of an Inexpensive Radio Receiver for Use in India.

Frank Edward Weeks, B.S. in E.E., Industrial Electronics, Machine Design. Thesis: An Investigation of Governors, Radio Interference, and Transfer Levers of an Electric Adding Machine.

#### CONFERRED JUNE 14, 1948

Laverne Roger Anderson, B.S. in E.E., Illumination Engineering, Psychology. Thesis: A Time Threshold Definition of Visibility.

Roy Tinsley Dodge, B.S., Industrial Engineering, Soil Mechanics. Thesis: An Analysis of the Economics of Earthmoving.

Richard Henry Free, B.S. in Eng., Materials of Engineering, Metallurgy. Thesis: Mechanical Properties of Magnesium Alloys at Low Temperatures.

Howard Golub, B.S. in C.E., Sanitary Engineering, Management Engineering. Thesis: A Study of Flocculation, with the Aid of an Overhead Drive Flocculator. Cary Hardison Hall, B.S., Engineering Physics, Administrative Engineering, Physical Chemistry. Thesis: Confidential.

Wei-Shing Ku, B.S. (E.E.), Electric Power Generation and Distribution, Industrial Control and Applications. Thesis: A Study of the Important Electrical Characteristics in a Steam Power Plant Design.

Frank Ernest Rom, B.S. in M.E., Heat Power Engineering, Aeronautical Engineering. Thesis: The Laboratory Testing of Aircraft Gas Turbines.

Arthur Wilson Starkey, G.S., Administrative Engineering, Soil Mechanics. Thesis: A Comparative Study of the Replacement Parts Supply System of the Corps of Engineers United States Army and the Chevrolet-Flint Division of the General Motors Corporation.

Paul Henry Symbol, B.S. in E.E., Industrial Engineering, Soil Mechanics. Thesis: Materials Handling in an Army Depot.

Clyde Fischer Townsend, B.S., B.S. in Ed., Administrative Engineering, Soils Mechanics. Thesis: A Study of the Training Requirements in the Arms and Services of the Army for Given Military Occupational Specialties.

Myron Edward Ullman, Jr., B.S. in A.E., Administrative Engineering, History of Architecture. Thesis: A Study of Industrial Design of an 8mm Motion Picture Sound Projector.

Victor Owen Wilson, B.S., Industrial Engineering, Soils Mechanics. Thesis: Economic Analysis of Flood Control Projects in the Corps of Engineers.

Sung-Yuen Wong, B.S. (E.E.), Electric Power Generation and Distribution, Industrial Electronics. Thesis: An Oscillograph Demonstration Set to Represent Impulse Waveforms.

# MASTERS OF CHEMICAL ENGINEERING

## CONFERRED SEPTEMBER 24, 1947

John Richard Connolly, B.Chem.E., Chemical Engineering, Physical Chemistry. Thesis: Pseudoplastic Flow Investigations in a Tube Viscometer.

Michael Rudolph Sfat, B.Chem.E., Chemical Engineering, Bacteriology. Thesis: Studies of the Thermophilic Fermentation of Cellulose.

Ogden Ray Smith, B.S., in Chem. Eng., Chemical Engineering, Administrative Engineering. Thesis: Estimation of Specific Surface by Absorption of Methylene Blue Dye.

Raymond Gerald Thorpe, B.Chem.E., Chemical Engineering, Physical Chemistry. Thesis: Pseudoplastic Flow in Capillary Tubes.

### CONFERRED JUNE 14, 1948

William Sanford Humphrey, Jr., B.S., Chemical Engineering, Administrative Engineering. Thesis: Bonding of Metallic Surfaces by Adhesives.

## MASTERS OF CIVIL ENGINEERING

## CONFERRED SEPTEMBER 24, 1947

Benjamin Jacob Aleck, C.E., Mechanics, Structural Engineering. Thesis: Complementary Energy.

Henry John Louis Rechen, B.C.E., Sanitary Engineering, Structural Engineering. Thesis: Coagulation Studies of Sulphate Paper Pulp Mill Weak Black Liquor,

### THE GRADUATE SCHOOL

### CONFERRED FEBRUARY 4, 1948

Richard Ackroyd, B.S. in C.E., Hydraulic Engineering, Structural Engineering. Thesis: An Analysis of Methods for Determining Peak Flood Discharge.

Raymond Joseph Hodge, B.C.E., Structural Engineering, Highway Engineering, Thesis: Mechanical Methods of Solving Indeterminate Structures.

Ta Liang, B.Eng., Highway Engineering, Structural Engineering. Thesis: Highway Reconstruction Problems in China.

Donald Raymond Lueder, B.S. in C.E., Highway Engineering, Management Engineering, Thesis: Some Relations between Geology, Soil Development, Airphoto Analysis and Highway Engineering.

Herbert Spencer Meltzer, B.C.E., Hydraulics, Theory of Structures. Thesis: Flow over Weirs at Low Heads.

### CONFERRED JUNE 14, 1948

John Martin Tully, B.C.E., Theory of Structures, Management Engineering. Thesis: An Investigation of Split Ring Timber Connector Joints.

## MASTERS OF ELECTRICAL ENGINEERING

#### **CONFERRED SEPTEMBER 24, 1947**

Robert Lloyd Chase, B.S., Radio and Communications, Physics. Thesis: Polarization in Ultra-High Frequency Fields.

George Robert Utting, B.S. in E.E., Radio and Communication, Physics. Thesis: A Wide Angle Pulse-Position Phase Modulator.

