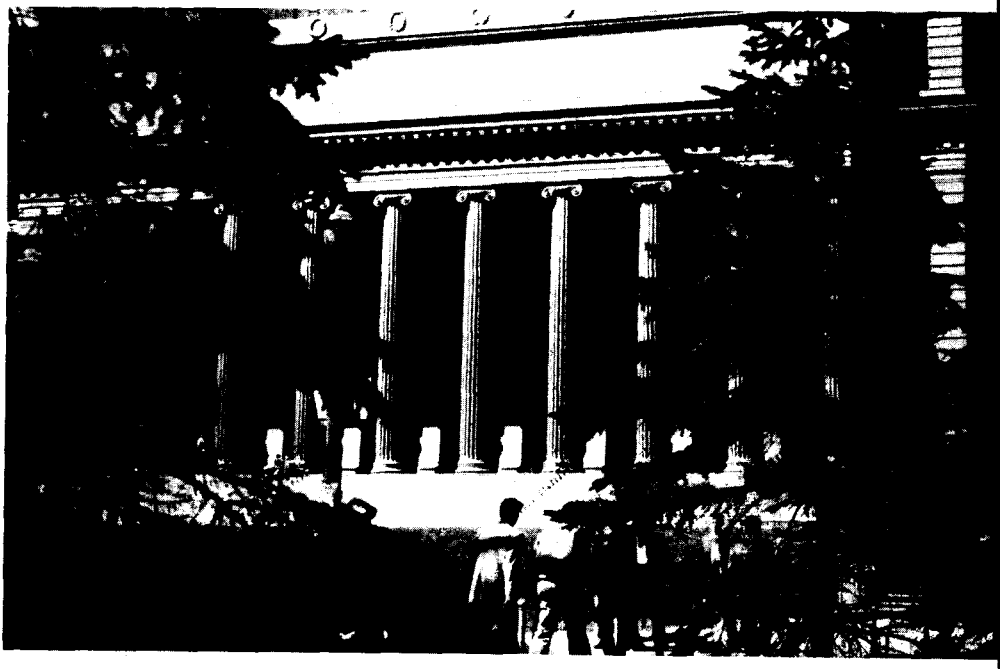
Bulletin of the

UNIVERSITY OF MINNESOTA



Graduate School 1954–1956

How To Use This Bulletin

The "General Information" section of this bulletin is your official source of information about the policies of the Graduate School and about procedures in earning graduate degrees.

The section entitled "Fields of Instruction" contains statements of the policies and requirements of the various departments and listings of the course offerings in those departments.

Do Not Fail To Read

(1) The complete description of conditions and requirements for the degree you hope to earn (for the Master's degree, pages 8-13, for the Ph.D. degree, pages 13-21).

(2) The section entitled "Abbreviations and Explanations" (page 42). This is your guide to the understanding of terms and symbols used in course descriptions.

Bulletin of the University of Minnesota

VOLUME LVII, NUMBER 7 APRIL 1, 1954

GRADUATE SCHOOL

1954-1956

General Information

Fields of Instruction

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Graduate School

GENERAL INFORMATION

Though the Graduate School was not organized as a separate unit until 1905, the University of Minnesota awarded its first Master's degree as early as 1880 and its first Ph.D. degree eight years later. From 1888 to 1913, when Guy Stanton Ford assumed the deanship of the Graduate School, 54 Ph.D. degrees were earned at Minnesota. Since 1913 the school has expanded greatly both in fields and areas and in numbers of students. By 1953, the Graduate School had awarded 2,953 Ph.D. degrees and more than 12,000 Master's degrees.

Central to the purposes of the Graduate School are the advanced training of men and women in a wide variety of fields for service and leadership in state and country and the promotion of research resulting in contributions to knowledge by faculty and students in an atmosphere of freedom of inquiry.

The Graduate School is organized under seven advisory group committees in the areas of Agriculture; Biological Sciences; Languages and Literature; Medical Sciences; Philosophy, Music, Psychology, Child Welfare, Education, Speech Pathology; Physical Sciences, Mathematics, Engineering; and Social Sciences. Together with the dean, the associate dean, and the secretary, the chairmen of these committees form the Executive Committee of the Graduate School. In addition there are four special committees which administer graduate work in American Studies, Statistics, Biophysics, and Dentistry.

Graduate work crosses the boundaries of the departments, schools, and colleges comprising the University including those at the Mayo Foundation at Rochester. Its faculty of full and associate members, numbering more than eight hundred, teaches both in the Graduate School and in the several undergraduate and professional colleges.

GRADUATE WORK AT DULUTH BRANCH

The Graduate School offers at the University of Minnesota, Duluth Branch, a full program for the master of arts degree with majors in education and in curriculum and instruction. This program is designed to serve elementary school teachers and principals, rural teachers, and secondary school teachers. Students will work under advisers at the Duluth Branch. The program is under the jurisdiction of the dean of the Graduate School and is identical in admission, candidacy, and degree requirements with the parallel program on the Minneapolis Campus. A special folder giving details of the program is available through either the Duluth Branch or the Graduate School office in Minneapolis. Blanks for use in applying for admission may be secured by writing to the Dean of the Graduate School, 316 Johnston Hall, University of Minnesota, Minneapolis 14.

In the following pages detailed information is given with respect to the structure and rules of the Graduate School, fellowships and assist-

antships open to graduate students, the programs of study made possible by the offerings in more than eighty-five majors, and a list of the courses offered.

ADMISSION

Any student with a Bachelor's degree or its equivalent from a recognized college or university may apply to the dean of the Graduate School for admission. An applicant with satisfactory scholastic record from an approved college or university and with satisfactory character and professional qualifications may be admitted by the Graduate School, with the approval of the major department concerned, for graduate work involving a major in that department.

The scholastic records of applicants are reviewed, special tests may be required, and the applicant may be admitted, with or without conditions, as determined in each case by the dean and an adviser in the student's proposed major.

An applicant who does not designate a major may be admitted to take work for which he is qualified, but if at a later time he chooses a major he must meet the requirements of that department for acceptance to do major work.

An applicant who holds a Bachelor's degree or its equivalent from a recognized college but whose scholastic record and qualifications are unsatisfactory from the point of view of preparation for and probable success in graduate work will be refused admission to the Graduate School. He may be advised, however, to apply for admission as an adult special student in the appropriate undergraduate college for a probationary period. Such an adult special student must complete successfully a minimum of one quarter's work in courses acceptable for credit by the Graduate School before being permitted to transfer his registration to the Graduate School. Upon successful completion of this probationary work the student may petition to transfer all work of graduate quality taken while registered as an adult special student to the records of the Graduate School and will be granted residence and credit in the Graduate School for it.

It is also possible to admit certain applicants to probationary standing in the Graduate School. In such cases the Graduate School reserves the right to cancel their registration if at any time their scholastic records fall substantially below the standard for successful graduate work.

The scholastic performance of all graduate students in residence is checked at the end of each academic quarter, and records judged to be poor or borderline are brought to the attention of the student's major adviser for special action. Continued inadequate performance on the part of any student may result in the cancellation of his registration and exclusion from further study in the Graduate School.

College graduates who desire simply to take additional work of undergraduate character without a view to ultimate preparation for an advanced degree should apply, not for admission to the Graduate School, but to the Office of Admissions and Records for admission as special students in the college giving the work.

Certain colleges and departments require the student to complete the Miller Analogies Test, graduate level, as part of the application. These

are: American Studies, Child Welfare, Economics and Business Administration, Library Science, Mechanical Engineering, Physics, Political Science including Public Administration, Psychology, Statistics, and Zoology. The Graduate School itself may ask the student to take this and other tests, and in such cases the student will be notified where and when the tests will be given.

In addition, the results of the Graduate Record Examination may be requested as supplementary information in determining admission. It would be wise therefore for candidates to complete this test either in their senior year of undergraduate work or before filing application for admission. For further information as to this examination and places where it may be taken, students should write to the Educational Testing Service, P.O. Box 592, Princeton, New Jersey. Students near the University of Minnesota may arrange to take the examination by communicating with the director of the Student Counseling Bureau, 101 Eddy Hall, University of Minnesota, Minneapolis 14.

All inquiries concerning admission should be addressed to the dean of the Graduate School, 316 Johnston Hall, University of Minnesota, Minneapolis 14. Applications should be sent to the dean of the Graduate School at least four weeks before the opening of the quarter in which the student matriculates, and must be accompanied by official transcripts in duplicate of undergraduate work and single official transcripts of any graduate work that may have been taken.

CANDIDACY FOR A DEGREE

Admission to the Graduate School does not admit a student to candidacy for a degree. Admission to candidacy indicates a judgment by members of the graduate faculty that the student shows sufficient promise to be permitted to proceed toward a degree, and depends on the student's ability and the quality of his work in the University of Minnesota and his personal and professional qualifications. No student will be admitted to candidacy until he has been in residence for at least one quarter or one Summer Session and has removed any deficiencies that may have conditioned his admission to the Graduate School. The procedure in applying for candidacy is included with the description of the requirements for the various degrees.

ADVANCED STANDING AND TRANSFER OF CREDITS

From an Undergraduate College—Credits for advanced courses earned while the student is registered in an undergraduate college, even though in excess of the credits required for the baccalaureate degree, can be transferred to the Graduate School only under the following conditions:

1. If not more than 9 quarter credits of undergraduate credit are lacking (taking into account required and sequence courses), a limited amount of graduate work may be carried (approved courses numbered above 99) for graduate course credit, such courses not to be applied toward an undergraduate degree. The conditions stated apply to the beginning of the quarter in which the courses for graduate credit are carried. Transfer of credit must be arranged by petition to the Graduate School.

2. Undergraduates lacking not more than 6 quarter credits (taking into account required and sequence courses) may register in the Graduate School.

From Other Institutions to Apply Toward the Master's Degree—The University of Minnesota will allow transfer of a maximum of 9 quarter credits of graduate work satisfactorily completed at other approved graduate schools toward the Master's degree requirements, provided that not more than 6 quarter credits be transferred to the major field and not more than 3 quarter credits to the minor field under Plan A, and that under Plan B none of the transferred credits be substituted for the required 9 credits in starred courses.

Transfer of the maximum of 9 credits may reduce the residence requirement for the Master's degree by one Summer Session for students whose Master's degree programs include Summer Session study. All such transfer of graduate credit and of residence from another institution must be recommended by the appropriate graduate group committee at the University of Minnesota.

Work at other institutions will not be transferred either for credit or in lieu of residence for the Master's degree under the above provisions until the student has completed satisfactorily at least 15 credits in the Graduate School of the University of Minnesota.

No more than 9 quarter credits may be transferred in combination of the foregoing rules and those relating to transfer of credits in courses earned through the Extension Division of the University of Minnesota (see below for these rules) for the Master's degree under Plan A and 12 quarter credits under Plan B.

From Other Institutions to Apply Toward the Ph.D. Degree—See Requirements for the Doctor's degree, page 13 of this bulletin.

From the Extension Division of the University of Minnesota—A graduate student may, upon the approval of his graduate adviser, petition the dean of the Graduate School to have transferred to his graduate record not more than 6 quarter credits under Plan A or 9 quarter credits under Plan B in courses numbered above 99 offered by the Extension Division of the University of Minnesota in the Twin Cities area, and taught by approved members of the graduate faculty. Such transfers of extension credits will not give residence credit. No graduate credits earned in any other institution through extension courses may be transferred.

For Correspondence Study—Graduate credit is *not* allowed for credits earned through correspondence study.

REGISTRATION

Directions for registration may be obtained at the Graduate School when the student arrives at the University. The essential documents for a graduate student, an official transcript in duplicate of the student's undergraduate record and a single official transcript of graduate work, should be sent to the Graduate School at least four weeks before the opening of the quarter in which the student enters the Graduate School, together with a formal application for admission stating his major for graduate study.

Registration in the Graduate School includes making out a program for the next quarter, which program must be approved by a departmental adviser and the dean. Before the student can complete his first registration in the Graduate School (unless he is a teacher in service carrying 5 credits or less), he must report to the Student's Health Service of the University of Minnesota to arrange an appointment for a physical examination.

FEES

Tuition fees for residents (except in dentistry, pharmacy, clinical medicine) per quarter	
6 credits or less, or thesis only	$ 23.00
More than 6 credits	46.00
Tuition fees for nonresidents per quarter	
6 credits or less, or thesis only	55.00
More than 6 credits	110.00
Incidental fee	14.00
Health fee for foreign students (per quarter)	8.00
Matriculation deposit (first quarter in residence)	3.00
Special deposit for chemistry laboratory	10.00
Graduation fee	10.00
Fee for binding Master's thesis	2.50
Fee for microfilming Ph.D. thesis	35.00

Candidates for advanced degrees must pay not less than the full normal tuition for three quarters before receiving the degree.

All Ph.D. candidates are required to register in the quarter in which their final oral examination is taken.

Because of the possibility of accidents, illness, or other unanticipated health problems the University maintains its own health service to provide medical care for students. Since University fees cover only a small part of the expense of such care, a special health service fee is required of all foreign students except those who already have a University-approved health insurance policy.

All the listed fees apply to the regular session. For the Summer Session fees, see *Bulletin of the Summer Session.*

Registration blanks filled out by the student and approved by his adviser and by the Graduate School office must be turned in at the Office of Admissions and Records to obtain a statement of fees which must be paid not later than the close of the first week of each quarter to avoid late fee. The fee for the privilege of late registration, or late payment of fees, is $2 through the third day of the following week; on the fourth day the fee is $2.50 and then increases 50 cents per day to a maximum of $5. For the dates when Summer Session fees are due, see the *Bulletin of the Summer Session.* See the *Bulletin of General Information* for estimates of living expenses.

ATTENDANCE AT COMMENCEMENT

Candidates upon whom degrees are to be conferred are required to be present at commencement unless especially excused by the dean of the Graduate School.

REQUIREMENTS FOR THE MASTER'S DEGREE**

The degree of master of arts is, in general, conferred for advanced nontechnical study; the degree of master of science, for advanced technical study in such areas as agriculture, industrial chemistry, engineering, etc. It is the field of graduate work and not the Bachelor's degree that determines whether the degree is master of arts or master of science. In the sciences usually called basic or fundamental such as physics, geology, zoology, etc., the student may elect the form he prefers.

Application for Admission to Candidacy—Following the completion of 9 to 15 graduate credits, at least 3 of which must be in the major, the student who expects to obtain a Master's degree should apply for admission to candidacy for that degree on a blank secured from the Graduate School office. This application should be submitted as soon as a student has earned sufficient credits to be eligible for candidacy.

The application for candidacy will be reviewed by an appropriate committee normally from the major department, school, or college. This committee will recommend to the dean, through the appropriate graduate group committee, the acceptance or rejection of the application for candidacy. The dean or the reviewing committee may require any evidence pertinent to the consideration of the application.

THE TWO PLANS FOR THE MASTER'S DEGREE

Preliminary Statement—In either of the two plans, it is possible and acceptable under the rules (save in certain specified areas) for the student who is adequately prepared and who can devote full time to graduate study to complete the requirements for the Master's degree in one academic year of three quarters,§§ or its equivalent in Summer Sessions.†† The completion of a Master's program ordinarily requires, however, from four to six quarters in residence, or its equivalent in Summer Sessions. Students who are planning to earn the Master's degree under either Plan A or Plan B, therefore, should take into account this customary rate of progress, as well as the minimum possible time interval of one academic year. If such matters as self-support, prerequisite work, or special study of foreign languages (or English for foreign students) are involved in attaining the Master's degree, students should anticipate and definitely plan for a period of residence longer than the minimum three academic quarters.

In courses *open to graduates only,* the student may receive a mark of "pass" or "satisfactory." This indicates the instructor's approval of the quality of the student's work on the graduate level. It signifies a letter

** A limited number of graduate students of exceptional scholastic standing who take the Master's degree may be certified for high school teaching in Minnesota though they lack formal residence in the College of Education. To qualify for certification under this plan students must meet certain requirements in the College of Education and secure the approval of its dean at the outset of their program.

§§ Certain programs for the Master's degree require more than one academic year. For example, the programs for the master of social work and the master of fine arts degrees require a minimum of two years.

†† One Summer Session is the equivalent in residence of one-half a school quarter of the regular academic year.

grade of B at least. In courses open to both graduates and undergraduates the system of marking by letters is normally used. No graduate credit is allowed for course work of D quality.

The Graduate School offers the Master's degree under two plans: Plan A, involving a thesis, and Plan B, which substitutes additional course work for the thesis. Departmental statements in this bulletin announce policies as to use of Plan A and Plan B.

The student will indicate at the time of matriculation his intention to be a candidate for the Master's degree and choose the plan he proposes to follow. After admission to candidacy, he shall present either the title of his Master's thesis or his Plan B program, which must be approved by an adviser or committee acting for the major department and confirmed by the group committee in which the major department falls. Appropriate forms may be secured from the Graduate School. Before approving the student's choice of plan and his program, the adviser must receive from the student a statement of his undergraduate record and any additional credits.

Plan A: Master's Degree with Thesis

Major and Minor Work—In choosing a field for major or minor work, the candidate must present the minimum undergraduate preparation prescribed in the departmental statements. He must complete in the Graduate School a minimum of 18 quarter credits in the major department and 9 in the minor with a grade not lower than B in any course offered as fulfilling the requirements in the major, and a grade not lower than C in minor courses. No graduate credit is allowed for course work of D quality.

In cases where the student takes course work beyond the minimum requirements already stated, both the adviser and the graduate group committee may demand comparable standards of performance for all work taken, in evaluating and approving the minimum program submitted, and may reject the minimum degree program if the total record falls substantially below B grades in the major field and C grades in the minor field.

The student's work for the minor must be logically related to his major work. The dean and the group committee may in exceptional cases allow the minor subject to be taken in the same department as that of the major.

All requirements for the Master's degree under Plan A must be completed within six years. The six-year period specified includes all work transferred to the graduate record of the individual, regardless of whether this transferred work was taken at another institution, as an adult special student at the University of Minnesota, or under any other conditions in which transfer is permitted.

Language Requirement—Reading knowledge of a foreign language, modern or ancient, the language to be determined by the major department, is required of candidates for the Master's degree, unless exemption is made in individual cases with the approval of the adviser and appropriate group committee or the requirement is specifically waived in a given area. Reading knowledge of French or German is normally expected. For further information, consult the Graduate School office and

the major department. Blanks for making application for the language examination may be obtained in the Graduate School office.

The candidate shall present to the office of the dean of the Graduate School a certificate of proficiency in the designated language before he may be admitted to the written or oral examinations required for this degree. The certificate must be signed by a representative of the appropriate foreign language department.

For regulations on transfer of language certificates, see page 17.

Master's Thesis—Following admission to candidacy, the student shall submit the title of his thesis and a complete program of the work to be offered for the degree on a special blank secured at the Graduate School office. The thesis title must be approved by his adviser and by the corresponding group committee. The thesis should be on a topic falling within the field of the major. The candidate will ordinarily devote approximately half of his time to the preparation of the thesis, including courses on which the thesis is based. The thesis must be written in acceptable English, show ability to work independently, and give evidence of power of independent thought both in perceiving problems and making satisfactory progress toward their solution. Familiarity with the bibliography of the special field and correct citation of authorities are expected.

The thesis must be in quadruplicate in order to facilitate its consideration. Two copies are for the University Library (as noted below), one for the candidate, and normally one goes to the adviser or major department. Some departments require more than four copies; the student should consult his major adviser on this point. One copy must be upon red-ruled twenty-pound linen stock of 75 per cent rag content and the others may be carbon copies on bond paper. The original and first copy must contain all illustrative material. Ample margins should be left for binding purposes. Samples in the dean's office of the papers to be used should be examined before the thesis is typewritten. The body of the thesis should be double spaced, but footnotes may be single spaced.

The thesis must be finished, certified by the adviser as complete on a form secured in the Graduate School office, and must be registered in the office of the dean of the Graduate School *at least eight weeks* before the commencement convocation at which the candidate presents himself for his degree.

The thesis will be examined by a committee of not less than three, appointed by the dean of the Graduate School upon recommendation of the appropriate group committee. The examining committee will include at least two representatives of the major field and one representative of the minor field. Unanimous approval by this committee will be necessary for the acceptance of the thesis, and a record of this approval must be filed in the Graduate School office on the appropriate form before the candidate may be admitted to the final written or oral examinations; and the Graduate School in any case should be informed, on the appropriate blank, of the action of the thesis committee.

If the thesis is accepted, the candidate must pay to the bursar, *at least five weeks* before commencement, $2.50 for binding the two copies of his thesis which will be catalogued and deposited in the University Library, one copy for reserve and one for loan purposes.

Examinations—All candidates for the Master's degree will meet the regular requirements as to examinations, reports, etc., of the classes in which they are registered.

In addition to the usual course examinations, the candidate for the Master's degree Plan A must pass a final written examination, a final oral examination, or both, at the discretion of his examining committee.

If only a final written examination is specified, it must be held not later than *five weeks* before the end of the quarter in which the student takes his degree. It will cover the major and minor fields and may include any work fundamental thereto. This examination will be arranged by the adviser as chairman of the thesis committee, the questions to be prepared with the cooperation of the faculty of the major and minor departments concerned. The chairman will report the results of the examination to the Graduate School office on the appropriate form. A majority vote of the committee is required for approval of the written examination.

If only a final oral examination is specified, it also must be held not later than *five weeks* before the end of the quarter in which the student takes his degree. This examination will be conducted by the committee appointed to examine the thesis, with the adviser serving as chairman, and will cover both the major and minor fields, including any work fundamental thereto. At the close of the examination, the committee will vote upon the candidate's performance, and a majority vote is required for approval. The chairman of the committee will then report the result of the vote to the Graduate School office on the appropriate form.

If both a written and an oral examination are specified, the written examination must precede the oral examination, and the time of completion of the oral examination indicated above must be adhered to.