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#### CONFERRED FEBRUARY 4, 1948

Frank Wood Noble, B.E.E., Electrical Communication, Electrical Measurements. Thesis: A Capacitance Diaphragm Manometer for Blood Pressure Recording.

### CONFERRED JUNE 14, 1948

Li-Shiang Liu, B.S. in E.E., Electric Power System Stability, High Voltage Engineering. Thesis: A Study of Transmission Line Design.

William Henderson Wilder, B.E.E., Servomechanisms, Physics. Thesis: A Method of Electronic Control of Motor Speed Employing Two Superimposed Rectangular Pulses.

## MASTERS OF MECHANICAL ENGINEERING

### CONFERRED JUNE 14, 1948

George Walter Morgan, B. (M.Eng.), Mechanics, Mathematics. Thesis: A Two-Dimensional Analysis of Stresses in a Rectangular Block.

William Frank Pearson, B.M.E., Materials of Engineering, Organization and Control of Industry. Thesis: The Effects of Interrupted Quenching and Sub-Zero Temperatures on the Properties of an Oil-Hardening Die Steel.

## MASTER OF LAWS

#### CONFERRED SEPTEMBER 24, 1947

William Polatsek, A.B., LL.B., Public Law, Jurisprudence, Private Law.

## ROSTER OF DEGREES

## MASTERS OF SCIENCE IN EDUCATION

### CONFERRED SEPTEMBER 24, 1947

Kenneth Wallace Anthony, A.B. Margaret Ellen Augst, B.S. Elda Minerva Bence, B.S. Lorraine Ann Bode, B.S. Arthur Ronald Brandoff, B.S. Arlo Bowlby Carroll, B.S. Agr. Wilson Robert Conrad, B.S. Madeline Alice Dunsmore, B.S. Mary Child Foster, B.S. Albert Edson French, B.S. in E.E. Charles Frederick Goliber, B.S. in Ed. Olive Helena Griffin, B.S. in H.E. William Francis Griffith, A.B. Crede Dale Hagerty, B.S. in Ed. Edward Kilian Halbleib, B.S. Florence Devoe Judy, B.S. (H.E.). John Bernard Labourr, B.S. Graydon Paul McCarty, B.S. Rose Theresa Mignot, A.B. Frederic Dexter Morris, B.S. Raymond Andrew Prosser, E.E. Kathleen Rhodes, Teachers Cert. Arthur Edward Smith, B.S. in Art Ed. Jack Raymond Terry, B.Sc. in Ed. James Oscar Warfield, A.B.

Richard Ernest Wells, B.A.

Norvin Trent Whitmore, B.S. in Ed. Thesis: A Study of the Methods for Financing Project Materials in the Industrial Art Courses on the Junior High School Level.

CONFERRED FEBRUARY 4, 1948

Lester Burns, B.S. Alfred Emerys Davies, B.S. in E.E. Robert Maurice Isenberg, B.S. in Ed. Gerald William Lattin, B.S. Robert McLaughlin, A.B. John Howell Powell, B.S. William Epes Skelton, B.S.

John Patrick Walsh, B.S. in Ind. Arts Educ., Thesis: A Survey of Occupations in the Glove Manufacturing Industry of Fulton County, New York, and a Community Occupational Survey of the City of Gloversville, New York for the Planning of Vocational Education in the Public Schools.

### THE GRADUATE SCHOOL

#### CONFERRED JUNE 14, 1948

Frank May Chambers, B.S.

Radha Charan Das, B.S. Thesis: Some Basic Considerations for the Development of Industrial Education in Orissa (India).

Burton William DeVeau, B.S. Thesis: School (Non-Agricultural) and Community Activities of Vocational Agriculture Teachers in New York State.

James Edward Dolan, A.B.

Mary Katherine Eckel, A.B.

Barbeur Lee Griswold Grimes, B.A. Thesis: A Study of In-Service Training Programs in Student Personnel for Graduate Students in American Colleges and Universities.

Jean Mayer Hill, B.S. in Ed.

Pearl Breitmaier Isenberg, B.S. in Ed.

Albert James Kingston, Jr., B.S. in Ed.

Gilbert Eugene McGrew, B.S.

Helen May McKercher, B.S. (H.Ec.).

Gertrude Miller, B.S. (H.E.).

Percival Ford Miller, E.E., M.S. Thesis: A Study of Shop Courses Offered in Engineering Curriculums at Selected Land Grant Colleges, Polytechnic Institutions and Universities in the Eastern United States.

James Jackson Rutherford Munro, B.S.

Harry Swainbank Powell, A.B.

Robert Otto Shaffer, B.A.

Raymond Warrick Van Giesen, B.S.

Harold Hughes Wood, B.S.

## MASTER OF SCIENCE IN INDUSTRIAL AND LABOR RELATIONS

#### CONFERRED FEBRUARY 4, 1948

Norman Francis Bourke, B. A., Collective Bargaining Mediation and Arbitration, Industrial and Labor Legislation and Administration. Thesis: A Study of Unionism in the Textile Industry of Utica, New York.

William Patrick Burns, A.B., Collective Bargaining, Mediation, and Arbitration, Personnel Management. Thesis: A Study of Personnel Policies, Employee Opinion and Labor Turnover (1930–1946) at the Endicott Johnson Corporation.

John Corbin Eddison, A.B., Collective Bargaining, Mediation, and Arbitration, Human Relations in Industry. Thesis: Teacher Strikes in the United States.

Henry Neil Rogers, B.Sc., Comm., Collective Bargaining, Mediation and Arbitration, Labor Legislation. Thesis: The Background of Organized Labor and an Analysis of Union Agreements in the Primary Pulp and Paper Industry.

Morris Sackman, B.S., Trade Union Organization and Administration, Collective Bargaining, Mediation and Arbitration. Thesis: An Investigation into the Operation of the Health and Welfare Fund of the Joint Board Dress and Waistmakers Union of Greater New York, International Ladies' Garment Workers' Union, A.F.L.

### ROSTER OF DEGREES

#### CONFERRED JUNE 14, 1948

Margaret Schaer Groat, B.S. (H.Ec.), Collective Bargaining, Mediation and Arbitration, Human Relations in Industry. Thesis: Collective Bargaining in Wall Street.

Richard Joseph Hanley, A.B., Human Relations in Industry, Collective Bargaining, Mediation, and Arbitration. Thesis: A Study of Union-Management Relations at the Amsterdam Plant of the Bigelow-Sanford Carpet Company with Emphasis on the Development of Human Relations in the Grievance Procedure.

John Cushman Truesdale, Jr., A.B., Labor Union Organization and Operation, Collective Bargaining, Mediation and Arbitration. Thesis: The History and Present Status of Legislation Concerning the Secondary Boycott.

## DOCTORS OF PHILOSOPHY

#### CONFERRED SEPTEMBER 24, 1947

MacLean Jack Babcock, B.S., M.S., Animal Nutrition, Biochemistry, Organic Chemistry, Thesis: The Determination of Metabolizable Fat in Foods and Feeds.

Horace Roy Baxman, B.S., Inorganic Chemistry, Physical Chemistry, Organic Chemistry. Thesis: A Study of Some Unsymmetrical Boron Compounds.

Paul Cecil Bibbee, B.S. Agr., M.S., Ornithology, Vertebrate Zoology, Entomology. Thesis: The Bewick's Wren, *Thryomanes bewickii* (Audubon).

Leonard Henry Blakeslee, B.S., M.S., Animal Husbandry, Agricultural Economics, Animal Physiology. Thesis: Changes in Beef Resulting From Aging and Freezing.

Frank Paul Boyle, Jr., B.S., Plant Physiology, Biochemistry, Organic Chemistry. Thesis: A Study of Oxygen Evolution From Cell-Free Suspensions of Triturated Spinach Leaves.

Herman John Carew, B.S., Vegetable Crops, Plant Physiology, Soils. Thesis: A Study of Certain Factors Affecting "Buttoning" of Cauliflower.

William Everett Chappell, B.S. Agr., M.S., Vegetable Crops, Plant Breeding, Plant Physiology. Thesis: Part One: Some Nutritional Factors Affecting the Yield and Keeping Qualities of Onions (Allium Cepa). Part Two: The Effect of Some Weed Control Practices on the Yield and Keeping Quality of Onions.

Ralph L. Chermock, B. S., M.S., Entomology, Zoology, Medical Entomology. Thesis: A Generic Revision of the *Limenitini* of the World.

Oliver Cecil Compton, B.S., M.S., Pomology, Soils, Plant Physiology. Thesis: Aeration and Salt Absorption by Young Apple Trees.

Arabinda Kumar Dutt, B.Sc., M.Sc., Soils, Plant Physiology, Field Crop Production. Thesis: The Effects of Various Physical, Chemical, and Biological Treatments on Soil Structure and Soil Aggregation and on the Yield and Composition of Crops.

Margaret Thekla Dyar, B.S., M.S., Bacteriology, Biochemistry, Plant Cytology. Thesis: Electrophoretic Studies on the Chemical Nature of Bacterial Surfaces.

Hamilton Dean Eaton, B.S., M.Sc., Animal Husbandry, Animal Nutrition, .Veterinary Physiology. Thesis: Studies on Prepartal and Neonatal Supplementation with Vitamin D in Dairy Cattle.

Maria Julieta Escudero, A.B., M.A., Spanish Literature, Spanish American Literature, French Literature. Thesis: Contemplación Del Quijote.

Clifford Dixon Firestone, B.S., Algebra, Mathematical Analysis, Philosophy. Thesis: Sufficient Conditions for the Modelling of Axiomatic Set Theory. Carolyn Elizabeth Foust, B.A., Bacteriology, Organic Chemistry, Biochemistry. Thesis: A Glycolytic Stimulant for Lactic Acid Bacteria.

Thelma Toby Gilman, A.B., A.M., Psychobiology, Social Psychology, Anthropology. Thesis: "Animal Hypnosis": A Study in the Induction of Tonic Immobility in Chickens.

Eva Lucretia Gordon, B.S., M.S., Nature Study, Entomology, Meteorology. Thesis: A Study of the Evaluation of Nature and Science Literature for Children of Elementary School Age.

Walter A. Gregory, A.B., M.S., Organic Chemistry, Biochemistry, Inorganic Chemistry. Thesis: A Study of Some Cyclic Disulfides Related to Gliotoxin.

Frederick William Haberman, A.B., A.M., Rhetoric and Public Speaking, English, Classical Rhetoric. Thesis: The Elocutionary Movement in England, 1750–1850.

Alfred von der Heydt, M.A., German Literature, German Philology, French Literature. Thesis: Friedrich Bodenstedt in Amerika Und Sein Buch Vom Alanteschen Zum Stillen Ozean.

Pei-Tung Hsu, B.S., M.S. in Eng., Structural Engineering Mechanics, Mathematics. Thesis: Elastic Stability of Members in Trusses.