SUMMARY OF REQUIREMENTS FOR MASTER'S DEGREE WITH THESIS

Requirements	*Under the Direction of*	*Date*
Initial registration	Adviser and dean of the Graduate School	On entrance
Approval of candidacy	Committee, normally from the major department, division, or college, and dean	After completion of 9 to 15 credits
Approval of thesis subject and degree program	Adviser and group committee	After approval of candidacy for degree but before final quarter
Language requirement	Adviser and language department	Before admission to written or oral examination
Registering of thesis	Graduate School office	Eight weeks before graduation**
Approval of thesis	Thesis committee	Before admission to final written or oral examination
Final examinations, written or oral or both	Major adviser and committee	Not later than five weeks before commencement
Filing of thesis	Graduate School office	Not later than five weeks before commencement
Graduation fee and fee for binding thesis	Office of Admissions and Records	Not later than five weeks before commencement

** Medical students should consult the Graduate School office for dates when their theses must be registered.

Candidates eligible for the "preliminary examination" for the Doctor's degree may substitute this examination for the final oral examination for the Master's degree, if all other requirements for the preliminary examination (see page 19) have been met.

Reports—Special blanks are provided for signed reports concerning the thesis and the final written or oral examinations. All reports must be filed in the office of the dean of the Graduate School *five weeks before the end of the last quarter.*

Candidates meeting the requirements outlined will be reported by the dean to the Executive Committee of the Graduate School, who will by vote recommend to the Board of Regents those approved for degrees.

Plan B: Master's Degree Without Thesis

The requirements under this plan in matters of admission, residence, transfer of credits from other institutions, and language requirements follow Plan A. Under Plan B, the student may be required to take either a final written examination or a final oral examination or both, at the discretion of his committee. This examination, if oral, will normally be an hour long. Plan B differs also in substituting for the thesis a heavier course requirement which if met in Summer Sessions means more than the minimum four sessions, under Plan A. (See page 21.) While it does not permit an indiscriminate scattering of courses over unrelated departments, it does not stress concentration on one major and one minor field. It is understood that more than one field will be included outside the field of concentration. Programs that simply represent more hours distributed between a major and a minor will be especially scrutinized by the graduate group committee. Insofar as it has a professional aspect, the Master's degree under Plan B is less a test of research interest and more adapted to individuals who will profit by a broader range of knowledge in their fields. Whether taken for professional or cultural purposes, the requirements under Plan B are meant to test interests and intellectual abilities for a different purpose but not on a different level from those for Plan A. Transfer from one plan to the other may be made with the approval of the adviser or the major department committee supervising the student's work.

Under Plan B candidates for the Master's degree must complete, with an average of B, a minimum of 45 quarter credits in graduate courses. No graduate credit is allowed for course work of D quality. At least 21 of the 45 credit hours should be in a single field of concentration. Not less than 18 of the 45 credits should be offered in at least two related fields.** At least 9 quarter credits either in the field of concentration or in related fields must be in advanced courses (courses identified in this bulletin by asterisks), seminars, or independent work under faculty supervision and requiring the preparation of written reports representing the quality but not the range of the Master's thesis.

In cases where the student takes course work beyond the minimum requirements stated, both the adviser and the graduate group committee

** For the master of social work degree, a minimum of 90 quarter credits covering established sequences in social work is required. For the master of fine arts degree approximately 90 quarter credits are required.

may demand comparable standards of performance for all work taken and may reject the minimum degree program if the total record falls substantially below the B average required for the Plan B degree.

All requirements for the Master's degree Plan B must be completed within seven years. The seven-year period specified above includes all work transferred to the graduate record of the individual, regardless of whether this transferred work was taken at another institution, as an adult special student at the University of Minnesota, or under any other conditions in which transfer is permitted.

The student's program, recorded on a blank provided by the Graduate School, shall be approved by a major adviser and shall be submitted following admission to candidacy and before the final quarter or final summer term. The program will be reviewed by the appropriate group committee. Intelligent planning of the student's program requires that he present to his adviser a statement of all college work completed with credit. In planning the student's program the adviser should not include in "related fields" courses from the field of concentration.

Under this plan, the candidate will be examined by a committee of not less than three members, appointed by the dean of the Graduate School upon recommendation of the appropriate group committee. This examination may be written or oral or both, at the discretion of the examining committee. The adviser will make available to the examining committee for its review the papers prepared to fulfill the requirement of nine hours of independent work. Procedures for the examination are the same as those already described for the Master's degree Plan A.

The student is expected to call at the Graduate School office before his final examinations for the degree to get an examination report form for the use of his examining committee.

SUMMARY OF REQUIREMENTS FOR MASTER'S DEGREE WITHOUT THESIS

Requirements	*Under the Direction of*	*Date*
Initial registration	Adviser and dean of the Graduate School	On entrance
Approval of candidacy	Committee, normally from the major department, division, or college, and dean	After completion of 9 to 15 credits
Filing program of all graduate work, with credits showing field of concentration, etc.	Adviser and group committee	Following approval for candidacy and before final quarter or summer term
Language requirement	Adviser and language department	Before admission to written or oral examination
Final examinations, written or oral or both	Adviser and committee	Not later than five weeks before commencement
Graduation fee	Office of Admissions and Records	Not later than five weeks before commencement

REQUIREMENTS FOR THE DOCTOR'S DEGREE

In the Graduate School, one Doctor's degree, doctor of philosophy (Ph.D.), is conferred by the University of Minnesota. This degree is granted not on the basis of successful completion of a definite amount of prescribed work but chiefly in recognition of the candidate's high attain-

ments and ability in his special field, as shown, first, by the preparation of a thesis, and second, by passing the required examinations covering both the general and the special fields of the candidate's subjects as detailed later. Grades of B or better are required in the major and grades of C or better in the minor.

Candidates for the Doctor's degree must spend at least three years** of graduate study in approved subjects. The first two years or the last year must be spent in residence at the University of Minnesota.

A member of the staff of instruction above the rank of instructor or research fellow is not permitted to take the Ph.D. degree at this University. He may register for graduate work, however, and credit thus obtained may be presented elsewhere.

Program of Study

First Year—Upon entrance to the Graduate School, the student shall select his adviser with the approval of the dean. With his adviser's approval he shall submit to the dean a program covering the work of the first quarter. In general, the first year primarily involves major emphasis on course requirements and attention to language and related requirements.

Second and Third Years—During the second year, the student shall secure from the Graduate School office the doctoral program blank in triplicate. On this blank he must submit to his adviser, his minor department, the group committee, and the dean, for approval, a complete statement of all work to be offered for the degree: (1) a list of all courses already completed in the major and minor, (2) an outline of proposed additional course work in the major and minor, (3) courses offered as a collateral field or a special research technique when one of these has been approved as a substitute for a foreign language, (4) a detailed list of graduate courses taken elsewhere if the candidate wishes to present such work toward the Ph.D. degree from the University of Minnesota. Transfer of credit from other institutions will be considered in acting on the doctoral program; no petition for transfer is necessary. Transfers of credit toward the Ph.D. will not become final and official until the student has passed his preliminary examination. The student shall also file with his adviser's approval the title of his Doctor's dissertation on a blank that he obtains in the Graduate School office.

Language Requirements

The following regulations are effective for all Ph.D. candidates. The reading knowledge of one foreign language is always required.

General Regulations

1. The Ph.D. candidate shall, with the approval of his major adviser, file in the Graduate School office by the end of the second quarter of his

** This time requirement will be met in three years only by students who devote full time to graduate study. Students who devote to graduate study the intervals between periods of professional or other regular employment will need to extend their total period of work over a longer time.

Ph.D. program his plans for meeting the requirements of the foreign language and the research technique or the collateral field of knowledge. Graduate School Form 79 for this purpose is available in the Graduate School office. The second quarter of the Ph.D. program is the second quarter in residence after completion of the M.A. or M.S. degree, or its credit equivalent in those cases where the individual proceeds directly toward Ph.D. candidacy.

2. The foreign language and the special research technique requirements (as defined in 10 and 11) must be completed before the student is admitted to the preliminary examinations for the Ph.D., and the work to be presented in meeting this requirement shall be entered on the student's program. The special research technique requirements may be met by special proficiency examinations where such examinations are feasible and practical.

3. Repetition of any examination taken under 2 is considered a special examination for which a fee of $5 is charged.

4. Where a collateral field of knowledge (as defined in 12) is offered in place of one foreign language, this collateral field must be completed before the student is admitted to the final oral examination for the Ph.D., and the work to be presented in meeting this requirement shall be entered on the student's doctoral program. Completion may be in terms of earned course credits, or of validated transfer of credits from another institution, or of special proficiency examinations where feasible and practical.

5. In meeting either the foreign language requirements or the requirements of a special research technique, credits earned or proficiency demonstrated in other approved institutions are transferable to the Minnesota record if these have been completed within a three-year period immediately prior to entering this Graduate School. To meet the requirements of a collateral field of knowledge, credits earned in other approved institutions are transferable to the Minnesota record in accordance with existing regulations governing transfer of credits for the Ph.D. degree.

6. Course credits presented to fulfill the requirements of a special research technique or a collateral field of knowledge shall be recorded on the student's permanent grade record and must represent a quality of work no lower than C. Any group committee may require a standard of performance higher than this minimum standard after appropriate consultation with the departments within its area.

7. The group committee may include the collateral field of knowledge in the final oral examination of the candidate by the appointment of a representative of this field to the oral examination committee.

8. In no case may the special research technique subject or the collateral field of knowledge be one that has regularly or traditionally been included in the major or minor fields of study of similar candidates in the past. The special research technique subject should represent the acquisition of any special skill that will effectively contribute to the research proficiency of the candidate. The collateral field of knowledge is expected to broaden the candidate's scholarly and scientific background by permitting exploration of knowledge in fields related to the major and minor. The collateral field of knowledge may include in this sense

any work now available or to be developed in the preparation for college teaching, including supervised instruction at the college level.

9. The burden of proof of the significance or relevance of options other than the foreign language rests upon the candidate and his major adviser. The group committee under whose jurisdiction the major field falls shall review the recommendations of the major adviser and in turn recommend action to the dean of the Graduate School.

10. The foreign languages in which proficiency may be demonstrated are: German, French, Spanish, Italian, Portuguese, the Scandinavian languages, the Oriental languages, Russian, Greek, or Latin.

11. A special research technique is defined as not less than 9 credits in approved Senior College or graduate courses, completed with a grade not lower than C.

12. A collateral field of knowledge is defined as not less than 15 credits of work in courses numbered above 99, completed with a grade not lower than C.

Major Field Requirements

1. Departments or major fields requiring two foreign languages, one of which must be German:

Agricultural Biochemistry
Biological Science
Botany
Chemical Engineering
Chemistry, Analytical
Chemistry, Inorganic
Chemistry, Organic
Chemistry, Physical
Civil Engineering
Entomology and Economic Zoology
Geography
Pharmacognosy
Philosophy
Physics
Zoology

2. Departments or major fields requiring two foreign languages without further specification:

American Studies
Anthropology
Applied Plant Physiology
Art
Classics
Comparative Literature
English
German
History
Linguistics and Comparative Philology
Mathematics
Neurology
Physiological Chemistry
Plant Pathology and Agricultural Botany
Romance Languages

3. Departments or major fields permitting the fulfillment of the requirements by (a) two foreign languages or (b) one foreign language and the option of a collateral field of knowledge:

Anatomy
Bacteriology
Biochemistry (Mayo)
Biophysics
Cancer Biology
Internal Medicine
Obstetrics and Gynecology
Ophthalmology and Otolaryngology
Pathology
Pediatrics
Pharmacology
Physical Medicine
Physiological Hygiene
Physiology
Psychiatry
Public Health
Radiology
Surgery

4. Departments or major fields permitting the fulfillment of the requirements by (a) two foreign languages or (b) one foreign language and the option of a special research technique:

Economics and Business Administration
Electrical Engineering
Geology
Mechanical Engineering
Mechanics and Materials
Metallurgical Engineering
Pharmaceutical Chemistry

5. Departments or major fields permitting the fulfillment of the requirements by (a) two foreign languages or (b) one foreign language and

the option of either a special research technique or a collateral field of knowledge:

Aeronautical Engineering
Agricultural Economics
Agronomy
Animal Husbandry
Biostatistics
Child Welfare
Dairy Husbandry
Education
Educational Administration
Educational Psychology
Forestry
Home Economics
Horticulture
Journalism
Music
Plant Genetics
Political Science
Poultry Husbandry
Psychology
Social Work
Sociology
Soils
Speech
Statistics
Veterinary Medicine

Transfer of Language Certificates—The Graduate School permits transfer of language certificates from institutions whose credits are regularly accepted by the Graduate School and whose language tests are administered in the same way as they are by the language departments of the University of Minnesota. Language certificates will not be accepted from institutions where the examinations are administered by the candidate's major department. Language certificates more than three years old when the student enters this Graduate School cannot be transferred.

Where certification at some other institution is not possible and where it would work a hardship on the candidate to come to Minneapolis for an examination, the language departments will send written examinations to be taken wherever the candidate may be, provided proper arrangements for proctoring can be made.

All examinations to meet the language requirement of the Graduate School, unless otherwise arranged with the language departments, shall be held on the second Thursday of each quarter and on the second Thursday of each term of the Summer Session.

A candidate who fails in a language examination for an advanced degree shall not be given a second examination until the following quarter.

A repetition of the language examination is considered a special examination for which a fee of $5 is charged.

Major Work

The major work must be in a department in which the candidate has had, in his undergraduate study, a minimum of 27 quarter credits if it be a department open to freshmen, or a minimum of 18 quarter credits if it be a department not open to freshmen. Part or all of this preliminary work may consist of designated prerequisite courses in the same or allied departments.

While working for the Doctor's degree, a student shall spend at least two-thirds of his time on the major subject, including work on the thesis.

Minor Work

The minor work must be selected in a department in which the student is prepared to pursue courses included in the group designated "for undergraduate and graduate students," and numbered above 99.

The minor must be in a department the work of which can be logically related to that of the department in which the student is doing his major work.

In exceptional cases, the dean and the group committee may allow the minor subject to be taken in the same department as that of the major or in two related departments.

Not less than one-sixth of the total work of the three years shall be devoted to the minor subject, which must be completed before admission to the preliminary examination.

Doctor's Thesis

The thesis, for which accumulation of material may well be started by the middle of the second year, must show originality and power of independent investigation and embody results of research that form a real contribution to knowledge as well as exhibit mastery of the literature of the subject and familiarity with the sources. The matter must be presented with a fair degree of literary skill.

No material that has been published prior to its approval by the thesis committee may be used to meet the thesis requirement. Candidates contemplating publication of any material that they expect to present for a thesis should therefore arrange through the Graduate School office to obtain such approval.

The thesis** must be typewritten in quadruplicate (in some departments five copies are required) to facilitate reading by the thesis committee. When it has been certified by the adviser as complete on a form to be secured in the Graduate School office, the thesis must be registered in the dean's office and four copies distributed to the thesis committee *not later than eight weeks* before the commencement at which the candidate expects to receive the degree.

The thesis must be read by a committee of not less than three members, appointed by the dean of the Graduate School, upon recommendation of the appropriate group committee. As a rule, the student's major adviser will be chairman of this committee, and the field of the minor will be represented by at least one committee member. Unanimous approval of the thesis by this committee is necessary before the final oral examination can be held, and the results of the review of the thesis shall be reported to the Graduate School office on an appropriate form available in that office.

When he submits his *final oral examination report,* the candidate will sign in triplicate a *Memorandum of Agreement* with *University Microfilms,* Ann Arbor, Michigan, under which the ribbon copy of the thesis will be microfilmed before being permanently filed in the University of Minnesota Library. He will then pay his microfilm fee of $35. If he wishes his thesis to be copyrighted he will pay an additional $5 plus 1¼ cents per page for two positive microfilm copies of his thesis, which will be deposited in the Library of Congress.

Two copies of the thesis on heavy bond paper are to be bound and deposited in the Graduate School office.

Each candidate for the Doctor's degree shall submit with the bound copies of his thesis an abstract of 600 words or less, approved by his ad-

** Instructions for typing and registration of the thesis may be obtained in the Graduate School office.

viser, embodying the principal findings of the research. Such abstracts will be published in *Microfilm Abstracts,* which announces the availability of the thesis for distribution.

Publication of Theses

Publication by microfilm normally does not preclude publication by other methods later, and it is hoped that attempts at publication in the usual way will not be relaxed.

Examinations

Written Examination—A written examination in the major subject shall be given by the graduate faculty in the major department prior either to the preliminary or to the final examination or to both, as the department may decide. This examination shall cover all the work done in the major, and *may include any work fundamental thereto.* The passing or failing of this written examination shall be reported by the major adviser to the Graduate School office on forms which students will obtain in that office. In case of failure, the candidate will normally be allowed only one opportunity to retake the failed examination; this re-examination will be permitted not earlier than the following academic quarter.

Preliminary Examination—At least one full academic quarter before the degree is conferred, and only after completion of the work in the minor field, the foreign language requirements or their research substitutes, and such preliminary written examinations as are required in the major field, a preliminary oral examination of the student shall be given by a committee appointed by the dean of the Graduate School, upon recommendation of the appropriate group committee. The student's adviser will be the chairman of this examining committee. The committee shall ordinarily include the three members of the thesis review committee, plus at least two additional members. The group committees may recommend the appointment of different examiners for the preliminary oral examination and for the final oral examination if in their judgment such a recommendation seems appropriate. The group committees may also recommend the inclusion on both the preliminary and final oral examining committees of a member of the graduate faculty outside the major and minor fields of the student. Ordinarily the examining committees for both the preliminary and final oral examinations shall include a minimum of five members, three from the field of the major and two from the field of the minor, although the group committees may recommend the appointment of additional members if this seems desirable in given cases.

The preliminary oral examination shall cover both the major and minor fields and may include any work fundamental thereto, except the thesis. Only after passing the preliminary oral examination may the student be considered a candidate for the Doctor's degree.

The outcome of the preliminary oral examination will be recorded in one of three possible ways: examination passed, examination failed, examination passed with reservations. The voting proportions neces-

sary for one of these decisions are as follows: in the case of a five-member examining committee, a favorable verdict for passing a candidate will consist of either a unanimous vote or a vote of four-to-one; if the committee consists of six members, a unanimous vote or a vote of five-to-one or four-to-two will pass the candidate; and if the committee consists of seven members, a unanimous vote or a vote of six-to-one or five-to-two will pass the candidate. Unless the candidate obtains favorable committee votes in these proportions, the outcome is failure, except that, on the basis of the same proportions in the voting, the verdict may be passed with reservations.

In the case of an examination reported as passed with reservations, these reservations may involve: additional preparation and study followed by re-examination; the preparation of a special paper or written examination in a stated field; or other special conditions deemed appropriate by the examining committee.

The chairman and the examining committee will report the results of the preliminary oral examination to the Graduate School office, stating clearly, in the case of passing with reservations, what additional requirements must be met by the candidate prior to re-examination or prior to the reporting of satisfactory performance, and when such re-examination shall take place.

Students failing the preliminary oral examination may, upon recommendation of the examining committee, be excluded from further candidacy for the degree, and in any case no re-examination shall be held until at least one full academic quarter has passed.

Preliminary oral examinations will not be scheduled during the period of final oral examinations for the June commencement—normally from about April 8 to May 6—or during the second term of Summer Session. Preliminary oral examinations must be scheduled *one week in advance* in the office of the Graduate School by the candidate or his adviser.

Final Oral Examination—After preliminary written and oral examinations, after acceptance of the thesis by the thesis review committee, after successful completion of final written examinations, when required, and not less than *five weeks* before graduation, the final oral examination shall be given. This examination shall be conducted by a committee consisting of the adviser, the two other members of the thesis review committee, and at least two additional members of the graduate faculty, appointed by the dean, upon recommendation of the appropriate group committee. This examination covers the thesis and the field of the candidate's special study and shall not exceed three hours. The final oral examination must be scheduled *one week in advance* in the office of the Graduate School.

The date of the final oral examination shall be publicly announced, and any member of the graduate faculty may attend. Upon completion of the examination, a formal vote of the committee shall be taken. To be recommended for the award of the doctoral degree, the candidate must receive either a unanimous vote or a vote showing not more than one dissenting member of the total final examining committee. The chairman of the examining committee will then report the result of the vote to the Graduate School office.

All Ph.D. candidates are required to register in the quarter in which their final oral examination is taken.

Reports—Special blanks are provided for signed reports on the written examination in the major, the preliminary oral examination, the review of the thesis, and the final oral examination. All of these must be filed with the Graduate School office: the thesis review report at the time the final oral examination is scheduled, and the final oral report form at least *five weeks* before graduation.

SUMMARY OF REQUIREMENTS FOR THE DOCTOR'S DEGREE

Requirements	*Under the Direction of*	*Date*
First Year		
Selection of major	Adviser and dean of Graduate School	
Selection of minor		
Second Year		
Doctoral program	Adviser, minor department, appropriate graduate committee, and dean of Graduate School	Before beginning work of second year
Thesis title	Adviser, appropriate graduate committee, and dean of Graduate School	Before admission to preliminary examination
Completion of minor	Course instructors	Before admission to preliminary examination
Language requirement	Adviser and language departments	Before admission to preliminary examination
Written examination	Graduate faculty of the major department	Before preliminary oral or before the final oral examination or both
Preliminary examination, oral	Committee	At least one academic quarter before degree is to be conferred
Third Year		
Filing of completed thesis certified by adviser	Graduate School office	Eight weeks before graduation**
Approval of thesis	Thesis committee	Before admission to final oral examination
Final oral examination	Committee	Not later than five weeks before commencement
Two bound copies, abstract of thesis, and payment of $35 for microfilming thesis	Graduate School office	Not later than five weeks before commencement
Release card	Graduate School office	Not later than five weeks before commencement
Graduation fee	Office of Admissions and Records	Not later than five weeks before commencement

GRADUATE WORK IN THE SUMMER SESSION

Graduate work in many fields of special interest to teachers is open in the Summer Session. Students interested in graduate summer study for purposes other than teaching will find offerings in such fields as agriculture, home economics, child welfare, and economics, as well as in the College of Science, Literature, and the Arts, the College of Educa-

** Medical students should consult the Graduate School office for dates when their theses must be registered.

tion, and the Institute of Technology. Announcement of these courses may be found in the *Bulletin of the Summer Session.*

Students who desire graduate credit for work in the summer must register through the office of the Graduate School. If not previously admitted they must apply at least four weeks in advance of the summer term they wish to enter.