Allan Siple Hurlburt, A.B., A.M., Educational Administration, Supervision, Rural Sociology. Thesis: An Analysis of Needs in a Junior High School Community in New Haven, Connecticut, as a Basis for Developing a School-Community Program.

Hazel Luella Ingersoll, B.S. in H.E., A.M., Family Life, Social Psychology, Child Development and Guidance. Thesis: A Study of the Transmission of Authority Patterns in the Family.

Esther Kaufman, B.A., A.M., English Literature Since 1700, English Renaissance, Philosophy. Thesis: The Use of Oriental Material by James Thomson, Oscar Wilde, and Rudyard Kipling.

Frank Kopko, B.Chem., Biochemistry, Organic Chemistry, Nutrition. Thesis: Some Factors Affecting the Degradation of Carotene in Plant Materials and Simple Chemical Systems.

Padmanabhan Subbarao Krishnan, B.A., M.A., Biochemistry, Animal Nutrition, Bacteriology. Thesis: Studies on Coenzyme I.

Bert Lear, B.S., Plant Pathology, Plant Breeding, Entomology. Thesis: The Use of Methyl Bromide and Other Volatile Chemicals for Soil Fumigation.

William Judson Le Veque, B.A., A.M., Algebra, Mathematical Analysis, Philosophy. Thesis: On the Distribution of Values of Number-Theoretic Functions.

Clearhos Logothetis, B.S., M.S., Economic Entomology, Medical Entomology, Plant Pathology. Thesis: The Biology of Some Tabanidae of New York State.

Alfred Delbert Longhouse, B.S., M.S. in Agr., Agricultural Engineering, Farm Equipment, Agricultural Economics. Thesis: Performance Characteristics of Long-Hay Blowers.

Abraham Morton Mark, B.A., M.S., Mathematical Analysis, Algebra, Theoretical Physics. Thesis: Limit Theorems in the Theory of Probability.

Don A. Marshall, B.S., M.S., Farm Management, Prices and Statistics, Money, Banking, and International Finance. Thesis: A Study of Farm Tenure in the Coastal Plain of Arkansas.

Eunice Sophia Matthew, B.A., M.A., Supervision, Rural Education, Rural Sociology. Thesis: An Evaluative Study of the Attitudes of Negro Elementary
School Teachers in One-Teacher Schools of Tennessee Toward Certain Educational Principles.

William Hardy McNeill, A.B., A.M., Modern European History, Medieval History, Ancient History. Thesis: The Influence of the Potato on Irish History.

Glenn Houston Miller, B.S., Experimental Physics, Theoretical Physics, Electrical Communications. Thesis: The Addition of Electrical Currents by the Use of Magnetic Amplifier Circuits.

Gordon McGlohon Nichols, B.S., Inorganic Chemistry, Organic Chemistry, Physical Chemistry. Thesis: A Study of the Systems Methylamine-Boron Trifluoride, Dimethylamine-Boron Trifluoride.

Charles Robert Nixon, A.B., Political Theory, Constitutional Law, Comparative Government. Thesis: French Speech for Anti-Democratic Groups?

Daniel Joseph O'Kane, Jr., B.S., M.S., Bacteriology, Biochemistry, Physical Chemistry. Thesis: The Properties and Purification of an Unidentified Factor Required for Pyruvate Metabolism by *Streptococcus Faecalis*.

Otto John<sup>®</sup> Plescia, B.S., Physical Chemistry, Mathematics, Physics. Thesis: The Fractionation of Proteins by Electrophoresis-Convection.

Jacob Riseman, B.S., Physical Chemistry, Physics, Mathematics. Thesis: The Intrinsic Viscosity of Linear High Polymers and Their Translational and Rotational Diffusion Constants.

Jean (Janina) Rosten, B.Sc., Organic Chemistry, Inorganic Chemistry, Biochemistry. Thesis: Synthetic Studies of 24- and 31-Membered Carbon Rings.

Roger William Roth, B.S., Economic Entomology, Insect Toxicology, Vegetable Crops. Thesis: A Study of the Compatibility of D.D.T. With Bordeaux Mixture and Copper Lime Dust.

Charles Sundy Schollenberger, B.A., Organic Chemistry, Inorganic Chemistry, Biochemistry. Thesis: Withheld.

Donald Rector Scott, B.A., M.A., Educational Administration, Rural Sociology, Public Administration and Finance. Thesis: Methods of Implementing the Educational Program in Intermediate Districts.

Harry Wilbur Seeley, Jr., B.S., M.S., Bacteriology, Dairy Science, Biochemistry. Thesis: Physiology of *Streptococcus Uberis*.

Thomas Howard Shelley, Jr., B.S., M.S., Organic Chemistry, Physical Chemistry, Inorganic Chemistry. Thesis: The Application of the Mannich Reaction to the Preparation of 2–Nitro-1–Alkenes.

Grant Newey Smith, A.S., A.B., Biochemistry, Plant Physiology, Organic Chemistry. Thesis: Studies on Lipoxidose.

Harold Eugene Smith, B.S., B.S., M.S., Rural Sociology, General Sociology, Agricultural Economics. Thesis: Some Case Studies of Social Participation in a New York Village.

Ralph Donald Spencer, B.A., M.A., Organic Chemistry, Inorganic Chemistry, Biochemistry. Thesis: A Study of Some Preparative Methods for Aliphatic Ketones and Development of a New Synthesis for Many-membered Rings.

Alice Sperduti, B.A., A.M., Latin Literature, Greek Literature, Italian. Thesis: Petrarch on Poetry.