Work of graduate character done in the Summer Session of the University of Minnesota may be counted for residence credit for the Master's degree, except in the case of candidates for the master of science with field named in a clinical branch of medicine. Candidates for these degrees are required to spend a minimum of nine *academic* quarters in residence.

A limited amount of graduate work done in the Summer Session may be counted for residence credit for the doctoral degree, except in the case of candidates for the doctor of philosophy with field named in a clinical branch of medicine. Candidates for these degrees are required to spend a minimum of nine *academic quarters* in residence.

Master's Degree, Plan A

Course work for the Master's degree, Plan A (see page 9), may be completed in four summer terms of six weeks each. The candidate may be permitted to register for thesis and carry *in absentia* thesis work to complete the equivalent of three quarters. All requirements for the Master's degree under Plan A must be completed within six years after initiation of the degree program except in social work where the time limit is eight years for the master of arts with a major in social work. Students working for the Master's degree under Plan A in summer terms must secure approval of candidacy after earning from 9 to 15 quarter credits and must file the subjects of their theses before completion of the first half of the required work. Theses of Summer Session students must be completed at least *eight weeks* before the end of the session in which they take the degree. (See page 10.)

Master's Degree, Plan B

All requirements for Plan B may be completed in six summer terms of six weeks each and must be completed within seven years following the initiation of the degree program.

GRADUATE PROGRAM IN AMERICAN STUDIES

The program in American Studies at the University of Minnesota is based on the proposition that a sound knowledge of the civilization of the United States, in its relations both to its own regions and to its neighbors throughout the world, contributes to human understanding and to the eventual achievement of world peace.

The program is designed for teachers (in the fields of history, literature, the fine arts, and the social sciences), journalists and creative writers, librarians, social workers, and public servants. An interdepartmental curriculum in this field leads to the degrees of M.A. and Ph.D. The pre-

requisite for graduate work in American Studies is an undergraduate major in one of the departments concerned, or an undergraduate major in American Studies, or other preparation which the Committee on American Studies considers adequate.

Candidates for the M.A. degree distribute their courses among four fields: history, literature, fine arts and philosophy, social sciences. Candidates for the Ph.D. degree study foreign civilization in addition to the four fields just named.

For the bulletin of the *Program in American Studies* and other information, address the Chairman of the Program in American Studies, 101 Temporary South of Folwell, University of Minnesota, Minneapolis 14.

For course descriptions, see page 52.

GRADUATE PROGRAM IN COMPARATIVE LITERATURE

Committee:

Professor
Norman J. DeWitt, *chairman* (Classics)
Huntington Brown (English)
Alrik Gustafson (Scandinavian)

Associate Professor
Frank H. Wood (German)

Assistant Professor
Guy Desgranges (Romance Languages)

The rapid development in recent years of instruction in world literature, the great books, and the humanities is in part a recognition that literature, like the other arts, is an international phenomenon, profitably studied in breadth as well as in depth. The University of Minnesota, although it has no formal department of comparative literature, is equipped to offer graduate work leading to the M.A. and Ph.D. degrees in this field to candidates well grounded in two or more foreign languages.

Comparative literature may also be offered as a minor field for those majoring for the Ph.D. in the language and literature departments.

Interested students are invited to discuss their proposals with the chairman of the Program in Comparative Literature, or with one of the designated advisers, looking toward the formulation of a tentative program, adapted to the special interests and preparation of the individual candidate, for recommendation to the graduate group committee.

Well-grounded scholarly competence in comparative literature may be regarded as especially valuable for students who are looking forward to a career in teaching literature and the humanities in general, to writing, to criticism, translating, or editorial work.

Language Requirement—Applicants for admission to this program will be expected to pass, during the first quarter of residence, a special sight-reading examination in two foreign languages. These examinations will be administered by the foreign language departments, and will require a level of achievement above that necessary for the use of language as a tool for research.

General Literature Requirement—Each applicant will designate, in his initial proposal, three or more languages, the literatures of which will form the core of his study. He must have sufficient linguistic competence to deal with two of these literatures in their original language. The third and any additional literatures he may offer in translation.

Special Field—Each applicant will also designate in his proposal a special field of study for which a logical case can be presented in the light of his linguistic preparation. For instance, this field may be either a chronological period or a literary type, such as: the Renaissance, the Age of Reason, Romanticism, the Late Nineteenth and Twentieth Centuries, drama, fiction, poetry, literary criticism, etc.

The designated special field will be that of the thesis or (in case of candidates for the M.A. under Plan B) the focus of the program. The program may include some work in relevant fields (history, philosophy, art, etc.) and must fulfill the general requirements of the Graduate School, including that of a minor field. A listing of courses approved for programs in the several special fields may be secured from committee members (as listed) or from the departmental offices.

Minor Field—One of the three literatures designated for the student's program, together with its related language, shall be regarded as a minor.

Advisory Committee—When the plan of study presented to the Committee on the Program in Comparative Literature is approved by it and by the group committee of the Graduate School, the student will proceed in the regular manner toward the degree (as described elsewhere in this bulletin).

Comparative Literature as a Minor for the Ph.D. Degree—A candidate for the Ph.D. degree in any of the cooperating departments may offer comparative literature as a minor on condition (1) that he fulfill the language requirement as stated above, (2) that he designate two literatures other than his major, one of them involving reading on the level specified for the language requirement, and (3) that he designate a special field of study as defined above.

GRADUATE WORK IN DENTISTRY

Graduate work in dentistry is offered to meet the need in two areas: preparation of qualified teachers and investigators in the various branches of dentistry and preparation of fully trained specialists for the various fields of dentistry. The course of study leads to the degree of M.S. in dentistry, a combination of the conventional work for the master of science degree plus achievement of proficiency in some phase of clinical dentistry. Applicants must be graduates of accredited schools of dentistry who have achieved superior scholastic records both in predental and dental requirements. They must also present or acquire sufficient training in one of the basic sciences, such as bacteriology, anatomy, pathology, physiology, and physiological chemistry, to enable them to apply this discipline to research in some of the problems facing dentistry as one of the health sciences. This requirement is met by the completion of at least 9 quarter credits in one of the basic sciences at the graduate level. Basic science courses necessary as a foundation for advanced study are outlined under the departmental offerings in the *Graduate Medical Bulletin*. When full time is devoted to study, two to three years in residence are needed to complete the program for the master of science in dentistry degree. Although a reading knowledge of German is recom-

mended as highly desirable candidates for the Master's degree in dentistry are exempted from the foreign language requirement.

GRADUATE WORK IN FOOD TECHNOLOGY

Committee:

Professor

William F. Geddes, *chairman* (Agricultural Biochemistry)
Ancel B. Keys (Physiological Hygiene)
Harold Macy (Dairy Bacteriology)
Edgar L. Piret (Chemical Engineering)
James D. Winter (Horticulture)

Through an all-University committee, the various colleges of the University are cooperating to provide an integrated program of teaching and research that will meet the diversified needs of the many academic and industrial fields in which a knowledge of food technology and of the underlying fundamental sciences is required.

Graduate study in food technology, leading to the M.S. degree, is offered under Plan A or Plan B to qualified students who have a broad background in basic and applied sciences substantially equivalent to that required for the B.S. degree in food technology. (See *Bulletin of the College of Agriculture, Forestry, and Home Economics* for 1953-55, pages 29-30.) The course and research programs of graduate students in this field will be arranged by the committee in accordance with their special interests and the general requirements for the M.S. degree.

GRADUATE WORK IN INDUSTRIAL RELATIONS

The Graduate School has authorized an experimental program of study leading to a Master's degree with a major in industrial relations for persons who cannot satisfy their needs under earlier provisions for the Master's degree. Students in this program are selected on the basis of the quality of their undergraduate work and their professional objectives without requirement of special undergraduate majors or courses.

Programs are planned to meet individual student needs. The major field is industrial relations. Related fields usually include economics, psychology, sociology, and such other fields as are appropriate for individual objectives.

An adviser for this degree may be chosen from among those members of the Industrial Relations Center staff who are full members of the graduate faculty. During the initial and experimental stage, all student programs are approved by members of the Industrial Relations Center Faculty Committee before submission to the Graduate School.

Work for this degree may be done under either Plan A or Plan B.

There are no language requirements.

The following list of courses is illustrative of those which may be included in the major field:

Econ. 161 ..... General Manpower Economics and Labor Problems
Econ. 162 ..... Labor Movements
Econ 163 ..... Union Government and Policies
Econ. 164 ..... Labor Legislation: Collective Bargaining
Econ. 166 ..... Settlement of Industrial Disputes
B.A 157 ..... Introduction to Industrial Relations

B.A. 168	Advanced Personnel Administration
Econ. 169	Labor Legislation: Economic Security
B.A. 170	Methods Analysis and Work Measurement
B.A. 171	Motion Study Applications
B.A. 180-181-182D	Senior Topics: Industrial Relations
B.A. 180-181-182G	Senior Topics: Production Management
B.A. 184	Scientific Management in Industry
Econ. 200-201	Seminar in Employment Theory
Econ. 251-252	Seminar in Industrial Relations
E.Psy. 120	Basic Principles of Measurement
E.Psy. 140	Instruments and Techniques of Measurement
E.Psy. 142	Individual Mental Testing
E.Psy. 143	Advanced Individual Mental Testing
E.Psy. 216-217-218	Statistical Methods in Education
I.E. 150	Elements of Industrial Engineering and Management
I.E. 153	Methods Engineering and Work Measurement
I.E. 165	Industrial Plants
Law	Modern Social Legislation
Law	Labor Law
Pol. 101-102-103	Principles of the American Constitution
Pol. 124	Recent Social Legislation
Pol. 126-127	Government and the Economic Order
Pol. 131-132-133	Public Administration
Pol. 210-211-212	Special Seminar in Public Administration
Psy. 125-126	Psychology of Individual Differences
Psy. 130	Vocational and Occupational Psychology
Psy. 135-136-137	Occupational Counseling
Psy. 160	Psychology in Personnel Work
Psy. 167-168	Techniques of Public Opinion
Psy. 295-296-297	Seminar in Individual Differences and Applied Psychology
P.H. 110	Biometric Principles
P.H. 120	Advanced Biostatistics I
P.H. 130	Advanced Biostatistics II
Soc. 120	Social Psychology
Soc. 180	Methods of Social Research
Soc. 182	Statistical Methods

INTERNATIONAL RELATIONS AND AREA STUDIES

Candidates for graduate degrees may, in consultation with advisers, plan interdepartmental programs in international relations or area studies. General regulations of the Graduate School for admission and graduation apply, except that an equivalent program will replace the normal major and minor requirement. The following programs are offered.

Note—For a more complete statement concerning requirements, recommended courses, and vocational suggestions, see the special bulletin, *Programs in International Relations and Area Studies.*

General International Relations

Advisers:

Professor
Jan O. M. Broek (Geography)
Harold C. Deutsch (History)
Werner Levi (Political Science)
Harold S. Quigley (Political Science)

Associate Professor
Charles H. McLaughlin (Political Science)

Prerequisites—Ordinarily an undergraduate major in international relations, an area study, or one of the social sciences is required. Students without such background may be permitted to enter if they have completed courses prerequisite to those in the fields of graduate study proposed and are prepared to undertake any additional study needed to correct deficiencies in their preparation.

Language Requirement—For the M.A. degree a reading knowledge of either French or German. For the Ph.D. degree a reading knowledge of

both French and German. Alternative foreign languages may be authorized upon recommendation of the graduate adviser if appropriate to the candidate's program of study or research.

It is not recommended that candidates for the M.A. or Ph.D. degrees with a major in other subjects attempt to present a minor in international relations unless their previous preparation in this field is such that an intensive and well-integrated program in several departments can be completed within the limited time available for the minor. Consult graduate advisers.

Programs for the M.A. Degree—PLAN A. Students will present a minimum of 27 credits of graduate course work, ordinarily including a field of concentration of from 12 to 15 credits in one of the social sciences, the remaining credits to be distributed among related courses in other social sciences or in journalism, art, languages and literature, humanities, and philosophy. At least 6 credits should be in seminars, proseminars, or readings courses.

PLAN B. Students will present a minimum of 45 credits of graduate course work, including a field of concentration of from 15 to 18 credits in one of the social sciences, the remaining credits to be distributed among related courses in at least two other social science departments, and in journalism, art, languages and literature, humanities, and philosophy. At least 9 credits should be in seminars, proseminars, or readings courses.

Programs for the Ph.D. Degree—The work leading to the Ph.D. degree in international relations comprises at least three full years of graduate study and will vary in amount according to the candidate's individual needs and the extent of his undergraduate preparation. Requirements may be decreased for those who enter with advanced standing. Candidates will prepare for the written and oral examinations prescribed by the Graduate School in six fields of study, ordinarily completing a minimum of 12 credits in graduate courses or seminars in each field, including in each case at least 3 credits in a seminar or course based upon individually assigned reading or research. The six fields should be distributed among not less than three social science departments and may include one or two fields in journalism, art, language and literature, philosophy, or humanities. An area of concentration consisting of two fields within a single social science department shall be included. Definition of fields must be made in consultation with a graduate adviser, and the entire program should form a consistent, integrated plan of study. General requirements of the Graduate School must be satisfied, including a substantial dissertation in the area of concentration.

Area Studies

Advisers:

Northwest Europe
Prof. Lawrence D. Steefel (History)
Prof. Harold C. Deutsch (History)

Russia
Assoc. Prof. George W. Anderson (History)

East and South Asia
Prof. Jan O. M. Broek (Geography)
Prof. Werner Levi (Political Science)

Latin America
Prof. Raymond L. Grismer (Romance Languages)

In addition to these advisers, who are the chairmen of the area committees, or their alternates, students may consult any other member of a committee whose field of specialization corresponds with the student's field of interest. For committee lists see the special bulletin, *Programs in International Relations and Area Studies.*

Able students who have adequate preparation will be permitted to plan graduate programs in area studies. Programs leading to the M.A. degree may be arranged in any of the following areas: Northwest Europe, Russia, East and South Asia, Latin America. In the Northwest Europe area program the student is expected, after completion of basic work upon the area as a whole, to specialize in one of several subareas, either the Scandinavian Countries, Great Britain, France, or Germany. In the East and South Asia program, specialization is permitted in either East Asia or Southeast Asia. The gift to the University of a nearly unique training and research resource for South Asia in the Charles Leslie Ames Library has led to the planning of course offerings which may soon permit specialization in that subarea.

Prerequisites—At least 18 credits in courses regarded by area study advisers as suitable undergraduate preparation for such work and prerequisites for the individual courses in the graduate program. Consideration will be given to study or other relevant experience abroad. Since graduate work in the Northwest Europe program is expected to emphasize a particular subarea, candidates should have completed basic courses on Europe as a whole at the undergraduate level. In some cases they may be permitted to remove deficiencies in this respect while pursuing work in the graduate major. No specific prerequisite in foreign languages is imposed, but a working knowledge of one or more languages appropriate to the area chosen is considered especially important.

Programs for the M.A. Degree—General regulations for admission and graduation apply, except that an equivalent program will replace the normal major and minor requirement. An approved language appropriate to the area or to research concerning the area may be presented in satisfaction of the foreign language requirement. All programs must be planned in consultation with an area adviser.

PLAN A. Students will obtain a minimum of 27 graduate credits, including at least 9 in the social sciences. The remainder may be distributed among two or three fields, including the social sciences, literature, art, humanities, and philosophy. The whole should constitute a coherent, well-balanced program.

PLAN B. Students will obtain a minimum of 45 graduate credits, including at least 9 in the social sciences. The remainder will be distributed among the social sciences, literature, art, humanities, and philosophy.

A minor program under Plan A, or "related courses" under Plan B, may also be elected in an area study intended to support a departmental major.

Programs for the Ph.D. Degree—It is not at present recommended that candidates for the Ph.D. degree major in area studies, since teaching materials are inadequate for intensive area study at this level in several of the contributing disciplines. Where relevant, area study may be included as part of a major program for the Ph. D. degree. It may also

be presented as a minor program, in which case it is recommended that it comprise such aspects of study in the chosen area as are especially relevant to the major field. Major and area advisers should be consulted.

Preparation for the Foreign Service

Advisers:

Professor
Harold S. Quigley (Political Science)
Asher N. Christensen (Political Science)

Associate Professor
Charles H. McLaughlin (Political Science

A specific graduate major in preparation for the Foreign Service is not offered, but candidates for a graduate degree may obtain much of the instruction usually recommended for this purpose as a part of an international relations or an area major, or may take some relevant work in conjunction with a departmental major. They may also undertake training for the Foreign Service without candidacy for a graduate degree.

Intelligence Research Training Program

Adviser:

Professor
Tom B. Jones (History)

The University inaugurated in 1951 a program designed to provide basic training in intelligence research at the graduate level. Candidates for the M. A. or Ph.D. degrees may combine this training with a graduate major in area studies or international relations, or one of the social science majors. Certificates of proficiency in intelligence research will be awarded to students who successfully complete the prescribed work. Two years of graduate study are usually required to complete the program in conjunction with an M.A. degree. Foreign language competency, research skill and command of methods, and area specialization are stressed.

Those admitted to the program must be able graduate students with a genuine motivation toward careers in intelligence research or related work. They will be expected to have satisfactory reading knowledge of at least one foreign language and a reasonable familiarity with the cultural area chosen for specialization. They should also have completed undergraduate courses in statistics and cartography, but in appropriate cases deficiencies in these skills may be removed during the first year of training.

Programs must be planned in consultation with the adviser. They will consist in general of a foreign area study, or a combination of area training with a major in a social science discipline. In addition the program will include the following required courses:

1. Lib. 62, 63, 164, Reference I, II, III. (7 cred.)
2. 9 credits of seminar work in the major field.
3. I.R.T. 200-201-202, Intelligence Research Training Seminar. (9 cred.; prereq. registration in the intelligence research training program and permission) Jones.
4. Additional foreign language training, as needed, to assure a reading knowledge of a second foreign language by the end of the training period.

Undergraduates who plan to enter the program after graduation should consult the adviser at an early date. For further details consult the special bulletin, *Programs in International Relations and Area Studies.*

GRADUATE WORK IN MEDICINE

The University of Minnesota offers in both the fundamental laboratory departments and the clinical branches of medicine graduate work leading to advanced degrees. This work is under the direction of the Graduate School, and candidates for admission and degrees must meet the requirements of the Graduate School as outlined in this bulletin. The work is offered by members of the graduate medical faculty in Minneapolis and the Mayo Foundation at Rochester, Minnesota, where part or all of the residence work may be done. Fellowships and assistantships supported by the University and others on the Mayo Foundation are open to qualified students pursuing graduate work in clinical medicine or in the laboratory branches. The *Graduate Medical Bulletin* should be consulted for graduate work in clinical fields and in the basic sciences of medicine.

GRADUATE WORK IN PUBLIC ADMINISTRATION

Individually planned courses of study designed to prepare persons for administrative positions in the several fields of government service—national, state, and local—and leading to the degree of master of arts in public administration are offered to qualified graduate students with the approval of the staff of the Public Administration Training Program.

Candidates for admission to such courses of study must be eligible for admission to the Graduate School, and their preparation for graduate work in public administration must be approved by the staff. They will be expected to fulfill the general requirements of the Graduate School for the Master's degree under either Plan A or Plan B with the following exceptions:

Course of Study—In place of the regular major and minor requirements, an individual program of study, including courses drawn from one or more departments, will be planned for each student, in consultation with members of the staff. All candidates, however, must enroll in the graduate seminar in public administration. Candidates for the degree under Plan A must receive a grade of B or better in at least two-thirds of their course work and a grade not lower than C in all other courses offered for the degree.

Internships—Internships in appropriate governmental departments or agencies—national, state, or local—will be arranged for students who desire them.

Other Requirements—Candidates for this degree must have a reading knowledge of a foreign language or a working knowledge of the principles of governmental accounting or statistics. A foreign language is recommended for those who expect to do further graduate study.

Examinations—All candidates will be required to pass a final comprehensive written examination in public administration and a final oral

examination covering all course work offered for the degree and the thesis.

Advanced graduate students who wish to major in public administration with a view to teaching or government service are advised to become candidates for the doctorate in political science, with public administration as the field of specialization and with a minor or minors in closely related social science departments.

For further information, see the special bulletin, *Graduate Training in Public Administration,* or write to the Director of the Public Administration Center, 354 Ford Hall, University of Minnesota, Minneapolis 14.

GRADUATE WORK IN STATISTICS

Committee:

Professor

William L. Hart, *chairman*	Leonid Hurwicz
Willard W. Cochrane	Palmer O. Johnson
	Alan E. Treloar

The Graduate School has authorized programs of study leading to the degrees M.A. and Ph.D., respectively, with a major in statistics, and also has authorized a minor in this field for either degree in association with a major in some other area. The special faculty committee which supervises graduate programs in statistics is called the Committee on Statistics of the Graduate School.

General Viewpoint—Any candidate for an advanced degree with a major in statistics will be expected to become familiar with statistical techniques in some field of application.

Prerequisites—A candidate for the degree M.A. or Ph.D. with a major in statistics is required to present differential and integral calculus as minimum preparation in mathematics.