Arthur Morton Squires, A.B., Physical Chemistry, Mathematics, Physics. Thesis: Electrolytic Transport of Non-Electrolytes.

Jung-yi Tung Sun, B.S., Insect Ecology, Plant Physiology, Insect Morphology. Thesis: An Ecological Study of the Barberry Looper *Coryphista Meadii* Packard. William Porter Swift, A.B., A.M., Applied Psychology, Education, Sociology. Thesis: Accidents to Farm People in New York State in 1946–47.

Robert James Tedeschi, A.B., M.S., Organic Chemistry, Analytical Chemistry, Biochemistry. Thesis: Studies of Many-membered Carbon Rings.

Charles Harrison Uhl, A.B., M.S., Cytology, Plant Morphology, Geology. Thesis: A Cytotaxonomic Study of the Crassulaceae.

Luitpold Wallach, Ph.D., Latin Literature, Medieval History, Modern European History. Thesis: Bertholdi Zwifaltensis Liber De Constructione Monasterii. Edited With an Introduction and Notes.

Samuel Hsuan Wang, A.B., International Law and Relations, Political Theory, American History. Thesis: The Sino-Japanese War and the American Far Eastern Policy, 1931–1941.

Dwain Willard Warner, B.A., Ornithology, Vertebrate Zoology, Botany. Thesis: The Ornithology of New Caledonia and the Loyalty Islands.

Paul Welsh, B.S., Ethics, History of Philosophy, Epistemology. Thesis: Dewey's Theory of Inquiry.

Minter Jackson Westfall, Jr., B.S., Nature Study, Entomology, Ornithology. Thesis: A Preliminary Biological Survey of a Central New York Woodlot With Special Reference to its Use to Naturalists and in the Training of Naturalists.

Willard Hall Whitcomb, B.S., M.S., Economic Entomology, Insect Morphology, Plant Pathology, Thesis: The Biology of the European Chafer *Amphimalon Majalis* (Razouomwsky).

Russell George Whitesel, B.A., M.A., Constitutional Law, American Governmental Institutions, International Law and Relations. Thesis: The Power of Congress to Remove Federal Officers.

William Thomas Winne, A.B., M.S., Economic Botany, Plant Physiology, Bacteriology. Thesis: Taxonomic and Ecologic Studies of the Aquatic Bryophytes of New York State: *Sphagnum, Drepanocladus, Fontinalis* and *Dichelyma*.

#### CONFERRED FEBRUARY 4, 1948

Paulo de Tarso Alvim-Carneiro, B.Sc. in Agr., Plant Physiology, Economic Botany, Vegetable Crops. Thesis: Studies on the Mechanism of Stomatal Behavior.

Coimbatore Panchanada Anantakrishnan, B.S., M.S., Dairy Chemistry, Dairy Science, Biochemistry. Thesis: A Study of the Isolation and Properties of Rare Sugars in Milk.

Carl Joseph Anderwald, B.S. in C.E., M.S. in Ed., Industrial Education, Personnel Administration, Supervision. Thesis: National Defence Training Program for Pre-Employment Machine Shop Practice in Central New York State: A Study of its Organization, Administration, and Supervision with an Appraisal of its Contribution.

Arthur Morford Barnes, A.B., A.M., Rhetoric and Public Speaking, American History, Phonetics and Speech Training. Thesis: American Intervention in Cuba and Annexation of the Philippines: An Analysis of the Public Discussion.

James Monroe Beattie, B.S., Pomology, Plant Physiology, Soils. Thesis: Studies on Sugars, Starch, and Hemicellulose in Relation to the Nitrogen Nutrition of the McIntosh Apple.

Kenneth Crees Beeson, B.S., M.S., Soils, Analytical Chemistry, Geology. Thesis: The Relation of Soils to the Cobalt Requirements of Ruminants.

# ROSTER OF DEGREES

Alfred John Canale, A.B., Organic Chemistry, Physical Chemistry, Inorganic Chemistry. Thesis: Nitroölefins as Dienophiles in the Diene Synthesis.

Richard Alfred Carrigan, B.S., Soils, Physical Chemistry, Plant Physiology. Thesis: The Chemistry of Cobalt in Florida Soils.

Howard Emerson Conklin, B.S., M.S., Land Economics and Farm Finance, Economic Theory and Its History, Prices and Statistics. Thesis: A Statistical Analysis of Employment and Farming Data for Open-Country Residents of Chemung and Monroe Counties, New York.

Dsai-Chwen Dju, B.S., M.S., Animal Nutrition, Foods, Biochemistry. Thesis: The Vigor and the Viability of Soy Beans during Storage, Heating, and Dehydration.

Franklin Elmer Eldridge, B.S. in Agr., M.S., Animal Husbandry, Veterinary Physiology, Genetics. Thesis: Evaluation of Dairy Bulls by Multiple Regression and a Study of Variability of Milk and Butterfat Records.

Rose Charlotte Engelman, B.A., American History, Modern European History, English History. Thesis: Washington and Hamilton: A Study in the Development of Washington's Political Ideas.

Robert Forney Eshleman, B.S., M.S., Rural Sociology, Land Economics and Farm Finance, Farm Management. Thesis: A Study of Changes in the Value Patterns of the Church of the Brethren.

James Brainerd Evans, B.S., Bacteriology, Organic Chemistry, Biochemistry. Thesis: Studies of Staphylococci with Special Reference to the Pathogenic Types.