Approval of Programs—Courses of study for the degrees M.A. and Ph.D. with a major in statistics are supervised by the Committee on Statistics. The adviser for a candidate may be any appropriate member of the faculty of the Graduate School.

Major in Statistics—Master of Arts

Either Plan A or Plan B may be followed. When Plan A is chosen, the minor shall be in mathematics or in some field of application. Under Plan B, the field of concentration may be statistics, or statistics and mathematics, with the related fields selected from the several fields of application and mathematics.

Language Requirement—There is no language requirement under either plan except as recommended in special cases by the student's adviser and approved by the Committee on Statistics.

Major in Statistics—Doctor of Philosophy

Major—The course program in the major normally should be chosen from the courses listed below, with such changes in this list as may be made later by the Committee on Statistics, and from courses in mathe-

matics which are particularly pertinent for the candidate's objective. The minimum requirements (taken in undergraduate or graduate work) shall include the equivalent of the following courses: Math. 121-122-123 (9 cred.), *Mathematical Theory of Statistics;* 6 credits selected from advanced calculus (6 cred.), and Math. 131 (3 cred.), *Advanced Algebraic Theory.*

Minor—The minor may be a field in which the candidate expects to apply his statistical theory. Or, the minor may be mathematics, provided that the major program alone gives satisfactory acquaintance with statistical techniques in a field of application.

Language Requirement—A reading knowledge of two foreign languages, or a reading knowledge of one foreign language and a special research technique or a collateral field will be satisfactory.

Minor in Statistics—Doctor of Philosophy

The candidate for a minor in statistics must not assume that an arbitrary selection of courses from the following list will satisfy the minor requirements. The minor program should be planned in advance with an adviser from the committee listed above.

Fellowships and Teaching Assistantships

In applying for financial aid, a candidate for an advanced degree with a major in statistics should specify an *associated* field. This field should be his proposed main field for application, if he intends to prepare primarily as an applied statistician. Or, he should specify mathematics as the associated field if he desires to emphasize the mathematical theory of statistics, and thus qualify as a mathematical statistician, with the ability to develop new theory and also to aid in applications of statistics in diverse fields. Then, usually, the Committee on Statistics will transmit the candidate's application, with a recommendation for the appropriate action, to the associated department—Agricultural Economics, Biostatistics, Business Administration, Economics, Educational Psychology, Mathematics, Mechanical Engineering, Psychology, or Sociology, where teaching assistantships or fellowships may be available.

COURSES ELIGIBLE FOR CREDIT IN STATISTICS**

		Credits
Ag.Ec. 191	Advanced Agricultural Statistics	3
Agro. 243	Applied Statistics	3
B.A. 119	Correlation	3
B.A. 180-181-182F	Senior Topics: Statistics	9
C.W. 227	Multiple Factor Analysis	2
Econ. 101-102	Econometrics I and II	6
Econ. 121-122-123	Theory of Statistics	9
Econ. 217	Seminar in Statistical Inference and Econometrics	Ar.
E.Psy. 208	Methods in Educational Research	3
E.Psy. 216-217-218	Statistical Methods in Education	9
E.Psy. 216a-217a-218a	Statistical Methods in Education—Laboratory	6
E.Psy. 219	Design and Analysis of Statistical Investigations	3
E.Psy. 219a	Design and Analysis of Statistical Investigations—Laboratory	2
E.Psy. 243	Problems in Statistics	Ar.
Math. 121-122-123	Mathematical Theory of Statistics	9
Math. 203-204-205	Advanced Mathematical Statistics. (Prereq. Math. 107-108)	9
Math. 258-259-260	Theory of Probability. (Prereq. Math. 245)	9

** It is possible to prepare Plan B papers for the Master's degree in any one of these courses not listed as laboratory.

Math. 132-133-134	Industrial Statistics	9
Math. 190-191-192	Advanced Topics in Industrial Statistics	9
P.H. 110	Biometric Principles	3
P.H. 111	Biostatistics Laboratory	2
P.H. 120	Advanced Biostatistics I	3
P.H. 121	Advanced Biostatistics Laboratory I	2
P.H. 130	Advanced Biostatistics II	3
P.H. 131	Advanced Biostatistics Laboratory II	2
P.H. 140	Vital Statistics I	3
P.H. 150	Vital Statistics II	3
P.H. 200	Research in Biometry	Ar.
P.H. 201	Topics in Biometry	3
P.H. 211	Seminar in Biometry	Ar.

FINANCIAL AIDS

A large proportion of the graduate students at the University of Minnesota find it necessary to finance their education, in part at least, by funds secured either through fellowships or some form of part-time employment. The Graduate School is deeply interested in calling the attention of such students to all possible sources of financial assistance. In general, opportunities may be found through teaching and research assistantships, service and nonservice fellowships, other part-time employment both on and off the campus, and loans.

The following announcement does not include fellowships and teaching and research assistantships open to students in the clinical branches of medicine. For information on such opportunities students should consult the *Graduate Medical Bulletin.*

Assistantships

Holders of appointments involving one-fourth of full-time service or more to the University pay tuition at the resident rate. All others pay tuition according to their status as residents or nonresidents.

Approximately 630 teaching and research assistantships are offered through the various colleges, divisions, and departments of the University.

Stipends for these appointments vary from $702 for 25 per cent of full-time service to $1,404 for half-time service for the academic year, to $1,872 for half-time service for the twelve-month period. The amount of graduate work that can be carried is proportionate to the service burden of the assistantship.

Administrative and clinical fellowships (not rigidly restricted as to major field of study) are available in the Graduate School office, the Social Science Research Center, Radio Station KUOM, the Office of Admissions and Records, the Student Unions, and the bureaus of the Office of the Dean of Students: the Counseling Bureau, the Bureau of Student Loans and Scholarships, the Student Activities Bureau, and the Foreign Student Adviser's Office. Holders of these fellowships will pay tuition at the resident rate.

Applications are due February 15 of each year unless specifically stated otherwise for appointments covering the ensuing academic year. Requests for further information and for application blanks may be addressed either to the dean of the Graduate School or to the head of the department in question, but all application blanks should be returned to the head of the department appointing the assistant.

A large number of residence counselorships are available to both men and women in the University dormitories and fraternities. These positions

require a minimum of twenty hours of work per week. Counselors become personally acquainted with each student in the unit and are expected to stimulate group activities and student participation. These appointments provide board and room plus, *for services in the dormitories,* a stipend of $50 per quarter. Holders are required to participate in a regularly scheduled training program. Application blanks may be obtained from the Office of the Dean of Students, 200 Eddy Hall, University of Minnesota, Minneapolis 14.

Clinical Psychology—Approximately 15 work-study stipends at from $1,487 to $2,240 for half-time psychological work under the joint training program of the University and the Veterans Administration are open to students who have completed at least one year of successful graduate work in clinical psychology.

Fellowships and Scholarships

Applications are due each February 15 unless otherwise stipulated.

Open Only to Graduates of the University of Minnesota

****Albert Howard Fellowship** at $240. Offered when funds suffice.

******Two **Alexander P. Anderson and Lydia Anderson Summer Fellowships** at $350 each in botanical and zoological science.

****Minnesota State Pharmaceutical Association Graduate Fellowship** at $500, open to qualified graduates of the College of Pharmacy of the University of Minnesota.

****Class of 1890 Fellowship.** Whenever sufficient funds have accumulated, this fellowship of approximately $250 is open to a graduate of the College of Science, Literature, and the Arts, or the College of Engineering and the School of Architecture.

Open to Qualified Graduates of Any College or University

Forty **foreign student tuition scholarships** open in any department or college are offered to qualified foreign graduate and undergraduate students. Applications should be sent by *April 15* to the Office of the Foreign Student Adviser, 302 Eddy Hall, University of Minnesota, Minneapolis 14.

Several **John Cowles Foundation Fellowships** in varying amount, depending on students' need, are open to nationals of many Asiatic countries with no restriction as to field of study. Recipients pay fees at the resident rate.

****Grace Ellis Ford Fellowship** of the Minneapolis Branch of the American Association of University Women at $1,200, open in alternate years to a graduate woman student without restriction as to major field. Offered 1954-55.

****Minnesota State Division of the American Association of University Women Fellowship** at $1,200, open in alternate years to a graduate woman student without restriction as to major field. Offered 1955-56.

** Applicants for this fellowship may apply concurrently for tuition scholarships if they are citizens of the United States and can supply evidence of need.

A limited number of **Norwegian-American Graduate Fellowships** at $750.

****Shevlin Fellowship** at $1,000, offered in rotation in the College of Agriculture, Forestry, and Home Economics, the College of Science, Literature, and the Arts, the School of Chemistry, and the Medical School. Each of these colleges offers the fellowship once in four years. Offered in the Medical School 1954-55.

****Minneapolis Woman's Club Fellowship** at $1,200, available in alternate years to a woman student meeting scholarship and leadership qualifications. Offered 1954-55.

Four **Greater University Graduate Fellowships** at $1,200 for all areas of graduate study. Agency pays fees not to exceed $300.

COLLEGE OF AGRICULTURE, FORESTRY, AND HOME ECONOMICS

****Caleb Dorr Research Fellowship** in agriculture at $500.

****Two F. H. Peavey, Van Dusen-Harrington Scholarships** to an outstanding student—American or foreign—at $500, for graduate work in the College of Agriculture, Forestry, and Home Economics.

Two **Hormel Institute Fellowships** at $1,360 for a twelve-month period, available to students interested in research that would have value for Hormel Institute projects.

Sport Fishing Institute Fellowship at $1,200 for research in fish conservation under Professor Lloyd Smith, Jr.

Chapman Chemical Company Fellowship at $1,500 for work in wood preservation in the School of Forestry.

Mando Graduate Scholarship at $900 for work in forest management in the School of Forestry.

American Potash Institute Fellowship of $1,000 for research in the field of soils.

Middle West Soil Improvement Fellowship of $1,283 for work in the field of soils.

Spencer Chemical Company Fellowship at $1,283 for research on fertilizer.

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Caroline M. Crosby Memorial Fellowship in botany provides tuition, room and board, travel, and miscellaneous expenses up to $400 to enable a student to take instruction at the University of Minnesota Forestry and Biological Station or a similar biological station.

****Conway MacMillan Memorial Research Fellowship** in botany at $1,200.

John C. Hutchinson Scholarship of $300, awarded every second year to a graduate student in classical languages. Offered 1955-56.

California Company Fellowship in geology at $1,250. Agency pays fees.

** Applicants for this fellowship may apply concurrently for tuition scholarships if they are citizens of the United States and can supply evidence of need.

Gulf Oil Fellowship in geology at $1,000. Agency pays fees not to exceed $500.

Magnolia Oil Company Scholarship in geology at $750.

Shell Fellowship in geology at $1,500. Agency pays fees not to exceed $300.

Carl Schlenker Memorial Fellowship at $300. Open to an unmarried American-born student majoring in German language and literature. Preference is given to graduate students.

One **Minneapolis Star and Tribune "World Affairs Program" Teaching Assistantship** in journalism at $1,404.

John C. Hutchinson Scholarship of $300 awarded every second year to a graduate student in library science. Offered 1954-55.

H. W. Wilson Scholarship of $300 open to students in library science.

Physics—A number of research assistantships in each of the fields of biophysics, nuclear physics, cosmic rays, and mass spectroscopy at the regular rate or more depending upon qualifications of individuals.

Clara H. Ueland Memorial Fellowship at $450, open to recent women graduates whose interests are in politics and government. The applicant may apply concurrently for a tuition scholarship.

Three **United States Health Service** stipends at from $1,200 to $2,400, involving only study for the Ph.D. in clinical psychology. The amount depends upon whether the student is in his first, second, third, or fourth year of graduate work when appointed.

One **Hill Foundation Research Fellowship** in speech pathology at $4,800 for twelve months.

Ossanna Transportation Foundation Scholarship at up to $2,000 for advanced study in various phases of mass transportation.

Social Work

Several agency fellowships at $75 or $100 a month, provided by Twin Cities social agencies.

Two **United States Public Health** stipends of $2,400 open to students working toward the Ph.D. who have the Master's degree in social work and three years of successful subsequent social work experience.

Seven **United States Public Health** stipends of $1,600 under the National Mental Health Act limited to psychiatric social work students in their second or third year of graduate social work training who will enter psychiatric social work practice on completion of their training.

A few work-study stipends of about $170 per month in cooperation with the Veterans Administration. These are open only to students who have one or more year's experience in a social agency and who are in their second year of graduate social work training as medical or psychiatric social work majors.

Several public welfare fellowships computed on estimated cost of living plus tuition for graduate students in social work who are com-

** Applicants for this fellowship may apply concurrently for tuition scholarships if they are citizens of the United States and can supply evidence of need.

mitted to accept employment with the Minnesota Division of Social Welfare or one of the Minnesota county departments of public welfare.

A few scholarships of the **Board of Charities of the American Lutheran Church** with a stipend up to $800, conditioned by the student's need. Available to Lutheran students with acceptable scholarship who must accept employment approved by the Lutheran Board of Charities.

A few scholarships of the **Board of Charities of the Evangelical Lutheran Church** at $800 to casework or group-work graduate students who are Lutherans.

A few scholarships of the **Wheatridge Foundation** at $1,000 for the academic year. Available to Lutheran students who are studying to be medical or family social workers.

One stipend of $1,000 per year for two years provided by the **Hennepin County Tuberculosis Association** for graduate study in medical social work.

A few stipends from the **Mrs. Archie Walker Fellowship Fund** for students of social group work, amount determined by individual need.

INSTITUTE OF TECHNOLOGY

Allied Chemical and Dye Corporation Fellowship in chemistry at $1,500. Agency pays fees.

American Cyanamid Company Fellowship in chemistry at $1,500. Agency pays tuition, excluding incidental fees, not to exceed $300.

Dow Chemical Company Fellowship in chemistry at $1,500.

Du Pont Postgraduate Teaching Assistantship in chemistry at $2,400 ($3,000 if student is married). Agency pays fees exclusive of laboratory fees, in the amount normally charged to a teaching assistant of equivalent status.

Ethyl Corporation Fellowship in chemistry at $1,500. Agency pays fees not to exceed $600.

General Electric Fellowship in chemistry at $1,400 (or $2,100 if the student is married). Agency pays fees.

Minnesota Mining and Manufacturing Company Fellowships for research in chemistry at $1,500. Agency pays fees not to exceed $300.

Shell Fellowship in chemistry at $1,500. Agency pays fees not otherwise paid by any governmental or private agency.

Eastman Kodak Company Fellowship in chemistry at $1,400. Agency pays fees not otherwise paid by any governmental or private agency.

United States Rubber Company Fellowship in chemistry at $1,400 (or $2,100 if the student is married). Agency pays fees not otherwise paid by any governmental or private agency.

Monsanto Chemical Company Fellowship in organic chemistry at $1,500. Agency pays fees.

Parke, Davis Company Fellowship in organic chemistry at $1,500 under Professor R. T. Arnold. Agency pays fees not to exceed $500.

Smith, Kline and French Laboratories Fellowship in chemistry at $1,500 under Professor R. T. Arnold. Agency pays fees not to exceed $500.

Union Carbide and Carbon Chemicals Corporation Fellowship in organic chemistry at $1,400 (or $2,100 if the student is married) under Professor C. F. Koelsch. Agency pays fees.

Seven fellowships in **Government Polymerization Research** at rates varying with qualifications of individual under Professor I. M. Kolthoff.

Two **United States Public Health Service Fellowships** on polarographic studies of cancer under Professor I. M. Kolthoff at varying amounts.

Allied Chemical and Dye Corporation Fellowship in chemical engineering at $1,500, open to male United States citizens in the last year of work for the doctorate. Agency pays fees not to exceed $300.

Du Pont Fellowship in Chemical Engineering at $1,500 (or $2,100 if the student is married). Agency pays fees not otherwise paid by any governmental or private agency.

Minnesota Mining and Manufacturing Company Fellowship for research in chemical engineering at $1,400. Agency pays fees not to exceed $600.

Two **Procter and Gamble Fellowships** for research in chemical engineering at $1,200. Agency pays fees not to exceed $350.

Standard Oil Foundation, Inc., Fellowship in chemical engineering at $1,500. Agency pays fees up to $500.

Visking Fellowship at $1,500 to rotate among chemistry, agricultural biochemistry, and chemical engineering. Offered in chemistry 1954-55. Agency pays fees, supplies, and equipment not to exceed $750.

Two **Mayo Engineering Graduate Scholarships** at $500 to students in electrical engineering with interest in medical instrumentation.

Several **Mayo Engineering Graduate Fellowships** to students in electrical engineering interested in medical instrumentation at varying stipend. Consult the Electrical Engineering Department, University of Minnesota.

Two **Minneapolis-Honeywell Research Fellowships** in electrical engineering at $1,404.

American Society of Heating and Ventilating Engineers Research Fellowship in mechanical engineering at $2,400 for a twelve-month period. Available to students interested in research in the heating and ventilating field.

Two **Minneapolis-Honeywell Fellowships** for research in mechanical engineering at $1,404.

Quaker Oats Research Fellowship for graduate study in fine particle technology area of mechanical engineering at $2,000 to $3,000 depending upon qualifications of recipient.

Westinghouse Fellowship for graduate work in mechanical engineering at $1,200.

United States Bureau of Mines Fellowship in metallurgical engineering up to $1,500 under Professor S. R. B. Cooke. Agency pays an allowance for supplies and equipment.

Wierton Steel Company Fellowship in metallurgical engineering up to $3,600 under Professors T. L. Joseph and Gust Bitsianes. Agency pays an allowance for supplies and equipment.

Armour and Company Fellowship in metallurgical engineering at $2,400 under Professor S. R. B. Cooke. Agency pays an allowance for tuition, supplies, and equipment.

Superior Metal Products Company Fellowship in metallurgical engineering at $1,600 plus an allowance for supplies, under Professor R. L. Dowdell.

United States Bureau of Mines Fellowship in mining engineering, up to $2,500 for fellowship and equipment, under Professor E. P. Pfleider.

MEDICAL SCHOOL

Five or more **United States Public Health Service Training Fellowships** in biostatistics ranging from one-fourth of full time to full time at $700 to $2,800, depending upon need and qualifications of students. Renewable.

Abbott Laboratories Fellowship in physiological chemistry at $1,500 under Professor W. D. Armstrong.

COLLEGE OF PHARMACY

Four $1,000 **Samuel W. Melendy Memorial Fellowships.** Major study must be pharmaceutical chemistry or pharmacognosy, and full time must be devoted to graduate study and research.

Medical Fellowships

The University of Minnesota offers both on the Minneapolis Campus and through the Mayo Foundation at Rochester, Minnesota, a large number of graduate medical fellowships in the fundamental laboratory branches of medicine and in the clinical fields of medicine.

Further information may be found in the *Graduate School Announcement of Graduate Work in the Medical School and the Mayo Foundation.* Requests for application blanks should be addressed to the Dean of the Graduate School, University of Minnesota, Minneapolis 14, or for fellowships on the Mayo Foundation to the Director of the Mayo Foundation, Rochester, Minnesota.

Honorary Fellowships

Professors or other eminent scholars who desire temporarily the privileges of the library, research facilities, and seminars in the University, and who are not candidates for a degree, may upon recommendation of the dean of the Graduate School and the approval of the president of the University be appointed honorary fellows without stipend.

Honorary fellows shall not be required to pay any fees except to cover the cost of unusually expensive supplies or equipment.

Possibilities for Employment

The Employment Bureau of the University maintains a file of available jobs on the Minneapolis Campus and in the Twin Cities. Further information may be found in the *Bulletin of General Information.*

Students in the Graduate School may also find it profitable to explore through other channels the possibility of part-time employment in the Twin Cities area in business, professional, or other fields.

Services of the Bureau of Student Loans and Scholarships

The University has funds available for personal loans to graduate students who have satisfactorily completed two quarters in residence. This eligibility requirement may be waived in cases of emergency. No security is required other than the student's integrity and his ability to do graduate work. A student may borrow up to $300 during any one year or a maximum of $600. All applications should be made to the Bureau of Student Loans and Scholarships, 201 Eddy Hall.

If a student wishes assistance in planning his finances during residence in the Graduate School and in working out a program of part-time employment and supplementary financial aid, the counselors in the Bureau will be glad to help by personal interview or by correspondence.

Aids to Veterans

Graduate students eligible to receive benefits under the G.I. Bill of Rights (Public Law 346 or Public Law 550) or the act relating to vocational rehabilitation (Public Law 16 or Public Law 894) are advised to secure general instructions and information from the office of the University Bureau of Veterans' Affairs, 115 Shevlin Hall. Graduate students planning thesis research are encouraged to visit 115 Shevlin Hall to obtain information on special procedures for securing required research supplies. They are also invited to communicate with or to call at the office of the Graduate School for helpful information and assistance.

Services for Students from Abroad

Counseling and advisory services are provided for students from other countries by the adviser to foreign students. Assistance is given in matters of language adjustment; orientation to federal, state, and local regulations; and other problems, educational, social, and financial in nature. All foreign students are invited to address inquiries concerning these matters to the Foreign Student Adviser, 302 Eddy Hall.

Placement of Graduate Students

Aid and counsel to graduate students who wish college, university, or other positions may be had from advisers and departments, the dean of the Graduate School, and the deans of various colleges of the University and through the Bureau of Recommendations, which receives reports of vacancies for college teaching in all fields as well as in counseling, administration, and research. For further information, students may address the Director, Bureau of Recommendations, 102 Burton Hall.

HOUSING FACILITIES

Student Housing Bureau—The University of Minnesota maintains a Student Housing Bureau with a full-time director and considers the housing of out-of-town students one of its major concerns. Students, whether

graduates or undergraduates, while attending the University must have their places of residence approved by the director of the Student Housing Bureau in 202 Eddy Hall. A list of approved and inspected places of residence may be obtained upon application to the director of student housing, Student Housing Bureau.

Women's Residence Halls—Comstock and Sanford, the women's residence halls, provide room, board, and social programs at a minimum cost. Graduate students are very welcome. Positions as counselors, open to qualified graduate students, offer full board and room for part-time duties. For additional information, please contact the director of women's residences, Comstock Hall.

Men's Residence Halls—Two large residence halls—Pioneer and Centennial—provide room, board. and social and athletic programs for men students at minimum cost. Pioneer Hall will be occupied largely by freshmen, Centennial Hall by upperclass and graduate students. Many residents earn part of their board and room by working in these dormitories. Positions as counselors, available to qualified graduate students, offer full board and room for part-time duties. The director of Centennial and Pioneer Halls will be happy to furnish additional information and suggests early reservations.

Housing for Married Students—*University Village*—Minnesota veterans with children still get top priority for the emergency housing in University Village. Probably some of this housing will be available for nonresident veterans, with or without children, and for nonveteran families with children. The village consists of one-room unfurnished prefab units and miniature unfurnished apartments with two bedrooms, in the quonset and metal barracks buildings. Rents are moderate in every case, and tenure is unlimited as long as the tenant carries a full graduate academic load. University Village projects are located between the Minneapolis and St. Paul campuses and adjacent to the St. Paul Campus. Both sections of the village are on the inter-campus carline.

Thatcher Hall—a modern, furnished apartment building on the St. Paul Campus is available to graduate students who are carrying a full academic load. Half of the apartments are of the in-a-door bed type, and the others have one bedroom. Priority is given to families with children, both for admission to the building and for the larger units.

For additional information on University Village and Thatcher Hall, please write to Director of Men's Residences, 108A Wesbrook Hall, University of Minnesota, Minneapolis 14.

ROTC PROGRAM

Students in the Graduate School may pursue the Air Force ROTC program. To be eligible for the basic corps, applicants must have two years of academic work remaining. If the applicant has had two years of basic Air Force ROTC and has two years of academic work remaining, he is eligible for the advanced corps. (A personal interview is required of all applicants for entry into the Air Force ROTC program.) No graduate credit may be earned.

FIELDS OF INSTRUCTION

Symbols and Explanations

A course sequence separated by hyphens (121f-122w-123s) must be taken *in the order listed* unless it is specifically stated that a student may enter any quarter.

When no departmental designation precedes the number of a course listed as a prerequisite, that course is in the same department as the course being offered.

A prerequisite reading "5 cred." means 5 credits earned in courses offered by the same department as that offering the course being described.

The following symbols are used throughout the course descriptions and will not carry any page footnotes:

* An asterisk indicates courses through which it is possible to prepare required Plan B papers.

† A dagger indicates that all quarters of a course preceding the dagger must be completed before credit is granted for any quarter.

‡ A double dagger following a sequence course number indicates that students may enter any quarter.

♯ This symbol appearing in the prerequisites means "consent of the instructor."

§ A section mark indicates that credit is not given if the equivalent course listed after the section mark has been taken for credit.

¶ A paragraph symbol preceding a course number in prerequisites for a given course means that the prerequisite course is to be taken simultaneously.

Courses numbered between 100 and 200 are open to both graduate and undergraduate students. Those numbered 200 or above are for graduate students.

Students should consult the *Class Schedule* for each quarter and special college and departmental statements to learn the hour and place of particular courses.

AERONAUTICAL ENGINEERING

Professor
John D. Akerman
Rudolph Hermann
Ralph H. Upson
Joseph A. Wise

Associate Professor
Alfred E. Cronk
Eugene Stolarik

Lecturer
Walter S. Bradfield, Jr.
Frank D. Werner

Language Requirement—For the Master's degree, none. For the Doctor's degree, either (a) two foreign languages or (b) one foreign language and the option of a special research technique or a collateral field of knowledge.

Master's Degree—Offered under both Plan A and Plan B.

Doctor's Degree—Work for the Ph.D. degree is offered in this department.

Courses

100f-101w-102s. Aerodynamics. Atmospheric properties; fluid mechanics; stream functions and velocity potential; motion of body in liquids in three dimensions. Prandtl's wing theory. Dynamic loads, stability, maneuverability, controllability. (3 cred. per qtr.; prereq. 1 and I.T.M. 25) Stolarik, Cronk

103f-104w-105s. Advanced Aerodynamics. Dynamic stability. Advanced theoretical aerodynamics, flutter analysis. (3 cred. per qtr.; prereq. 102; 3 lect. hours per week) Stolarik, Cronk

106f,w,s. Advanced Aerodynamics. Compressible flow. Comparison of compressible and incompressible flow influences on aircraft. Airfoil analysis and design. Spanwise lift distribution. (3 cred.; prereq. 102; 3 lect. hours per week) Upson, Stolarik

107s. Aerodynamics of Viscous Fluids. Viscosity effects in fluid flows. Navier-Stokes equation, laminar boundary layer theory. Application of boundary layer theory to aerodynamic design problems. (3 cred.; prereq. 102; 3 lect. hours per week) Cronk

110f,w,s. Vibration and Flutter. Free harmonic and forced vibrations. Spring constants. Critical frequency. Vibrating systems with several degrees of freedom. Vibration of aircraft. Tail and wing flutter. (3 cred.; prereq. 115, I.T.M. 80; 3 lect. hours per week) Werner

115f,w, or s. Airplane Stresses. Deflection of structures. Theory of statically indeterminate structures. Analysis of fuselage trusses, landing gear, wing beams. Structural details and connections. (3 cred.; prereq. 83) Cronk

116f. Advanced Airplane Stresses. Frames, space frameworks, secondary stresses, beams, columns, curved beams, rings, multispar and unit wing construction, monocoque fuselages. (3 cred.; prereq. 115 or M.&M. 180; 3 lect. hours per week) Wise

117w. Advanced Airplane Stresses. Analysis of thin-shelled plates and membranes used in aircraft wings and fuselages. Local stresses and effects of discontinuities. Initial and thermal stresses, combined stresses, and theories of failure as applied to aircraft structures. (3 cred.; prereq. 115) Wise

118s. Advanced Stresses on Aircraft Structures. Theory of flexure of flat plates. Bucklings of plates. Combined bendings and axial stress in plates. Application and design of seaplane floats and hulls. (3 cred.; prereq. 115; 3 lect. hours per week) Wise

119s. Testing of Aircraft Structures and Models. Theory of model studies. Similitude. Maxwell theorem of reciprocal deflections. Begg's deformeter. Strain gauges, mechanical, optical, magnetic and electrical resistance types. Interpretation of tests. Mohr's circles of stress and circles of strain. Measurement of deflection. (3 cred.; prereq. 115; 2 lect., 3 lab. hours per week) Wise

120f-121w-122s.* Airplane Design. Design and stress analysis of aircraft structures involving beam—columns, thin web beams, multicell wings, closed frames. Sheet bucklings and tension characteristics of sheet-stringer combinations. Shear, bending, and torsion in shell structures. (2 cred. per qtr.; prereq. 83, 102; 2 lect. hours per week) Upson

123f,w,s-124f,w,s-125f,w,s.* Advanced Airplane Design. Problems in airplane design or development. (2 to 5 cred. per qtr.; prereq. 121 and ♯) Akerman

126f.* Airscrew Propulsion. Study of the theory common to the propulsive and lifting airscrews. Theory of the helicopter performance. (3 cred.; prereq. 120 or ♯; 3 lect. hours per week) Stolarik

127f,w,s*-128f,w,s.* Advanced Problems in Airscrew Design. (2 to 5 cred. per qtr.; prereq. 126 and ♯) Stolarik

130f. Aerodynamics Design Laboratory. Preliminary airplane design. (2 cred.; prereq. ¶120; 6 lab. hours per week) Stolarik

131w-132s. Airplane Design Laboratory. Air loadings analysis. Load factors. Structural design and analysis. (2 cred. per qtr.; prereq. for 131, ¶121, for 132, ¶122) Stolarik

141f,w,s. Aerodynamics Laboratory. Measurement of air flow; calibration of Pitot tubes and anemometers; distribution of air pressure on surfaces; wind tunnel tests of wing, propeller, and airplane models. (3 cred.; prereq. 101) Cronk, Upson

164s. Problems Relating to the Stratosphere. (3 cred.; prereq. 102) Akerman

165f,w,s.* 166f,w,s.* 167f,w,s.* Advanced Aeronautical Laboratory. Advanced research problems in aeronautical engineering, requiring laboratory or field research facilities. (2 to 4 cred. per qtr.; prereq. 141 and ♯) Staff

173f. Introductory Meteorology. Survey of meteorological phenomena and related physical principles: atmospheric statics; atmospheric thermodynamics; equations for simple atmospheric motions. Laboratory work consists of problems illustrating the physical principles involved. (3 cred.; 2 lect., 3 lab. hours per week) Mantis

174w. Applied Meteorology. Meteorological observations; collection and dissemination of meteorological data. Elementary weather analysis and interpretation of weather charts. (4 cred.; prereq. 173; 1 lect., 6 lab. hours per week) Mantis

175s. Advanced Meteorology. Physical meteorology. Atmospheric stability; heat balance; equations of hydrodynamics as applied to the atmosphere; structure and mechanism of cyclones and anticyclones. (4 cred.; prereq. 173; 3 lect., 3 lab. hours per week) Mantis

180f,w, or s. Instrumentation and Techniques for Supersonic Flow. Principles, uses, and limitations of measuring devices used in supersonic flow. Static and dynamic pressure orifices; Mach cones and wedges; shadowgraph and Schlieren apparatus; interferometer; hot wire anemometer; temperature measuring devices and methods; specific conditions and problems. (2 cred.; prereq. 106 or M.E. 134; 1 lect., 2 lab. hours per week) Bradfield

190f-191w-192s.* Seminar. Readings, reports, conferences, and discussions. (1 cred. per qtr.; prereq. 102) Akerman

193f,w,s-194f,w,s-195f,w,s.* Advanced Problems in Aeronautical Engineering. (2 to 5 cred. per qtr.; prereq. ♯) Staff

201f-202w-203s. Aerodynamics of Compressible Fluid. Equations of motion in a compressible fluid. Thermodynamic considerations. Isentropic channel flow. Method of characteristics. Application of aerodynamic design. The small perturbation method. The Busemann first and higher order approximations to pressure coefficient on aerodynamic surfaces. Aerodynamic characteristics of two-dimensional supersonic profiles. Extension of foregoing techniques to three dimensions. Finite wing theory. Conical flow. Applications to supersonic aircraft design. (3 cred. per qtr.; prereq. 106 or ♯; 3 lect. hours per week) Hermann, Bradfield

204s. Supersonic Aerodynamics Laboratory. A laboratory course in supersonic wind tunnel operations, technique, and instrumentation. Flow study and model testing supersonic wind tunnels at Rosemount Research Laboratory. (3 cred.; prereq. ¶201 or M.E. 134; 2 lect., 3 lab. hours per week) Akerman, Bradfield

208s. Aerodynamics of Viscous Fluids. Turbulent boundary layers, free turbulence and laminar stability in incompressible flow. Laminar and turbulent boundary layers in compressible flow with applications. (3 cred.; prereq. 107; 3 lect. hours per week) Staff

220w. High Speed Performance and Design. General principles of designing for performance. Compressibility corrections at subsonic speeds. Transonic effect. Supersonic possibilities and requirements. (3 cred.; prereq. 202 or ♯; 3 lect. hours per week) Upson

230f. Aerodynamics of Supersonic Inlet Diffusers. Diffuser types and pressure recovery. The one-dimensional normal shock diffuser. Various definitions of diffuser efficiency. Compression by one, two, or more oblique shocks. Two-dimensional diffuser for ramjets. Spike diffusers and pulsations. (3 cred.; prereq. 201 or M.E. 134; 3 lect. per week) Hermann

231w. Aerodynamics and Flight Performance of Supersonic Missiles. (3 cred.; prereq. 230; 3 lect. hours per week) Hermann

232s. Aerodynamics and Flight Performance of Supersonic Missiles. (3 to 5 cred.; prereq. 231 or ‡) Hermann

238f,w, or s. Joint Seminar with Institute of Technology Mathematics Department. Topics vary from year to year and are announced each time the course is given. (3 cred.; prereq. ‡) Aeronautical Engineering and Institute of Technology Mathematics staffs

240f,w, or s. Dynamics of Aircraft Structures. Fundamental principles of vibrations of spring-supported masses, beams, trusses, and other structural forms; response of structures to suddenly applied forces and impulses; strength of structures under impactive and repeated forces; application to vibration and flutter of aircraft structures and components, and their response to blast or explosion, jet reaction, gust loads, landing loads, and similar dynamic forces. (3 to 5 cred.) Wise

241f,w, or s. Dynamics of Aircraft Structures. (3 cred.; prereq. 240) Wise

272f-273w-274s.* Research in Aeronautical Engineering. (2 to 5 cred. per qtr.) Staff

275f,w,s-276f,w,s-277f,w,s.* Advanced Aircraft Engines. Advanced study of aircraft engines and auxiliary equipment; analysis of current developments in aircraft engines, new engine accessories, and installations; theoretical analysis of their effect upon the performance of modern aircraft. (2 to 5 cred. per qtr.) Staff

AGRICULTURAL BIOCHEMISTRY

Professor
William F. Geddes
Paul D. Boyer
David R. Briggs
Robert Jenness
Walter O. Lundberg
Max O. Schultze
Fred Smith

Associate Professor
Irvin E. Liener

Assistant Professor
Louis S. Cuendet

Prerequisites—For major work undergraduate courses satisfactory to the student's adviser are required in mathematics through integral calculus, general physics, inorganic chemistry, qualitative and quantitative analysis, organic chemistry, biochemistry, general biology (or botany or zoology), and general bacteriology. Physical chemistry is advised.

For minor work the student must satisfy the department staff that he has an adequate background.

Major—Candidates for the Ph.D. degree must have completed a year of physical chemistry, one year of advanced organic chemistry, and have accumulated 6 credits in course 224. Candidates for the M.S. degree must have completed 3 credits in course 224. With the approval of the adviser, courses in various fields of mathematics, physics, chemistry, biology, agricultural and medical sciences may be included as part of the major course of study.

The thesis may be conducted in such fields of biochemistry as colloids, proteins, carbohydrates, lipides, enzymes, cereal chemistry, dairy chemistry, animal nutrition, and plant biochemistry.

Minor—Courses 119 to 124, 129 to 133, and 202 provide a basic training in biochemistry and are particularly recommended to students registered for the Ph.D. degree. The minor requirement may be met by completing 23 to 25 credits from these courses.

Language Requirement—For the Ph.D. degree, a reading knowledge of two foreign languages is required, one of which must be German. For the M.S. degree, one foreign language, French or German, is required. In special cases some other language may be substituted by petition.

Master's Degree—In general, offered only under Plan A.

Doctor's Degree—Work leading to the Ph.D. degree is offered.

Courses

103s.†† Advanced Dairy Chemistry. Lectures and laboratory work on the physical, colloidal, and chemical properties of milk and dairy products. (5 cred.; prereq. 10) Jenness

105s.* Plant Biochemistry. An introduction to the chemistry, metabolism, and nutrition of plants. (3 cred.; prereq. organic chemistry, 3 or equiv.) Cuendet

106s.* Animal Biochemistry. An introduction to the chemistry, metabolism, and nutrition of animals. (3 cred.; prereq. organic chemistry, 3 or equiv.) Schultze

108s. Chemistry of Wheat and Wheat Products. A lecture course, with collateral library reading on the chemistry and technology of wheat. (3 cred.; prereq. 5) Geddes

110s. Flour Laboratory Methods. Analysis of wheat and its products. (3, 4, or 5 cred.; prereq. 2 or equiv., ¶108) Cuendet

116w. Advanced Animal Nutrition. Biochemistry of animal nutrition. (3 cred.; prereq. 6 or equiv., 120 advised) Schultze

117s. Laboratory Problems in Animal Nutrition. A laboratory course on methods used in nutrition studies. (3 cred.; prereq. 116 and ♯) Liener

118f,w,s. Laboratory Problems in Biochemistry. Laboratory work in the preparation and isolation of pure compounds and in methods of identification or determination of biochemical products. (3 to 5 cred. per qtr.; prereq. ♯) Staff

119f. Colloids. Lectures and assigned reading on the preparation and properties of colloidal systems, and their relation to biochemical processes. (3 cred.; prereq. Phys. 9 advised, Ag.Bi. 3, or 8 cred. in organic chemistry) Briggs

120w,121w,122s. Proteins, Carbohydrates, Lipides. Lectures and assigned reading on composition, structure, chemical and physical properties, and the functions of proteins, carbohydrates, and lipides. 120: Proteins. Briggs, Boyer, Schultze; 121: Carbohydrates. Smith; 122: Lipides. Lundberg. (3 cred. per qtr.; prereq. 119 or ♯)

123s. Enzymes. Lectures and assigned reading on the nature and function of enzymes. (3 cred.; prereq. 6 cred. of advanced biochemistry or ♯) Boyer

124f. Vitamins. Lectures and reading on the biochemistry of vitamins and their physiological action. (3 cred.; prereq. 6, 119; 123 advised, or equiv.) Schultze

129f. Colloids Laboratory. Preparation, purification, and physical chemical properties of inorganic and biocolloid systems. (2 cred.; prereq. 2 or equiv., ¶119) Briggs

130w,131w,132s,133s. Proteins, Carbohydrates, Lipides, and Enzymes Laboratory. Laboratory courses in the preparation, identification, and analysis of proteins, carbohydrates, and lipides, and on the preparation and properties of enzymes paralleling courses 120, 121, 122, 123. 130: Proteins. Jenness; 131: Carbohydrates. Smith; 132: Lipides. Lundberg; 133: Enzymes. Boyer. (2 cred. per qtr.; prereq. 2 or equiv.)

202f. Biochemical Methods. Laboratory work with methods such as chromatography, fluorometry, spectrophotometry, microbiological, isotopic, and microtitration techniques. (2 to 4 cred.; prereq. 6 cred. from 129 to 133 inclusive or ♯) Boyer

203f,w,s,su.* Research Problems. Work on research problems in various fields of biochemistry. (2 to 5 cred. per qtr.; prereq. ♯) Staff

205f,w,s,su.* Special Topics in Biochemical Literature. Library work and preparation of reports on special biochemical problems. (1 to 3 cred. per qtr.; prereq. ♯) Staff

†† Lectures only may be taken upon consent of instructor.

208f,w,s. Cereal Chemistry Seminar. (1 cred. per qtr.; prereq. 108 or #) Geddes, Cuendet

213f,w,s.* Seminar in Dairy Chemistry. (1 cred.; prereq. 103 and #) Jenness

216f,w,s.* Nutrition and Enzymes Seminar. (1 cred.; prereq. 116, 123 and #) Schultze, Boyer, Liener

219f,w,s.* Colloid Chemistry Seminar. (1 cred.; prereq. 119 and #) Briggs

220f,w,s.* Protein Chemistry Seminar. (1 cred.; prereq. 120 and #) Briggs, Jenness

221f,w,s.* Carbohydrate Chemistry Seminar. (1 cred.; prereq. 121 and #) Smith

222f,w,s.* Chemistry of Lipides Seminar. (1 cred.; prereq. 122 and #) Lundberg

224f,w,s.* General Seminar. Reports on recent developments in biochemistry and on research work carried out in the department. (1 cred.) Staff

AGRICULTURAL ECONOMICS

Professor
Oscar B. Jesness
Willard W. Cochrane
E. Fred Koller
George A. Pond
Philip M. Raup

Associate Professor
Rex W. Cox
Selmer A. Engene

Assistant Professor
Truman R. Nodland

Prerequisites—For major work, 18 quarter credits in courses acceptable to the student's adviser. Further courses may be required if the adviser thinks necessary. For minor work, 9 quarter credits.

Major and Minor—The thesis may be in any field of agricultural economics (marketing, farm management, economics of agricultural production, agricultural prices, agricultural policy, farm finance, land economics.) Candidates will be expected to take work in different fields, the program depending upon the field of specialization. With the approval of the adviser, certain courses in general economics and business administration may be accepted as major work. The minor may be in general economics.

Language Requirement—For the Master's degree, none. For the Ph.D. degree, either (a) two foreign languages or (b) one foreign language and the option of a special research technique or a collateral field of knowledge.

Master's Degree—Offered under both Plan A and Plan B.

Doctor's Degree—This department offers work leading to the Ph.D. degree.

Note—For courses in general economics and business administration, see Economics.