William Howell Ewing, A.B., M.A., Veterinary Bacteriology, Veterinary Pathology, Parasitology. Thesis: Interrelationships within the *Enterobacteriaceae*.

Robert Harry Ferguson, A.B., A.M., Labor Economics, Economic Theory and Its History, Economic History. Thesis: The Unionization of Foremen.

Charles Occlus Fitzwater, A.B. Ed., A.M., Administration, Public Finance, Rural Sociology, Thesis: Principles Underlying the Community Use of the School in Rural Areas.

Giles George Greene, B.S. in C.E., S.M. in C.E., Structural Engineering, Transportation, Mechanics. Thesis: Lateral Buckling of Elastically Braced Columns.

William George Houk, B.S., M.S., Plant Anatomy, Plant Physiology, Mycology. Thesis: Affinities of the Lower Rosaceae.

John Southgate Yeaton Hoyt, B.S., M.S., Ornithology, Nature Study, Biology. Thesis: Further Studies of the Pileated Woodpecker *Hylatomus pileatus* (Linnaeus).

Mary Jean Humphreys, B.S., A.M., English Literature Before 1700, Prose Fiction, English History. Thesis: The Problem of Death in the Life and Works of John Donne.

Charles Joseph Kensler, A.B., M.A., Pharmacology, Biochemistry, Physiology. Thesis: Studies on the Anticurare Activity of Congo Red and Related Compounds.

Cletus Paul Kohake, B.A., A.M., Rural Secondary Education, Mediaeval History, Educational Psychology. Thesis: The Life and Educational Writings of Rabanus Maurus.

Glen Pehr Lofgreen, B.S. in Agr., M.S., Animal Nutrition, Veterinary Physiology, Biochemistry. Thesis: The Protein Requirements of Growing Holstein Cattle. A Comparative Study of Conventional Allowances and Theoretical Minimum Requirements.

Ralph Edward Miegel, A.B., A.M., Organic Chemistry, Physical Chemistry, Inorganic Chemistry. Thesis: Derivatives of Dimethylketene Dimer.

William Seastream Monlux, D.V.M., Animal Pathology, Pathogenic Bacteriology, Parasitology. Thesis: 1. The Incidence of Leptospirosis in the Rat Population of Ithaca and Vicinity. 2. The Clinical Pathology of Canine Leptospirosis.

Eugene Gordon Munroe, B.Sc., M.Sc., Insect Taxonomy, Insect Physiology, Economic Entomology. Thesis: The Geographical Distribution of Butterflies in the West Indies.

(Wilbur) Stanley Newcomer, B.S., M.S., Invertebrate Zoology, Animal Physiology, Vertebrate Morphology. Thesis: Segmentation of the Head and Development of the Mouth Parts and Related Structures of the Milkweed Bug, *Oncopeltus Fasciatus* (Dallas).

Leo Dale Newsom, B.S., Field Crop Production, Economic Entomology, Vegetable Crops. Thesis: The Biology and Economic Importance of the Clover Root Borer *Hylastinus obscurus* (Marsham).

Gerhard Adolf Nothmann, B.S. in M.E., M.S. in M.E., Mechanics, Heat Power Engineering, Mathematics. Thesis: Vibration of Cantilever Beam with Prescribed End Motion.

Manuel Rodriguez-Diaz, A.B. in Ed., M.A. in Ed., Educational Administration, Supervision, Rural Sociology. Thesis: Conceptions Involved in Replanning Rural Education in Puerto Rico.

Martin Sherman, B.Sc. in Agr., M.S., Insect Toxicology, Economic Entomology, Plant Physiology. Thesis: The Relative Toxicity of the Isomers of 1,2,3,4,5,6– Hexachlorocyclohexane to Several Insect Species and the Bioassay of the Gamma Isomer as Determined in the Laboratory.

Edward Holman Smith, B.S., M.S., Economic Entomology, Pomology, Entomology. Thesis: On the Mode of Action of Petroleum Oils as Ovicedes.

Harold Arthur Strecker, A.B., Inorganic Chemistry, Organic Chemistry, Physical Chemistry. Thesis: A Study of the System Tantalum-Boron.

Cyrl Waldie Terry, M.E., M.M.E., Agricultural Engineering, Experimental Mechanical Engineering, Heat Power Engineering, Thesis: The Thermodynamics of Hay Driers.

Marlowe Driggs Thorne, B.S., M.S., Soils, Physics, Physical Chemistry. Thesis: The Dielectric Properties of Soil Moisture and Their Determination.

Edward Bayard VanDusen, B.S. in I.E., M.Ed., Industrial Education, Guidance and Personnel Administration, Educational Administration. Thesis: Apprenticeship in Western New York State. A Study of the Development and Present Status of Apprentice Training Programs and of Indentured Apprentices.

Robert Adolph Wichert, A.B., A.M., The Romantic Period, History, Old and Middle English. Thesis: Napoleon and the English Romantic Poets.

William Walton Woodhouse, Jr., B.S., M.S., Soils, Plant Physiology, Field Crop Production. Thesis: The Relation of Species and Fertilizer Placement to the Productivity of Pasture Swards.

#### CONFERRED JUNE 14, 1948

Abraham Abraham, B.S., M.A., M.S., Genetics, Cytology, Plant Morphology. Thesis: A Cytogenetical Study of Trisomic Types in *Nicotiana langsdorffii*.

Ross Harold Arnett, Jr., B.S. (Agr.), M.S., Entomology, Medical Entomology, Botany. Thesis: A Revision of the Nearctic Oedemeridae (Coleoptera). Donald Ashdown, B.S., Economic Entomology, Vegetable Crops, Biology. Thesis: Control of the Lettuce Yellows Disease through Control of *Macrosteles divisus* (Uhl) in New York.