Courses

102w. Farm Organization. The business side of farming with emphasis on farm selection and organization. (3 cred.; prereq. 2) Pond

103s. Farm Operation. A continuation of 102 with special attention to efficiency in farm operation. (3 cred.; prereq. 102) Pond

104s. Types of Farming. A study of types of farming and of prevailing farm practices in the principal agricultural production areas. (3 cred.; prereq. 2) Pond

107s. Farm Work Simplification. A study of principles and methods of accomplishing work in less time and with less effort. Practice in planning improved working methods. (3 cred.; prereq. 2) Engene

110f. Economics of Agricultural Production. Principles of production economics elaborated in terms of the production of the major farm products and producing areas. (3 cred.; prereq. 2) Engene

126f. Economics of Consumption. Formulation of the economic principles relating to choice between different uses of income, time, and energy by individuals and family organizations. (3 cred.; prereq. 2 or 3) Cochrane

127w. Economics of Food and Nutrition. A review of consumption trends; the relation of food consumption to price, income, and other variables, the economic implications of nutrition, the consumption-production balance, food consumption problems, food policy. (3 cred.; prereq. 126 or ♯) Cochrane

131w. Market Prices. Analysis of the price-making process as it works out in the market places where the major farm products are sold. Market quotations and price quoting. (3 cred.; prereq. 30) Cochrane

140f. Marketing Organization: Staples. Principles of production economics applied to the organization of markets and marketing organization for the grains, tobacco, cotton, and wool. (3 cred.; prereq. 40) Cox

141w. Marketing Organization: Dairy and Poultry Products. (3 cred.; prereq. 40) Jesness

142s. Marketing Organization: Fruits and Vegetables. (2 cred.; prereq. 40) Cox

143w. Marketing Organization: Livestock and Meats. (3 cred.; prereq. 40) Raup

144f. Cooperative Organization. (3 cred.; prereq. 40) Jesness

150s. Advanced Farm Finance. (3 cred.; prereq. 50 or equiv.) Koller

170w. Land Economics. (3 cred.; prereq. 110) Raup

172s. Economics of World Agriculture. Distribution, quality, and utilization of agricultural resources: variations in population densities and characteristics, internal organization and techniques, comparative advantage, world trade in agricultural products, national and international policies relating to agriculture, future trends and prospects. (3 cred.; prereq. 110 or ♯) Raup

190f. Agricultural Statistics. Intended for beginning graduate students who have had no course in the elements of statistical method. (3 cred.) Cox

191w. Advanced Agricultural Statistics. (3 cred.; prereq. 190) Cox

200f-201w-202s.* General Seminar in Agricultural Economics.** (Cred. ar.) Jesness, staff

206w.* Seminar in Agricultural Policy. A study of economic problems of agriculture and policies adopted by governmental, agricultural, and other agencies toward such problems. (3 cred.) Jesness

221f.* Farm Organization Studies. A seminar study of the principles involved in the analysis of farm organization data and the computation of farm costs. (3 cred.) Pond

226s.* Advanced Farm Organization. Analysis of farm organization and the application of the budgeting method in improving the farm business. (3 cred.) Pond

230.* Research Problems in Farm Organization and Operation. Individual study of methods of conducting research work and analyzing problems in farm organization and operation. Reports required for credit. (Cred. ar.; offered when demand warrants) Pond, Engene, Nodland

235s.* Methods of Price Analysis. Application of economic theory and statistical techniques to agricultural price and market research. (3 cred.; prereq. 191) Cochrane

241f.* Seminar in the Marketing of Livestock and Livestock Products. (3 cred.; offered when demand warrants) Raup

244w.* Seminar in Cooperative Marketing. (3 cred.; offered when demand warrants) Koller, Jesness

** Under this head special seminars or individual work may be arranged on subjects suited to the needs of particular groups of graduate students.

246f.* Seminar in Economics of Consumption. (3 cred.; offered when demand warrants) Cochrane

270s.* Seminar in Land Tenure. (3 cred.; offered when demand warrants) Raup

AGRICULTURAL ENGINEERING

Professor	Associate Professor	Assistant Professor
Arthur J. Schwantes	Evan R. Allred	Arnold M. Flikke
Andrew Hustrulid	Clarence H. Christopherson	
Philip W. Manson	John Strait	
Charles K. Otis		

Prerequisites—For a major in agricultural engineering the general prerequisite comprises all *specified* work in the undergraduate professional curriculum in agricultural engineering at the University of Minnesota or its equivalent in general character, and in extent and value.

For a minor in agricultural engineering, the student must satisfy the department staff as to his preparation.

A graduate of an approved undergraduate curriculum in another line of engineering might select a major in some phase of agricultural engineering for which his undergraduate work has furnished the foundation. Additional supporting work may be required.

Major and Minor—With the approval of the adviser, courses in other branches of engineering and in agricultural or allied pure sciences may be included in the major. The minor may be taken in one of the other branches of engineering or some other related field of study approved by the adviser.

Language Requirement—No language is required.

Master's Degree—Offered under Plan A. In special cases Plan B is accepted when approved by the department graduate faculty.

[Professional degrees in engineering are administered by the Institute of Technology.]

Courses

104s. The Soil Moisture Relation in Agriculture. The scientific basis of soil moisture regulation and conservation in such phases as irrigation, drainage, and soil erosion. Lecture and problems. (4 cred.; not open to engineers; prereq. Soil. 4) Manson

106w. Agricultural Hydrology. Study of the hydrologic cycle and its component parts—precipitation, transpiration, evaporation, infiltration, and runoff. Measurement and estimation of runoff by various methods. Ground water hydrology. (3 cred.; prereq. 51 or ¶ or ♯; offered 1956 and alternate years) Manson

107s. Drainage, Irrigation, and Soil Erosion Control Design. Design and field layout of drainage, erosion control, and irrigation systems for the control and conservation of soil and water in agriculture. (4 cred.; prereq. 61 or ¶61, 106 or ♯; 2 lect., 6 lab. hours per week; offered 1956 and alternate years) Manson, Allred

111-112-113.* Problems in Agricultural Engineering. S, Soil and Water; B, Buildings; P, Power and Machinery; R, Rural Electrification. (2 to 6 cred. per qtr.; prereq. ♯) Staff

114w. Buildings, Equipment, Materials, and Methods of Construction. The relation of structures and building equipment to agriculture. Lectures and special problems. (3 cred.; not open to engineers; prereq. 3, 6, 7, or equiv.) Christopherson, Otis

117s. Applied Electricity. Topics including farmstead wiring, instruments, lighting, motors and controls, control circuits, and storage batteries. (3 cred.; prereq. E.E. 37) Hustrulid

124s. Agricultural Machinery and Mechanical Power Management. Machinery and power management, use, and costs. (3 cred.; not open to engineers; prereq. 9 cred. in agricultural engineering including physics and Ag.En. 12; offered when demand warrants) Schwantes, Strait

125s. Topics in Agricultural Physics. Advanced studies of the essential physical principles involved in the utilization of electricity in agriculture. (3 cred.; prereq. 117, or calculus and 24, 25 or equiv.; offered when demand warrants) Hustrulid

126s. Management of Agricultural Machinery. Principles of power and machinery management. Term problem and assigned topics. (3 cred.; prereq. 52, Ag.Ec. 102; offered when demand warrants) Schwantes

167w. Advanced Farm Structures. Design of structural members and assemblies for farm structures. Insulation and ventilation of animal shelters. Building equipment. (3 cred.; prereq. 63; offered 1955 and alternate years) Otis

171f. Design of Agricultural Machinery. Operating principles and problems. (3 cred.; prereq. 52, M.E. 121) Strait

200f,w,s. Seminar. Reports on current topics and department research. (1 cred.; prereq. consent of adviser) Staff

211f-212w-213s.* Advanced Problems and Research. (2 to 6 cred. per qtr.; prereq. 111, 112, or 113 and #) Staff

AGRONOMY AND PLANT GENETICS

Professor
Will M. Myers
Elmer R. Ausemus
Charles R. Burnham
Joseph O. Culbertson
Raymond S. Dunham
Ernest H. Rinke

Associate Professor
Jean W. Lambert
Emmett L. Pinnell
Alois R. Schmid
Horace L. Thomas

Assistant Professor
Robert G. Robinson

Prerequisites—In agronomy or plant genetics, sufficient credits in plant sciences must be presented to satisfy the adviser. Further courses may be required without credit at the option of the adviser.

Major and Minor Work—With the approval of the adviser, courses in agricultural biochemistry, botany, horticulture, plant pathology, plant physiology, soils, and other biological sciences may be accepted as major work in both agronomy and plant genetics. Students majoring in plant genetics are required to continue study during at least one summer.

Language Requirement—Reading knowledge of one foreign language is advised although not required for the Master's degree. For the Ph.D. degree the requirement may be fulfilled by (a) two foreign languages or (b) one foreign language and the option of a special research technique or a collateral field of knowledge. The student will find it to his advantage to prepare himself in advance for the language examinations. This is particularly true of those who are unable to spend more than one or two quarters at a time in residence at the University of Minnesota while doing graduate work.

Master's Degree—Offered under both Plan A and Plan B.

Doctor's Degree—The department offers work leading to the Ph.D. degree.

Courses

AGRONOMY

121w. Grain and Oilseed Crops. Production, improvement, and uses of corn, small grains, and oilseed crops. (4 cred.; prereq. 1; lect., lab.) Dunham

122s. Grain and Hay Grading. Development of grades, study of grading methods, and actual practice in grading grain and hay samples according to federal standards. (3 cred.; prereq. 1; lect., lab.) Lambert

123f. Forage Crops. Distribution, characteristics, production, preservation, and uses of forage crops. (4 cred.; prereq. 1; lect., lab.) Schmid

126f. Crop Judging. Laboratory practice in identification of crops, weeds, and diseases in relation to judging and grading farm crops. (4 cred.; prereq. 24, 122) Schmid

133s. Pasture Crops and Management. Characteristics, distribution, establishment, renovation, and management of crops for temporary and permanent pastures. (4 cred.; prereq. 123; lect., lab., field work) Schmid

135f. Weed Control. Cultural and chemical methods of weed control; weed and seed laws pertaining to dissemination and control. (3 cred.; prereq. 1, Pl.Pa. 3; lect., lab., field work) Dunham, Heggeness

201f,w,s,su.* Research in Farm Crops. Problems in physiology, production and classification of crop plants. (Cred. ar.; prereq. 121, 123) Dunham, Schmid

202f,w.* Farm Crops Seminar. Reviews and discussions of important agronomic literature. (1 cred. per qtr.; prereq. 9 cred. in farm crops) Dunham, Thomas, Schmid

203w. Advanced Studies in Agronomy. Origin, classification, and ecology of major crop plants; techniques in agronomic research; agricultural biology and other new concepts of crop production. (3 cred.; prereq. 21, 23) Dunham, Schmid, Thomas

PLANT GENETICS

131f,w. Principles of Genetics. Fundamental principles of breeding, heredity, variation, biometry, and evolution. (4 cred.; lect. and lab.) Lambert

132w. Farm Crops Plant Breeding. Applied genetics. Methods of breeding each of the important agricultural crops. (4 cred.; prereq. 31 or 131; lect., lab.) Rinke

136f. Introduction to Applied Statistics. Material covered will be probability, mean, normal distribution, variance, standard error, t test, X^2 test, correlation, and analysis of variance. Emphasis will be placed on how to do the required computing and interpretation of the results in terms of biology rather than of the mathematical background. (3 cred.; lect. and lab.) Thomas

241f,w,su.* Research in Plant Genetics. May be taken as major or minor work. (Cred. ar.) Myers, Burnham, Rinke, Thomas, Lambert, Pinnell

242f,s.* Plant Breeding Seminar. (1 cred. per qtr.) Agronomy and Horticulture staffs

243f. Methods in Plant Breeding. Methods applicable to improving self- and cross-pollinated crop plants, the effects of inbreeding, selection, hybridization, and heterosis. (3 cred.) Myers

244f,su. Laboratory Methods in Plant Breeding. Practice in plant breeding technique, methods of controlling pollination, and handling of plant cultures. (Cred. ar.) Staff

245f. Advanced Genetics. A survey of genetic knowledge. (3 cred.; prereq. elementary genetics; lect., lab.) Burnham

246w.* Genetics Seminar. Contributions to genetic theory and practice. (2 cred.) Agronomy, Horticulture, and Animal Husbandry staffs

247w. Cytogenetics. A survey of knowledge of chromosome behavior, polyploidy, and chromosomal aberrations with supplemental laboratory work in cytology. (3 cred.; prereq. Bot. 119, Agro. 245 or ♯; lect., lab.) Burnham

248w. Applied Statistics. Design of experiments and the application of statistical methods to the analysis of biological data, particularly with small samples. (3 cred.; prereq. P.H. 110 or 136 or similar course at another institution) Thomas

249f. Advanced Genetics, Specialized. (2 cred.; prereq. 245) Burnham

250w. Cytogenetics, Specialized. Advanced material. (2 cred.; prereq. 247) Burnham

AMERICAN STUDIES

Professor
Tremaine McDowell, *chairman*
H. Harvard Arnason
Ralph D. Casey
Lowry Nelson
Andreas G. Papandreou
Alice F. Tyler

Associate Professor
Bernard Bowron, *administrative secretary*
Mulford Q. Sibley

Assistant Professor
Clarke A. Chambers

Prerequisites—An undergraduate major in one of the participating departments (history, English, philosophy, art, music, anthropology, economics, education, journalism, political science, sociology), or a major in American Studies, or other preparation acceptable to the Committee on American Studies.

Language Requirement—For the Master's degree, reading knowledge of one foreign language. For the Ph.D. degree, reading knowledge of two foreign languages.

Master's Degree—Under Plan B, 45 hours of American courses are required, distributed in four fields: (1) history, (2) literature, (3) philosophy and fine arts, (4) social sciences. All candidates must include American Studies 200-201-202 in their program and must pass a written and an oral examination in American Studies.

Doctor's Degree—Candidates for the Doctor's degree enroll in American courses distributed in the four fields named above and in the fifth field of foreign civilization. All candidates must include American Studies 200 and 210-211-212 in their program, write an interdepartmental dissertation, and pass a series of written examinations, the preliminary oral examination, and the final oral examination.

For further details see the bulletin of the *Program in American Studies.*

Courses

200f-201w-202s. Introduction to American Studies. Exposition of interdisciplinary methods and of the concept of American Studies; reading of classics in American civilization; extended exploration of a topic. (3 cred. per qtr.; limited to candidates for the M.A. degree) McDowell, staff

210f-211w-212s. Seminar in American Studies. An overview of American civilization in the terms of the various departments which cooperate in the Program in American Studies. (3 cred. per qtr.; limited to candidates for the Ph.D. degree) Hornberger, staff

250f-251w-252s. Readings in American Civilization. Independent study of interdisciplinary aspects of American civilization under guidance of members of various departments. (Cred. ar.; prereq. permission of program chairman)

Note—For approved American courses in history, literature, philosophy, and other departments concerned, see the bulletin of the *Program in American Studies.*

ANATOMY

Professor
Arnold Lazarow, M.D., Ph.D., *head*
Olof Larsell, Ph.D., D.Sc.
Lemen J. Wells, Ph.D.

Associate Professor
Berry Campbell, Ph.D.
J. Francis Hartmann, Ph.D.
R. Dorothy Sundberg, Ph.D., M.D.
W. Lane Williams, Ph.D.

Prerequisites—Prerequisite work for all majors or minors in the Department of Anatomy includes general zoology, 9 credits.

Major and Minor Work for the Ph.D.—Each major in anatomy must have had or take the elementary courses in anatomy—embryology, gross anatomy, histology, and neurology. For majors in anatomy (hematology), 165 and 166 are required and may be substituted for neurology. Majors in clinical subjects who desire a minor in anatomy must have had as prerequisites the courses in anatomy usually required of medical students (including 100-101, 103, 104, 107, and 111).

Language Requirement—For the Master's degree, a reading knowledge of one foreign language. For the Ph.D. degree, either (a) two foreign languages or (b) one foreign language and the option of a collateral field of knowledge.

Master's Degree—Offered only under Plan A. (Consult department head.)

Doctor's Degree—The department provides excellent facilities for work in anatomy leading to the Ph.D. degree.

Courses

100f-101w. Gross Human Anatomy. Dissection of the human body. (8 cred. per qtr.; enrollment limited)

102s. Anatomy of the Head and Neck. (6 cred.; prereq. 59) Hartmann

103w-104s. Human Histology. Microscopic study of the various tissues and organs. (8 cred.; prereq. 100-101 or equiv.) Williams

105f. Microscopic Anatomy. (9 cred.; prereq. 102) Campbell

107f. Human Embryology. Development of the human body. (5 cred.; prereq. 100-101 or equiv.) Wells

111s. Human Neurology. A study of the gross and microscopic structure of the central nervous system and sense organs of man. (6 cred.; prereq. 103, 104, and 107, or Zool. 149-150) Larsell

131f. Biological Electron Microscopy. (Hours and cred. ar.) Hartmann

132w. Experimental Study of the Fetus. (Hours and cred. ar.) Wells

134w. Anatomy of the Newborn. Detailed laboratory study of the anatomy of the newborn. (3 cred.; prereq. 107 or equiv.) Wells

149f,w,s. Experimental Neurology. Morphology of the central nervous system as determined by experimental methods. (Hours and cred. ar.; prereq. 111) Campbell

150s. Special Topics in Neurology. Study of the literature in selected phases of human neurology. (Hours and cred. ar.; prereq. 111) Larsell

153f,154w,155s,156su. Advanced Anatomy. Advanced work in embryology, gross anatomy, hematology, histology, or neurology. (Hours and cred. ar.) Larsell, Wells, Campbell, Hartmann, Sundberg, Williams

158s. Special Histology and Neurology of the Head Region. (3 cred.; prereq. 103, 104, 111) Larsell

164w. Segmental and Topographic Anatomy of the Lungs. (2 cred.; prereq. 101)

165f-166w. Hematology. Normal and pathologic morphology of the blood and blood-forming organs, with emphasis on study of the blood from the standpoint of diagnosis and prognosis. (4 cred. per qtr.; prereq. 103 or equiv.) Sundberg

167s. Seminar in Hematology. (1 cred.; prereq. 165, 166) Sundberg

201f,202w,203s,204su. Research in Anatomy. Gross anatomy, embryology, histology, hematology, and neurology. Special facilities are offered to graduate students in the clinical departments for work upon problems in applied anatomy. (Hours and cred. ar.) Larsell, Wells, Campbell, Hartmann, Sundberg, Williams

205f,206w,207s. Anatomical Seminar. Reviews of the current literature and discussion of research work being carried on in the department. (1 cred. per qtr.) Staff

ANIMAL HUSBANDRY

Professor	Associate Professor	Assistant Professor
Evan F. Ferrin	Philip A. Anderson	Woodrow J. Aunan
Lester E. Hanson	John N. Cummings	William E. Rempel
Alfred L. Harvey		
Laurence M. Winters		

Prerequisites—For major work, 24 quarter credits in animal husbandry or closely allied subjects; for minor work, 12 quarter credits.

Major and Minor—Candidates doing major work for the Doctor's degree may emphasize animal husbandry or animal breeding but must select a minor in some other field. With the approval of the adviser, graduate courses in agricultural biochemistry, genetics, zoology, veterinary medicine, economics, dairy husbandry, and statistics may be accepted as major work.

Language Requirement—Candidates for the Master's degree may, with Graduate School approval, be exempted from the language requirement. For the Ph.D. degree this requirement may be fulfilled by (a) two foreign languages or (b) one foreign language and the option of a special research technique or a collateral field of knowledge.

Master's Degree—Offered under both Plan A and Plan B.

Doctor's Degree—The department offers work leading to the Ph.D. degree with major specialization in the field of animal production or animal breeding.

Courses

101f. Livestock Selection. Competitive selection of several types and breeds of livestock. Evaluation of ancestry, performance records, and other factors as aids to observation in selecting breeding animals. Visits to stock farms. (3 cred.; prereq. 9) Staff

107s.* Meat Problems. Wholesale cuts and grades of meat; the processing industry and the utilization of by-products. Special problems and visits to processing and merchandising establishments. (3 cred.; prereq. 53) Anderson

112w. Animal Breeding. Application of the physiology of reproduction and genetics to the breeding of farm animals. (3 cred.; prereq. Agro. 31) Rempel

113s. Livestock Management. Management principles and problems of care and of health in the production of beef cattle, sheep, and swine. (3 cred.; prereq. 56, 57, 112) Anderson, Ferrin, Harvey

114s. Artificial Insemination. Lectures and laboratory on the fundamentals and techniques involved in artificial insemination. Problems and procedures in managing artificial breeding associations. (4 cred.; prereq. 112 and #) Cummings

116f. Prenatal Development of Farm Animals. Textbook, lectures, and demonstrations dealing with prenatal development of farm animals. (4 cred.; prereq. 112 or equiv.) Cummings

201f.* Advanced Animal Breeding I. Assigned readings and lectures devoted to the more recently proposed techniques in breeding, and their likely application to farm animals. (3 cred.; prereq. 112, P.H. 110) Winters, Rempel

203w.* Advanced Animal Breeding II. Assigned readings and discussions of recent literature concerning physiology of reproduction with special reference to farm animals. (3 cred.; prereq. 112, 116) Cummings

204s. Advanced Animal Breeding III. Assigned readings and discussions on outlining and initiating a research project and methods of calculating and interpreting the data after they are gathered. (3 cred.; prereq. 201, 203, P.H. 130) Rempel

205s.* Seminar in Animal Breeding. Review of current literature and discussion of topics having special emphasis on constructive livestock breeding. (2 cred.; prereq. 201, 203) Winters

206w.* Advanced Livestock Feeding I. Nutrition of farm animals with particular reference to cattle, sheep, and swine. (3 cred.; prereq. 56, 57, Ag.Bi. 6, or equiv.; lect., special assignments) Hanson

207s. Advanced Livestock Feeding II. (3 cred.; prereq. 206) Hanson

208f,209w,210s.* Animal Husbandry Seminar. Special assignments and review of literature pertaining to the livestock industry. (1 cred. per qtr.) Ferrin

211f.* Experimental Methods. Theory, plan, and conduct of experimental work in animal husbandry. Factors affecting results, sources of error, interpretation of data. (3 cred.) Ferrin

212w,s.* Research in Meats. Problems assigned to fit the needs of the student. (3 to 9 cred. per qtr.) Anderson, Aunan

213f,w,s.* Research in Animal Husbandry. Problems assigned to fit the needs of the student. (3 to 9 cred. per qtr.) Ferrin, Hanson, Harvey, Winters

ANTHROPOLOGY

Professor
E. Adamson Hoebel
Lloyd A. Wilford

Associate Professor
Robert F. Spencer

Language Requirement—For the Master's degree, one foreign language. For the Ph.D. degree, two foreign languages.

Master's Degree—Offered only under Plan A.

Doctor's Degree—The department offers work leading to the Ph.D. degree.

Courses

105. Elements of Language. A survey of speech sounds followed by practice in phonetic recording. Analysis of phonetic patterns in language. Practical work in dictation of Chippewa, Dakota, Finnish, and other languages. (3 cred.) Spencer

106s. European Prehistory. Types of prehistoric men and cultures. (3 cred.)

109f. Descriptive Linguistics. (4 cred.) Spencer

110f. Physical Anthropology. Physical types of man, prehistoric and contemporary. (3 cred.) Wilford

111w. Advanced Physical Anthropology. (3 cred.; prereq. 110, or Zool. 22 or 133, or a course in human anatomy, or ♯)

113f. Character of Culture. (3 cred.)

116s. Indians of the Southwest. Pueblo and other tribes. (3 cred.)

117s. Anthropology and Contemporary Problems. (3 cred.)

118w. Indian Civilizations of Mexico and Central America. (3 cred.)

119s. Contact of Cultures. The impact of western civilization on native societies. The tenacity of culture patterns and the disintegration of aboriginal culture. Case examples from North America, Africa, and Asia. (3 cred.)

120f. Indians of the Plains. The tribes which lived between the Upper Mississippi and the Rockies, from the forests of western Canada to Texas. (3 cred.)

122f-123w-124s. Problems in Anthropology. Advanced work with individual guidance on special problems. (Cred. ar.; prereq. ♯) Wilford, Spencer, Hoebel, Johnson

125f. Peoples of Southeast Asia and Indonesia. (3 cred.) Spencer

126f. Ethnology of India. (3 cred.) Spencer

127w. Races and Cultures of China. (3 cred.) Spencer

128s. Races and Cultures of Japan. (3 cred.) Spencer

129s. Economic Activities in Primitive Culture. (3 cred.) Johnson

131w. Islamic Culture Sphere. (3 cred.) Spencer

140su. Field Trip in Archaeology. (1 to 12 cred.; limited to male students; prereq. ♯; may be taken for credit only once) Wilford

161s. Primitive Religion. Concepts of the sacred and the supernatural. Religious and ceremonial practices. (3 cred.) Spencer

162. Peoples of Negro Africa. Physical types; social, political, and economic phases of the cultures of Negro Africa. (3 cred.)

165f. Psychological Phases of Culture. The role of the individual in primitive culture. Psychological factors in diffusion of culture traits. (3 cred.) Hoebel

166f. History of Anthropological Theory and Method. An examination and critique of theory and method in historical perspective. (3 cred.)

169w. Peoples of the South Seas. Survey of the native cultures of the Pacific Islands. (3 cred.)

171s. Peoples of Northeastern Asia and Northwestern North America. (3 cred.) Spencer

172f. Indians of South America. (3 cred.)

204f-205w-206s. Seminar in Anthropology. Individually directed research. (3 cred. per qtr.) Wilford, Spencer, Hoebel, Johnson

251f-252w-253s. Seminar in Culture and Personality. (Cred. ar.; prereq. M.D. degree) Spencer

ARCHITECTURE

Courses Carrying Graduate Credit

104f. City Planning. (Same as Pol. 123, Soc. 106.) Social, economic, political, and technical phases of modern city planning. For mature students in the College of Science, Literature, and the Arts and the Institute of Technology. (3 cred.) Cerny, McClure, Vivrett, Anderson, Caplow, Filipetti, Vaile

105w. Professional Relations. Relations of the architect to clients, contractors, and fellow practitioners. Procedures of architectural practice. (3 cred.) Cavin

106s. City Planning. Technical phases of modern city planning, with special reference to the architects' functions therein. (3 cred.; prereq. 104) Cerny, McClure, Vivrett

201f,w,s. Special Researches in Architectural History. (Cred. ar.; prereq. 51-52-53) Koeper

250f,w,s. (AD-VI). Architectural Design, Grade VI. Problems involving individual research in either composition or construction. (Cred. ar.; prereq. AD-IV or equiv.) Cerny, McClure

ART

Professor
H. Harvard Arnason
Dimitri T. Tselos

Associate Professor
Philip G. Morton
Malcolm H. Myers
John Rood

Assistant Professor
Bernard P. Arnest
Lorenz E. A. Eitner
Hylton A. Thomas
Donald R. Torbert

Lecturer
Cameron Booth

Prerequisites—For the *master of arts* degree, a minimum undergraduate preparation of 27 Senior College credits in the history of art or its equivalent.

For the *master of fine arts* degree, admission to candidacy is limited to students who provide evidence of exceptional promise as creative artists in one or more of the following fields: painting, printmaking, sculpture, design.

Language Requirement—For any of the three Master's degrees, reading knowledge of one foreign language, French or German. For the Ph.D. degree, two foreign languages, preferably German and French.

Master of Arts Degree (Art History and Criticism)—Offered only under Plan A. The thesis subject and major work will be in the historical field. A total program of 45 quarter credits is required.

Master of Fine Arts Degree (Studio)—The candidate for the master of fine arts degree must complete a program of approximately 90 quarter credits, and submit a thesis in the form of creative work. Eighteen quarter credits, not including the thesis seminar, will be earned in courses in the history and criticism of art. The remainder of the credits will be in studio courses in art and in such areas of study outside the Department of Art as are approved for the individual student by the M.F.A. committee. The candidate must be in continuous residence at the University through the three quarters immediately prior to his graduation.

Master of Arts Degree (Preparation for Museum Work)—This two-year degree places special emphasis on preparation for art museum work. The candidate must have an undergraduate major in art history of approximately 27 credits of Senior College courses or the equivalent with permission of his adviser. Some experience in studio work, preferably design, is recommended. To earn the degree he must offer 45 credits of course work including a minimum of 27 credits in art history and criticism, the other 18 credits being divided between studio courses in design and courses outside the Department of Art. The required thesis will be in history or criticism of art.

The candidate will devote about half of his time over a two-year period to intern work in museums of the Twin Cities.

Doctor's Degree—The Department of Art offers work leading to the Ph.D. degree in the history and criticism of art.

Courses

HISTORY OF ART**

106f. Art in Egypt, Mesopotamia, and Greece. Architecture, sculpture, and painting of the pre-Hellenic civilizations in Egypt, Mesopotamia, and the Aegean. Development of Greek art from its beginnings to the Periclean age. (3 cred.) Eitner

107w. Hellenistic Art to Christian Art. Art of the Hellenistic kingdoms. Hellenic and Etruscan art in Italy. Art of the Roman Empire. The transformation of classical styles under the influence of oriental traditions and of Christian religion. Development of Christian art. Art of the Byzantine Empire. Survivals of classical forms in early medieval art. (3 cred.) Eitner

108s. Romanesque and Gothic Art. Development of architecture, sculpture, and painting in western Europe and Italy from the tenth to the fifteenth century. Art of the cathedrals. Romanesque and Gothic monumental and manuscript painting. Development of Gothic art as manifestation of currents in medieval culture. (3 cred.) Eitner

116f. Renaissance and Baroque Art in Italy: Origins and Early Phases, 1350-1490. Development of Italian painting and sculpture out of the Byzantine, Gothic, and Greco-Roman traditions: the Pisani, Giotto, Duccio, and the Sienese. The late International Style in Italy and the continuing Gothic tradition. The birth of Renaissance arts in Florence; the monumental realists Masaccio, Brunelleschi, Donatello, Ghiberti. The refinements of the later fifteenth century. The spread of the new style into Umbria, Rome, Padua, Venice. (3 cred.; offered 1955-56) Thomas

117w. Renaissance and Baroque Art in Italy: High Renaissance, Mannerism, Early Baroque, 1490-1625. The Florentine-Roman synthesis around 1500: Leonardo, Raphael, Michelangelo. The development of oil painting in Venice and north Italy; Giorgione, Titian, Tintoretto, Veronese, Correggio. Trends in architecture throughout the century. The mannerist reaction against classicism. Protobaroque tendencies: Michelangelo's influence. The first phases of the baroque: the Carracci and the Academy; Caravaggio and the new realism. (3 cred.; offered 1955-56) Thomas

118s. Renaissance and Baroque Art in Italy: The Full Baroque and the Rococo, 1625-1800. Bernini and the baroque fusion of architecture, sculpture, and painting. New trends in architecture: town planning, civic structures, the villa and garden. Illusionistic and decorative painting in Rome. The spread of the baroque outside of Rome: Bologna, Naples, Genoa, Milan. The development of new types of painting in Venice. Eighteenth-century prints. The growth of the neoclassic style. (3 cred.; offered 1955-56) Thomas

126f. Renaissance and Baroque Art in the North: The Renaissance in the Netherlands and Germany, 1350-1500. Late Gothic art: the International Style; courtly art of France and Burgundy. The new Netherlandish realism around 1400: Sluter and the van Eycks. Later fifteenth-century Flemish painting. National and Italianate traits in sixteenth-century Flanders. The development of the print in fifteenth-century Germany. The German Renaissance: the contact with Italy—Dürer and Holbein; native traits—Grunewald. German sculpture. (3 cred.; offered 1954-55) Thomas

127w. Renaissance and Baroque Art in the North: Baroque Art in Flanders, Holland, France, and Germany, 1600-1700. Flemish painting; its connections with Italy, France, and Holland. Rubens and the Classic Style in the north. The growth of Dutch painting: the emergence of new styles and types—the genre painters, the landscapists, the minor specialists. Rembrandt as painter, draughtsman, etcher. His position and his school. France and the classic-baroque tradition: Louis XIV and the arts. Baroque architecture and sculpture in Germany. (3 cred.; offered 1954-55) Thomas

128s. Renaissance and Baroque Art in the North: Baroque England and Spain; Eighteenth-Century France and Germany. England and classic-baroque

** Unless otherwise noted the prerequisite for History of Art courses is 9 credits in history of art, or literature, or history with permission.

architecture. Eighteenth-century English painting. Baroque painting in Spain: Valasquez, Goya, and the modern world. Spanish architecture and sculpture. French rococo architecture, sculpture, and the decorative arts. Rococo painting: Watteau, Boucher, Fragonard. New trends in the late eighteenth century; France and the emerging neoclassic theories. The art of rococo Germany. (3 cred.; offered 1954-55) Thomas

136f. Art in the United States. The origins. Painting, sculpture, and architecture from the beginnings through the Colonial and Revolutionary periods. Relations with England and the European continent. Copley, Stuart, West, and their followers. Influence of Jefferson. (3 cred.) Torbert

137w. Art in the United States. The Nineteenth Century. The rise of a national style in landscape and realistic genre. Homer, Eakins, Ryder, and their influence. Impressionism and relations with Europe after the Civil War. Beginnings of modern architecture. (3 cred.) Torbert

138s. Art in the United States. The Contemporary Movements. The Armory Show and development of modern realism, expressionism, and abstraction. Frank Lloyd Wright and modern American architecture. (3 cred.) Torbert

146f. European and American Architecture: 1775-1850. Revivalist and progressive movements; neoclassic and neo-Gothic styles; the genesis of modern style under rationalism and industrial revolution. Emphasis on the contributions of the most important architects of France, England, and the United States. (3 cred.; prereq. 1, 9 cred. in history of art or literature or history or ♯; offered 1955-56) Tselos

147w. European and American Architecture: 1850-1900. Victorian Gothic, eclecticism, and the rise of modern pragmatism in architecture within historical and antihistorical currents; the influence of Victorian Gothic and French academism on American architecture and the divergent reactions to it in Art Nouveau and the Chicago School. (3 cred.; prereq. 1, 9 cred. in history of art or literature or history or ♯; offered 1955-56) Tselos

148s. Modern Architecture: 1900-1950. Rise of protomodern architecture in European and American centers; development of the new international style and its various phases; its relation to modern sculpture and painting and its meaning in the new aesthetic directions. (3 cred.; prereq. 1, 9 cred. in history of art or literature or history or ♯; offered 1955-56) Tselos

156f. European and American Painting: 1775-1830. The beginnings of classicism and romanticism in the late baroque. The art of the French Revolution and of the Napoleonic era. The classical and Gothic revivals. Goya, David, Delacroix, Ingres, and their contemporaries. (3 cred.; prereq. 1, 9 cred. in history of art or literature or history or ♯; offered 1954-55) Tselos

157w. European and American Painting: 1830-1875. The last phases of romanticism and classicism. The realist movement and the further development of realism in impressionism. The later work of Delacroix and Ingres; Courbet, Millet, Manet, Monet, Renoir, Degas, and their contemporaries. (3 cred.; prereq. 1, 9 cred. in history of art or literature or history or ♯; offered 1954-55) Tselos

158s. European and American Painting: 1875-1900. The reaction against impressionism; neoromanticism, symbolism, postimpressionism. The pre-Raphaelites. The work of Gauguin, Van Gogh, Toulouse Lautrec, Cezanne. The neoimpressionists. (3 cred.; prereq. 1, 9 cred. in history of art or literature or history or ♯; offered 1954-55) Tselos

156Af-157Aw-158As. Twentieth-Century European and American Painting. Growth of modern painting and of the postimpressionist inheritance; French Fauves and German Expressionists; the impact of primitive art and its assimilation in cubism; the puristic defections and rise of Dada and surrealism; the new objectivity, the new romanticism and the new eclecticism; attention to peculiarly American assimilation of the European phases of painting. (3 cred. per qtr.; offered 1955-56) Arnason

166f. European and American Sculpture from Houdon to Rodin: 1770-1900. Transition from the rococo to neoclassicism; the academic, romantic, and realistic currents culminating in impressionistic realism in Rodin. Parallel developments in Germany, England, and the United States are considered

in terms of their outstanding representative sculptors. (3 cred.; prereq. 1, 9 cred. in history of art or literature or history or ‡; offered 1954-55) Tselos

167w. Modern Sculpture in Europe and the United States: 1900-1950. Influence of Rodin and the reactions against his impressionist romanticism; the direction toward the archaic, medieval, and primitive sculpture; the impact of abstract painting and the expansion of the limits of sculpture into symbolic primitivism, constructivism, and kinetic sculpture. (3 cred.; prereq. 1, 9 cred. in history of art or literature or history or ‡; offered 1954-55) Tselos

168s. The History of the Graphic Arts. Origins of the woodcut and of engraving. Renaissance and baroque master etchers and engravers. Mantegna; Raimondi, Schongauer; Dürer; Holbein; Lucas van Leyden; Callot, Rembrandt. The reproductive and portrait engraving of the seventeenth and eighteenth centuries. Lithography. Gericault, Delacroix, Daumier. Twentieth-century printmaking. (3 cred.; prereq. 1, 9 cred. in history of art or literature or history or ‡) Thomas

196f-197w-198s. Readings in Art History and Criticism. (3 cred. per qtr.; prereq. ‡) Staff

206f-207w-208s. Seminar in European and American Architecture. (3 cred. per qtr.; prereq. ‡) Tselos

216f-217w-218s. Seminar in European and American Painting. (3 cred. per qtr.; prereq. 27 cred. in Senior College courses in art history, ‡) Arnason, Tselos

236f-237w-238s. Seminar Problems in Art History and Criticism. (Cred. ar.; prereq. ‡) Staff

250f-251w-252s. Thesis Seminar. Independent creative and critical research. Required of M.F.A. students. Also open to second year M.A. and Ph.D. students. (No cred.; prereq. permission of graduate adviser) Arnest, Booth

STUDIO COURSES

101w-102s. Ceramic Sculpture. A course designed to provide a disciplined and permanent medium for advanced sculpture integrated with the courses offered in wood, stone, and metal; to increase the tactile experience of the student through study of a variety of ceramic materials; to study relationships of abstract form compatible with the requirements of the ceramic medium. (3 cred. per qtr.; prereq. 45) Rood, Tovish

103f. Design in Industry. Historical development of industrial design. An evaluation, by means of research problems, of the relationship between design, function, and manufacturing processes. (3 cred.; prereq. 53-54-55) Staff

104w. Design in Industry. Continued research and field trips investigating design in industry and the effects of mass production of the product. Practical laboratory problems in design for industry. (3 cred.; prereq. 103) Staff

105s. Design in Industry. Continuation of 104 leading to a final experimental problem. (3 cred.; prereq. 104) Staff

110f,w,s-111f,w,s-112f,w,s. Advanced Drawing. Primarily for painting majors. Drawing in all media from life and from imagination. Studies of the history of drawing. (3 cred. per qtr.; prereq. 62, 70-71-72 may be ¶) Arnest

123f-124w-125s. Film Workshop. A practical study of the motion picture as an art form. Studio problems in script preparation, camera technique, and editing, with an emphasis on the visual aspects of film making. Analysis of selected professional films and visits to local studios. (3 cred.; prereq. major in art, theater, humanities, or music or ‡) Downs

140f,w,s. Metal Sculpture and Jewelry. Introduction to metal design in jewelry. Study of the basic processes of soldering, forming, forging, engraving, chasing, and repousse. (3 cred.; prereq. ‡) Morton

141f,w,s. Metal Sculpture and Jewelry. Special problems in the areas of metal sculpture, relief sculpture in repousse, jewelry, and enameling. (3 cred.; prereq. ‡) Morton

142f,w,s. Metal Sculpture and Jewelry. Advanced problems in metal sculpture, relief sculpture, jewelry, or enameling. (3 cred.; prereq. ‡) Morton

150f,w,s,151f,w,s,152f,w,s. Problems in Painting. (Cred. ar.; prereq. ‡) Staff

180f,w,s,181f,w,s,182f,w,s. Problems in Sculpture. (Cred. ar.; prereq. ‡) Staff

190f,w,s,191f,w,s,192f,w,s. Advanced Printmaking. (Cred. ar.; prereq. ‡) Myers

193f,w,s,194f,w,s,195f,w,s. Advanced Problems in Design. Offers advanced students opportunity to carry out a creative problem in design with guidance in practice and research methods. Discussion of the common denominators of art as they occur in commercial art, illustration, display and museum techniques, and industrial design. (3 cred. per qtr.; prereq. ‡) Staff

200f-201w-202s. Advanced Problems in Studio Work. (Cred. ar.; prereq. ‡) Staff

250f-251w-252s.† Thesis Seminar. Independent creative and critical research. Required of M.F.A. students. Also open to second year M.A. and Ph.D. students. (Cred. ar.; prereq. permission of graduate adviser) Arnest, Booth

ASTRONOMY

Professor
Willem J. Luyten

The Astronomical Observatory possesses a ten and one-half inch refracting telescope; a five-inch star camera; a photographic measuring machine by the Société Génévoise.

Prerequisites—For major work, Ast. 51-52-53 and Math. 50; for minor work, Math. 50 and 3 credits in astronomy.

Language Requirement—Exemption from the language requirement for the Master's degree may be made in individual cases by petition.

Master's Degree—Offered under Plans A and B.

Courses

101f. Celestial Mechanics. A course dealing with Newton's Laws of Motion and their application to gravitational astronomy. (3 cred.; prereq. Math. 51) Luyten

121f-122w-123s.* Astrophysics and Stellar Statistics. An introductory course on the motions of the stars. (3 cred. per qtr.) Luyten

140f. Method of Least Squares. Applied especially to engineering, physics, and astronomy. (3 cred.; prereq. Math. 51) Luyten

211f-212w-213s.* Seminar. For students who are prepared for advanced work along specific lines. (1, 2, or 3 cred. per qtr.) Luyten

BACTERIOLOGY AND IMMUNOLOGY

Professor
Jerome T. Syverton, M.D., *head*
Harold Macy, Ph.D.
Dennis W. Watson, Ph.D.

Associate Professor
Herman C. Lichstein, D.Sc.
Joseph C. Olson, Jr., Ph.D.
Newell R. Ziegler, M.D., Ph.D.

Assistant Professor
Wendell Hall, M.D., Ph.D.
James J. Jezeski, Ph.D.
Karl R. Johansson, Ph.D.
William F. Scherer, M.D.
Edwin L. Schmidt, Ph.D.
Robert I. Wise, M.D., Ph.D.

Language Requirement—For the Master's degree, one foreign language. For the Ph.D. degree, either (a) two foreign languages or (b) one foreign language and the option of a collateral field of knowledge.

Master's Degree—Offered under Plan A.

Doctor's Degree—Work toward the Ph.D. degree is offered in this department.