John Milton Bell, B.Sc. Agr., M.Sc., Animal Nutrition, Animal Physiology, Biochemistry. Thesis: Investigations of the Methionine Requirement for Growth of Swine. With Preliminary Studies on the Lysine and Tryptophane Requirements.

Frederick Joseph Bueche, B.S., Experimental Physics, Theoretical Physics, Mathematics. Thesis: The Optical Properties of Ni, Co, Fe, Mn and Cd.

Wallace Caughey Caldwell, B.S., M.S., Experimental Physics, Theoretical Physics, Mathematics. Thesis: The Photoconductivity of Silver Chloride and Thallium Bromide in the Visible and Near Infrared.

Philip Wright Callanan, A.B., English Literature to 1700, English History, Dramatic Literature. Thesis: Samuel Daniel's *Delia*: A Critical Edition.

Rameswar Singh Choudhri, B.S., M.Sc., D.Sc., Plant Physiology, Vegetable Crops, Soils. Thesis: Studies of the Effects of Certain Plant Hormones on Growth, General Behaviour and Food Transport of *Phaseolus Vulgaris L*.

Madanlal Dewan, B. Sc., M.Sc., Soils, Plant Physiology, Crop Production. Thesis: Certain Factors Affecting the Efficiency of Utilization of Phosphatic Fertilizers.

Robert Louis Ehrenfeld, A.B., Organic Chemistry, Physical Chemistry, Inorganic Chemistry. Thesis: Photochemical Chlorination of Chlorofluoro Ethylenes as Related to their Fluorination with Elementary Fluorine.

Watson Harry Everhart, B.S., M.S., Fisheries, Entomology, Vertebrate Zoology. Thesis: A Critical Study of the Scale Method in Back-Calculating Lengths of the Smallmouth Bass, *Micropterus dolomieu* Lacepede.

Leonard James Eyges, B.S., M.S., Theoretical Physics, Experimental Physics, Mathematics. Thesis: On the Scattering of Particles in Extensive Air Showers.

Gilbert Gavlin, B.S., (Chem.E.), Organic Chemistry, Physical Chemistry, Inorganic Chemistry. Thesis: The Fluorination of Hexachlorobutadiene and Hexachloropropylene.

Isabella Brogan Grace, A.B., Parasitology, Histology, Medical Entomology. Thesis: A Study of Toxoplasmosis.

Harold Ellsworth Gray, B.S. in Agr. Eng., Agricultural Engineering, Floriculture, Soils. Thesis: A Study of the Problems of Heating, Ventilating, and Air Conditioning Greenhouses.

Thomas Francis Hall, Jr., B.S., M.S., Economic Botany, Plant Anatomy, Entomology. Thesis: Studies on the Use of Synthetic Growth Regulating Substances for the Control of Littoral Plants in the Tennessee Valley.

Carl Arnold Hanson, B.A., Human Relations in Industry, Personnel Management, Collective Bargaining, Mediation, and Arbitration. Thesis: The Arbitration of Grievances: An Investigation to Determine the Presence of Settlement Patterns in Disputes over Conditions of Work.

Maurice Addison Hatch, A.B., M.A., The English Renaissance, Dramatic Structure, American Literature. Thesis: The Ascham Letters: An Annotated Translation of the Latin Correspondence Contained in the Giles Edition of Ascham's Works.

Daniel Joseph Hays, B.S., M.S. in Ed., Agricultural Education, Agricultural Economics, Supervision. Thesis: Special Programs and Activities That Should Be Provided by the Secondary Schools Serving Rural Areas in New York State.

Katherine Helena Heinig, B.S., M.S., Plant Morphology, Cytology, Histology. Thesis: Studies in the Floral Morphology of the Thymelaeaceae and Embryology.

Francis Richard Hodge, A.B., A.M., Drama and the Theatre, Dramatic Literature, Phonetics and Speech. Thesis: Yankee Theatre: 1825–1850.

Maybel Marion Holmes, A.B., M.A., Family Life, Foods, Educational Psychology. Thesis: A Source Book of Chinese Food Habits.

Sarah Foresman Hoyt, A.B., M.S. in Ed., Ornithology, Vertebrate Zoology, Invertebrate Zoology. Thesis: A Reference Book and Bibliography of Ornithological Techniques.

Melvin David Hurwitz, A.B., S.M., Organic Chemistry, Inorganic Chemistry, Physical Chemistry. Thesis: An Investigation of the Reactions of Chlorofluoro Olefins with Anionic Reagents.

Albert Edward Johnson, B.A., M.A., Drama and the Theatre, Dramatic Literature, Phonetics and Speech Training. Thesis: American Dramatizations of American Literary Material from 1850–1900.

Elizabeth Beach Keller, S.B., M.S., Biochemistry, Physiology, Pharmacology. Thesis: Transmethylation Studies Using Methyl Compounds Labeled with Deuterium and Carbon 14.

Charles Joseph Kentler, Jr., B.Eng., Chemical Engineering, Physical Chemistry, Organic Chemistry. Thesis: Preparation of Naphthalene B-Sulfonic Acid Under Reduced Pressure.

Hugh Charles Kirkpatrick, B.S. in Agr., M.S. in Agr., Plant Pathology, Plant Physiology, Plant Breeding. Thesis: Studies on the Transmission of the Potato Leafroll Virus.

Harry William Kitts, B.S., Agricultural Education, Agricultural Economics, Educational Administration. Thesis: Educational and Occupational Readjustment of Rural Veterans.

Johanna Malandrone Lee, S.B., Biochemistry, Bacteriology, Physiology. Thesis: Studies on the Metabolism of Rat Liver.

Mary Ann Lee, B.A., M.A., Applied Mathematics, Mathematical Analysis, Physics. Thesis: Summability of Diagonal Series Formed from the Terms of Double Series.

Joseph Solomon Levinger, S.B., S.M., Theoretical Physics, Mathematics, Experimental Physics. Thesis: Effects of Radioactive Disintegrations on Inner Electrons of the Atom.

Ching Hsiung Li, B.S., M.S., Cytology, Plant Breeding, Plant Physiology. Thesis: Chromosomal Aberrations Induced by X-Rays in Zea Mays.

Claud Collier Marion, B.S., M.S., Agricultural Education, Rural Secondary Education, Agricultural Economics. Thesis: A Qualitative and Quantitative Study of the Effectiveness of Instructional Programs in Technical Agriculture in Negro Land-Grant Colleges.

Clayton Doyle McAuliffe, A.B., M.S., Soils, Inorganic Chemistry, Plant Physiology. Thesis: Determination of the Hydroxylic Surface of Soil Minerals Using Deuterium Oxide.

Fred McGoldrick, B.S. in Agr., M.S., Vegetable Crops, Plant Physiology, Plant Breeding. Thesis: Potato Vine Killing and Its Effect on Yield and Quality of Tubers.

Eilif Verner Miller, B.A., M.S., Soils, Inorganic Chemistry, Plant Physiology. Thesis: Ecuadorean Soils and Some of Their Fertility Properties.

Robert Demorest Miller, B.S. in Agr., M.S., Soils, Physics, Chemistry. Thesis: An Apparatus for Precise Measurement of Low Concentrations of Carbon Dioxide by Infra-Red Absorption.

Frederick James Parrott, B.A., M.S. in Ed., Dramatic Production, Dramatic Literature, Speech and Phonetics. Thesis: The Mid-nineteenth Century American Theatre, 1840–1860. A Survey of Theatre Production, Comment, and Opinion.

Badarinnisa Begum Quaraishi, B.A., M.Sc., Economic Entomology, Medical Entomology, Vertebrate Zoology. Thesis: A Study of the Insect Pests of Stored Grains and Flour Mills with Special Reference to the Biologies of *Rhizopertha* dominica (Lesser Grain Borer) and Laemophlocus minutus (Flat Grain Beetle).

Walter Ernest Schlaretzki, B.A., A.M., Philosophy, History of Philosophy, Logic. Thesis: The Idea of Community in Royce, Peirce, and Mead.

Raymond Carson Scott, B.S. in Agr. Ed., M.S., Marketing, Prices and Statistics, Land Economics and Farm Finance. Thesis: An Analysis of Frozen Food Purchases in Three New York Areas.

John George Seeley, B.Sc. in Agr., M.Sc., Floriculture and Ornamental Horticulture, Agronomy, Plant Physiology. Thesis: Some Responses of Greenhouse Roses to Various Oxygen Concentrations in the Substratum.

Guillermo Serra, B.S. in Agr., M.S. in Agr., Farm Management, Rural Sociology, Public Administration and Finance. Thesis: An Economic Study of Family-Sized Farms in Puerto Rico.

Obed Lavelle Snowden, B.S., M.S., Agricultural Education, Farm Management, Secondary Education. Thesis: The Development of a Training Program to Meet the Needs of Veterans of World War II Who Are Farming in Mississippi.

Nicolas Theodore Theodorou, M.S. in Agr., Agricultural Education, Agricultural Economics, Secondary Education. Thesis: Occupational Establishment and Needs of Former Students of Vocational Agriculture in the Watkins Glen Area.

Charles Augustus Thomas, A.B., M.S., Plant Pathology, Plant Physiology, Plant Breeding. Thesis: Studies on the Fusarium Wilt and Stem-end Rot Disease ("Z" Disease) of Potatoes.

Adna Heaton Underhill, A.B., Aquiculture, Vertebrate Zoology, Ornithology. Thesis: Studies on the Life History of the Chain Pickerel *Esox Niger* Le Sueur.

Robert Lee Wilker, S.B., Experimental Physics, Theoretical Physics, Mathematics. Thesis: Gamma Ray Spectrometer Measurements of Fluorine and Lithium under Proton Bombardment.

Donald Picket Watson, B.S. in Agr., M.S., Botany and Floriculture, Plant Physiology, Pomology. Thesis: An Anatomical Study of the Modification of Bean Leaves as a Result of Treatment with 2,4–D.

Frank Whiting, B.Sc. in Agr., Animal Nutrition, Biochemistry, Animal Physiology. Thesis: The Mammary and Placental Transfer of Vitamins A and E.

Robert Elzworth Wilkinson, B.A., M.S., Plant Pathology, Plant Physiology, Plant Breeding. Thesis: Studies on the X Virus of Potatoes with Special Attention to a Local Lesion Host.

John Eric Wilson, B.S., Biochemistry, Physiology, Pharmacology. Thesis: Penicillamine as a Metabolic Antagonist.

Opal Powel Wolford, B.Sc. in H.E., M.Sc., Child Development and Family Life, Social Psychology, Education. Thesis: The Dating Behavior and the Personal Family Relationships of High School Seniors. With Implications for Family Life Education.

# MEMBERS OF THE STAFF

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