Courses

100s. Bacteriology for Dental Students.** Morphology; methods of staining; culture media; methods of identification; principles of sterilization and disinfection; antibiotics; bacteria and disease; fundamentals of immunology; the oral flora; bacteriology of oral infections, dental caries, alveolar abscess, and periodontal infection; the relationship of oral infections to other focal and general infections. (6 cred.) Staff

102s. Medical Bacteriology.** The pathogenic bacteria, especially in their relationship to disease; principles of infection and immunity; microbiological techniques for laboratory diagnosis and antibiotic determinations. For students other than medical students. (4 cred.; prereq. 116) Watson, staff

103s. Soil Microbiology. Methods for enumeration and study of microflora and microfauna. Biochemical activities of soil population. (4 cred.; prereq. 53, 8 cred. in organic chemistry and #) Schmidt

104f. Sanitary Bacteriology. Standard and other methods for the bacteriological analysis of water, sewage, food, and dairy products. Preparation of standard culture media, technique, and evaluation of results. Primarily for majors in bacteriology. (4 cred.; prereq. 53, 15 cred. in chemistry) Johansson

105f-106w. Principles of Infectious Disease.** The instruction, which includes medical bacteriology, immunology, mycology, and virology, is designed to familiarize medical students with the factors that operate to result in an infectious process. Emphasis is given to the principles and techniques that make possible the diagnosis, treatment, and prevention of specific infectious disease. (5 cred. per qtr.; prereq. Anat. 103, Ph.Ch. 100 or 101, or Ag.Bi. 120) Syverton, staff

112f. General Mycology. (Formerly Bact. 113) A survey of the fungi with emphasis on life cycles, morphology, physiology, ecology, and economic significance. (3 cred.; prereq. 53, 15 cred. in chemistry) Roth

113w. Actinomycetes and Yeasts. (Formerly Bact. 114) A study of the taxonomy, morphology, genetics, and ecology of the actinomycetes and yeasts; detailed consideration is given to the physiology and economic importance of these microorganisms. (3 cred.; prereq. 112) Roth

114s. Medical Mycology. The pathogenic fungi and the mycotic infections in man and animals; emphasis on diagnostic procedures. (3 cred.; prereq. 102; offered 1954-55 and alternate years) Roth

115s. The Fungi Imperfecti. The ecology, biochemistry, nutrition, metabolism, genetics, and economic role of the more important genera of the asexual fungi. (3 cred.; prereq. 112; offered 1955-56 and alternate years) Roth

116w. Immunology. Mechanism of the interactions between host and parasite. Techniques and theories of serologic procedures; laws of hemolysis, quantitative relationship between antigen and antibody; opsonins, serums, vaccines, toxin, antitoxin, complement fixation, neutralization, precipitative and agglutinative reactions, blood grouping, atopy, anaphylaxis. (4 cred.; prereq. 53 or 105) Watson

121f. Physiology of Bacteria. A detailed study covering: chemical and physical structure; staining; growth; influence of environment on growth; nutrition; enzymes; metabolism. (3 cred.; required of all bacteriology majors; prereq. 53, 8 cred. in organic chemistry or biochemistry) Lichstein

122w. Physiology of Bacteria Laboratory. Techniques employed in study of bacterial physiology and metabolism. (3 cred.; required of all graduate students in bacteriology; open to others by consent; prereq. 121) Lichstein

** Microscope required. Students may obtain use of microscope by purchasing $3 microscope cards from the bursar.

123s. Bacterial Metabolism. Advanced treatment of several broad aspects of metabolism including enzymes; biological energy; fermentation; respiration; nitrogen metabolism. (3 cred.; required of all graduate students in bacteriology; open to others by consent; prereq. 121-122 or equiv., introductory biochemistry; offered 1955-56 and alternate years) Lichstein

124f. Viruses and Rickettsia. Character, nature, and transmission of viruses and rickettsia; important viral and rickettsial diseases; method for identification and laboratory diagnosis. (4 cred.; prereq. 102 or 105, 116) Syverton

125f. Animal Cell Cultures and Viruses. (4 cred.; prereq. 124, #) Scherer, staff

153f,w,s. Special Problems. (Cred. ar.; prereq. #) Staff

201f,w,s. Research in Bacteriology and Immunology. Graduate students with the requisite preliminary training may elect research, either as majors or minors in bacteriology or immunology. (Hours and cred. ar.) Staff

203f,w,s. Seminar. (1 cred.) Staff

204w-205s. Advanced Bacteriology. Techniques in bacteriology; microscopy and photomicrography; methods for studying variation; quantitative methods; cultivation and identification of anaerobes; methods of studying bacterial reactions catalyzed by enzymes. (3 cred. per qtr.; prereq. 121-122, which may be ¶, #)

D.H.115s. Advanced Dairy Bacteriology. Investigations of specific problems in the microbiology of milk and dairy products. (3 cred.; prereq. D.H. 150 or equiv., D.H. 111 or 112) Jezeski

D.H.150w. Dairy Bacteriology. Microbiology in relation to milk production and the processing of milk and dairy products. (3 cred.; prereq. Bact. 53; lect., lab.) Olson

D.H.212f,*213w,*214s,*215su,216su. Research in Dairy Bacteriology. Opportunities and facilities are offered for investigation and advanced study of problems involving the bacteriology and mycology of milk and dairy products. (Cred. ar.; open in the Summer Session only to those who have preliminary graduate work) Macy, Olson, Jezeski

Pl.Pa.117f. Virus Diseases of Plants. The nature of plant viruses and types of diseases they cause; particular emphasis on methods for studying virus diseases. (3 cred.; prereq. Pl.Pa. 1 or 10; offered 1955-56 and alternate years) King

BIOPHYSICS

Advisers:

Professor
Otto H. Schmitt (Biophysics)
Edward J. Baldes (Biophysics and Medical Physics, Mayo Clinic)
Karl W. Stenstrom (Medical Physics and Radiology)

Staff:

Professor
Edward J. Baldes
Kenneth N. Ogle
Otto H. Schmitt
Karl W. Stenstrom
Marvin M. D. Williams

Associate Professor
Julia F. Herrick

Assistant Professor
James F. Marvin

Staff for the program in Biophysics is drawn also from the departments of Physics, Zoology, and Botany and from the Medical School and the Mayo Clinic.

Prerequisites—Basic preparation in biology, physics, chemistry, and mathematics with an undergraduate major in one of these subjects or in biophysics is required. Each program for graduate work in biophysics must be approved by the appropriate adviser.

Language Requirement—For the Master's degree, reading knowledge of either French or German. For the Ph.D. degree, reading knowledge of

German and any one of the following: French, Russian, Italian. In special cases another language may be substituted by petition.

Master's Degree—Offered in general under Plan A. By petition Plan B may be followed.

Doctor's Degree—This department offers work leading to the Ph.D. degree.

Courses

105. A review of elementary physics for medical students. (Part of Rad. 121) By arrangement with instructor. (1 cred.) Stenstrom

138f,w,s. Seminar in General Physiology and Biophysics. (Cred. ar.) Staff

170f,w,s,su. Problems in Biophysics. Investigations of the effects of Roentgen, radium, visible, and ultraviolet radiation may be undertaken. Instruments are available for spectrophotometric work in the visible and ultraviolet regions, for temperature measurements by means of thermocouples, and to a certain extent for electrical measurements. (Hours and cred. ar.) Stenstrom

204f,w,s,su.* Research in Biophysics and Physiology of Radiation. (Cred. ar.) Stenstrom

221f,w,s*-222f,w,s-223f,w,s.* Research in Biophysics. (Cred. ar.) Schmitt

Rad.236. Radioactive Isotopes Seminar. (1 cred.; prereq. ♯) Marvin

Zool.155f,*156w,*157s.* Biophysics. Theoretical and experimental aspects of biology that can be studied by quantitative physical means. 155: Tissue ultrastructure (biostatics) as revealed by hypermicroscopy, birefringence, X ray, electron and radioactive means, and by colloidal and micellar phenomena. 156: Dynamics of biophysical systems: excitatory state, contraction, secretion, synthesis. 157: Integrative biophysical systems: stability of systems, transmission of information, sensory mechanisms. (3 cred. per qtr.; prereq. 28 cred. distributed between physics and biology, ♯, physical chemistry and general physiology recommended; schedule ar.; any section may be taken separately) Schmitt

Zool.296f*-297w*-298s.* Seminar in Biophysics. (Cred. ar.) Schmitt

Credit in biophysics is regularly granted for the following courses drawn from other departments. For descriptions of courses listed only by title, see detailed listings under the respective departmental headings.

Bot.118w. Extranuclear Cytology. (3 cred.) Dahl

Bot.119f. Nuclear Cytology. (3 cred.) Dahl

Ph.Ch.100f,su-101w,su. Physiological Chemistry. (7 cred., 6 cred.) Armstrong, others

P.Ch. 101f-102w-103s. Physical Chemistry. (3 cred. per qtr.) Crawford, Lipscomb, Wertz

Phys.101f-103w-105s. Theoretical Physics. (5 cred. per qtr.) Nier

Phys.107f*-109w*-111s.* Modern Physics. (3 cred. per qtr.)

Phys.120f.* Atomic Physics. (3 cred.) Blair

Phys.121w.* Experimental Nuclear Physics I. (3 cred.) Blair

Phys.134f,w.* Experimental Optics. (3 cred.) Valasek

Phys.144f. Electrical Measurements. (4 cred.) Blair

Phys.146w.* Electronics. (3 cred.) Blair

Phys.148s. Applications of Electronic Circuits. (3 cred.)

Phys.181f*-183w*-185s.* Atomistics and Elementary Quantum Mechanics. (3 cred. per qtr.) Williams

Phys.191f*-192w*-193s.* Introduction to Mathematical Physics. (3 cred. per qtr.)

Phsl.106s-107su.† Human Physiology. (15 cred.) Visscher, Gellhorn, others

Zool.100f,101w,102s. Zoological Techniques. The content of this course is subject to the direction of the major adviser. (Cred. ar., not to exceed 3 cred. per qtr.)

Zool.109w. Sense Organs. (3 cred.) Minnich

Zool.110s. Animal Reactions. (3 cred.) Minnich

Zool.112f*-113w.* Advanced General Physiology. (3 cred. per qtr.) Steinbach

Zool.128f-129w. Insect Physiology. (4 cred. per qtr.) Richards

Zool.140s. Biological Microscopy. (4 cred.) Richards

Zool.160w-161s. Cytology. (3 cred. per qtr.)

Zool.182s. Experimental Embryology. (5 cred.) Spratt

Zool.291f-292w-293s. General Seminar.

BIOSTATISTICS

(A Division of the School of Public Health)

Professor
Alan E. Treloar, Ph.D.
Joseph Berkson, M.D., D.Sc.

Assistant Professor
Jacob E. Bearman, Ph.D.

Lecturer
Lillian R. Elveback, M.A.

Prerequisites—Satisfactory evidence of high aptitude for quantitative reasoning, supplemented by scientific training of a broad character. Preparation in college mathematics through integral calculus is desirable but not essential if there is a compensating breadth in scientific background.

Language Requirement—For the M.S. degree, none. For the Ph.D. degree, either (a) two foreign languages or (b) one foreign language and the option of either a special research technique or a collateral field of knowledge.

Major—Courses in mathematics, theoretical and applied statistics, philosophy, and the sciences may be required at the discretion of the adviser as part of the major program.

Minor—Courses in statistics or closely related fields may be accepted as part of a minor program. Approval must be secured from the minor adviser.

Master's Degree—Offered under both Plan A and Plan B. (See the *Bulletin of the School of Public Health* for the master of public health degree.)

Doctor's Degree—Work for the Ph.D. degree is offered both in this department and under the statistics curriculum (see page 31) in accordance with the general requirements of the Graduate School.

Courses

P.H.110f,s. Biometric Principles. An introduction to statistical analysis with special reference to large samples and the basic principles of reasoning. Description of univariate distributions, normal correlations, and simple tests of significance. (3 cred.; prereq. college algebra, ¶111 Treloar, staff

P.H.111f,s. Biostatistics Laboratory. Practical training in techniques discussed in 110, which must be concurrent. (2 cred.) Sheldahl, staff

P.H.120w.* Advanced Biostatistics I. The nature of estimation and hypothesis testing as techniques in experimental science; small sample tests (t, X^2, F, analysis of variance) and their power. (3 cred.; prereq. 110 with grade not lower than C, ¶121) Elveback

P.H.121w. Advanced Biostatistics Laboratory I. Practical exercises in theory discussed in 120, which must be concurrent. (2 cred.) Elveback, Sheldahl

P.H.130s.* Advanced Biostatistics II. (Continuation of 120) Includes correlation and regression with two or more variables; further discussion of χ^2 and analysis of variance. (3 cred.; prereq. 120 with grade not lower than C, ¶131) Elveback

P.H.131s. Advanced Biostatistics Laboratory II. Practical exercises associated with 130, which must be concurrent. (2 cred.) Elveback, Sheldahl

P.H.140w. Vital Statistics I. Study of official sources; population changes; rates; trends; tests of significance. (3 cred.; prereq. ‡) Treloar, staff

P.H.150s.* Vital Statistics II. Sources of error in vitality records; adjustment procedures; morbidity and survival rates; the life table and its application in medical problems; population sampling. (3 cred.; prereq. ‡; offered when demand warrants) Treloar

P.H.200f,w,s.* Research in Biometry. (By special arrangement only) Staff

P.H.201f,w,s.* Topics in Biometry. (Individual studies by special arrangement) Staff

P.H.211f,w,s. Seminar in Biometry. (By special arrangement only) Staff

BOTANY**

Professor	Associate Professor	Assistant Professor
A. Orville Dahl, *chairman*	Albert W. Frenkel	John W. Hall
Ernst C. Abbe	Gerald B. Ownbey	Thomas Morley
Alan H. Brown		
Donald B. Lawrence		

Prerequisites—For major work, general botany (Bot. 1-2-3 or 4-5 or equivalent) and at least 17 additional credits in botany approved by the department; with consent of the major adviser, credits in related subjects may be substituted. For minor work, general botany (Bot. 1-2-3 or 4-5 or equivalent).

Language Requirement—For the Master's degree, reading knowledge of scientific literature in one foreign language, preferably French or German. For the Ph.D. degree, two languages, one of which must be German.

Master's Degree—Offered under both Plan A and Plan B.

Doctor's Degree—The department offers work leading to the Ph.D. degree.

Courses

106w. A Survey of Angiosperm Families I—Lower Angiosperms. (3 cred.; prereq. 52 or ‡; offered 1955-56 and alternate years) Morley

107s. A Survey of Angiosperm Families II—Higher Angiosperms. (3 cred.; prereq. 106; offered 1955-56 and alternate years) Morley

108w. Pteridophytes. The classification of living ferns and fern allies. (3 cred.; prereq. 52 or ‡; offered 1955-56 and alternate years) Ownbey

110f. Gymnosperms. Classification of gymnosperms. (3 cred.; prereq. 52 or 54 or ‡; offered 1954-55 and alternate years) Ownbey

112w,su.* Aquatic Flowering Plants. (3 cred. [4 cred. when taken at Itasca]; prereq. 10 cred. in botany or zoology or ‡; in summer offered only at Itasca Park Biological Station) Ownbey

** For courses in plant pathology and mycology, see Plant Pathology; for courses in plant genetics and cytogenetics, see Agronomy and Plant Genetics.

113f. Fall Flora of Minnesota. A survey of the flowering plants of the state with particular reference to the fall flora of the local area. (3 cred.; prereq. 52 or equiv. or ‡) Ownbey, Morley

114w.* Phyletic Taxonomy of Angiosperms. A study of evolutionary relationships within the angiosperms. (3 cred.; prereq. 52 or ‡; offered 1954-55 and alternate years) Morley

115s. Spring Flora of Minnesota. A survey of the flowering plants of the state, especially the spring flora of the local area. (3 cred.; prereq. 52 or equiv. or ‡) Ownbey, Morley

116su. Summer Flora of Minnesota. (4 cred.; prereq. 10 cred. in botany or zoology or ‡; offered only at Itasca Park Biological Station)

117s. Floristic Plant Geography. (Cred. ar.; prereq. 52 or ‡; offered when staff permits)

118w. Extranuclear Cytology. Studies of the structure of protoplasm, cytoplasmic constituents, and the cell wall. (3 cred.; prereq. 10 cred. in botany or zoology or ‡; lect., lab., reading) Dahl

119f. Nuclear Cytology. Studies of chromosomes and other nuclear structures. Nuclear phenomena, life cycles, and taxonomy. (3 cred.; prereq. 10 cred. in botany or zoology and an elementary course in genetics, or ‡; lect., lab., reading) Dahl

120s.* Research Methods in Cytology. Principles and practice of preparing materials for cytological investigation; photomicrography. (3 cred., 5 cred. with Plan B paper; prereq. 1-2-3 or 4-5, 118 or 119, and ‡; lect., lab., reading; offered 1954-55 and alternate years) Dahl, Hansen

121f. Developmental Anatomy. Origin, development, and structure of the organs of higher vascular plants. (5 cred.; prereq. 10 cred.) Abbe

123w. Research Methods in Histology. Principles and practice of preparing materials for histological investigation; photomicrography; preparation of manuscript. (3 to 5 cred.; prereq. 1-2-3 or 4-5, 121 or 125, ‡; offered 1955-56 and alternate years) Abbe, Hansen

125w.* Morphogenesis. Response of the vegetative body of the plant to environmental and genetical change. (5 cred.; prereq. 10 cred.; offered 1954-55 and alternate years) Abbe

127w.* Morphology of Vascular Plants. A detailed consideration of the evolutionary interrelationships of the vascular plants. (5 cred.; prereq. 10 cred.; offered 1955-56 and alternate years) Abbe

128s. Introduction to Paleobotany. Identification and structure of fossil plants; relationship of fossil plants to modern groups. (3 cred.; prereq. 54 or ‡) Hall

130f.* General Plant Ecology. Interrelations of plants and environment. Term paper required. (3 cred.; prereq. 10 cred.) Hulbert

131f. Field Ecology. Vegetation of the Twin Cities region. Written reports. (5 cred.; prereq. 50 or 130 or For. 3, 4) Lawrence

132w. Morphological Ecology. Evolution of life forms. Term paper required. (5 cred.; prereq. 50 or 130 or For. 3, 4; offered when staff permits) Lawrence, Hulbert

133s.* Ecological Plant Geography. Vegetation of North America. Term paper required. (5 cred.; prereq. 50 or 130 or For. 3, 4) Lawrence

134f. Research Methods in Ecology. Vegetation sampling, measurement of environment, scientific writing. Term paper required. (5 cred.; prereq. 18 cred. in plant science including 50 or 130) Lawrence

136su. Organisms, Microclimate, and Weather. (4 cred.; prereq. 10 cred. in biology, botany, or zoology, a course in physics recommended; offered only at Itasca Park Biological Station)

137s. Experimental Ecology. Ecological life histories, field manipulation of plants and communities, measurement and presentation of results. (5 cred.; prereq. 18 cred. in plant science including 50 or 130, 51) Hulbert

140f. Advanced Survey of Plant Physiology. Designed for graduate students or advanced undergraduates having a rudimentary knowledge of plant or

animal physiology and desiring a comprehensive survey course at a somewhat more advanced level than is provided by 51. Students who have had 51 should not enroll in 140. (3 cred. without lab., 5 cred. with lab.; prereq. an elementary course in botany or zoology, a course in animal or plant physiology, or # and a course in organic chemistry or biochemistry) Brown

154f. Spectroscopy and Photochemistry Applied to Biology. (3 to 5 cred.; prereq. 20 cred. in chemistry or biochemistry or #; offered when staff permits)

155su. Fresh-water Algae. (4 cred.; prereq. 10 cred. in biology or #; offered only at Itasca Park Biological Station)

157su. Bryophytes and Pteridophytes. (4 cred.; prereq. 10 cred. in biology or #; offered only at Itasca Park Biological Station)

165s. Introduction to Pollen Analysis. Basic pollen morphology in relation to pollen analysis in allergy, ecology, and phylogeny. (3 cred.; prereq. #; lect., lab., reading; offered 1955-56 and alternate years) Dahl

170f. Water Relations of Plants. (3 cred.; prereq. 51 or 140, 20 cred. in chemistry or biochemistry, P.Ch. 101-102-103 or 107, or #; offered 1954-55 and alternate years) Brown, Frenkel

171w. Mineral Nutrition of Plants. (3 cred.; prereq. 51 or 140, 20 cred. in chemistry or biochemistry, or #; offered 1954-55 and alternate years) Brown, Frenkel

172s. Plant Growth. (3 cred.; prereq. 51 or 140, 20 cred. in chemistry or biochemistry, or #; offered 1954-55 and alternate years) Brown, Frenkel

173f,174w,175s. Advanced Physiology Laboratory. (2 cred. per qtr.; to be taken with or after 170, 171, 172, respectively; offered 1954-55 and alternate years) Brown, Frenkel

176f. Plant Respiration. (3 cred.; prereq. 51 or 140, 20 cred. in chemistry or biochemistry, P.Ch. 101-102-103 or 107, or #; offered 1955-56 and alternate years) Brown, Frenkel

177w. Photosynthesis. (3 cred.; prereq. 51 or 140, 20 cred. in chemistry or biochemistry, P.Ch. 101-102-103 or 107, or #; offered 1955-56 and alternate years) Brown, Frenkel

178s. Nitrogen Metabolism of Plants. (3 cred.; prereq. 51 or 140, 20 cred. in chemistry or biochemistry, or #; offered 1955-56 and alternate years) Brown, Frenkel

179f,180w,181s. Advanced Physiology Laboratory. (2 cred. per qtr.; to be taken with or after 176, 177, 178, respectively; offered 1955-56 and alternate years) Brown, Frenkel

185w. Physiology of Algae. The isolation and culture of algae. Emphasis on the use of pure cultures of algae for studies in the fields of respiration, intermediary metabolism, and photosynthesis. (2 to 5 cred.; prereq. 51 or 140 or #; offered 1954-55 and alternate years) Frenkel

194su,*195su,*196su,*197f,*198w,*199s.* Problems. Advanced work in a specialized field. (1 to 5 cred. per qtr.; prereq. 20 cred. in natural science and #)

201f,*202w,*203s,*204su.* Research Problems in the Morphology of Vascular Plants. (Cred. ar.) Abbe

205f,*206w,*207s,*208su.* Research Problems in Taxonomy. (Cred. ar.) Ownbey, Morley

209f*-210w*-211s.* Research Problems in Paleobotany. (Cred. ar.) Hall

221f,*222w,*223s,*224su.* Research Problems in Ecology. (Cred. ar.) Lawrence, Hulbert

225f,*226w,*227s,*228su.* Research Problems in Plant Physiology. (Cred. ar.) Brown, Frenkel

229f,*230w,*231s,*232su.* Research Problems in Cytology. (Cred. ar.) Dahl

240f-241w-242s. Seminar in Morphology. (1 cred. per qtr.) Abbe

243f-244w-245s. Seminar in Taxonomy. (1 cred. per qtr.) Ownbey, Morley

246f-247w-248s. Seminar in Paleobotany. (1 cred. per qtr.) Hall

249f-250w-251s. Seminar in Ecology. (1 cred. per qtr.) Lawrence, Hulbert

252f-253w-254s. Seminar in Plant Physiology. (1 cred. per qtr.) Brown, Frenkel
255f-256w-257s. Seminar in Cytology. (1 cred. per qtr.) Dahl

CANCER BIOLOGY

Professor
John J. Bittner, Ph.D., *head*
Maurice B. Visscher, M.D., Ph.D.

Prerequisites—Graduate study in the field of cancer biology, leading to the Ph.D. degree, with a major in cancer biology, is offered to qualified students who have a broad background in basic sciences.

Minor—It is suggested that students majoring in cancer biology present a minor in any one of the following fields: pathology, genetics, virology, bacteriology, physiology, biochemistry, cytology, histology. Students using cancer biology as a minor are limited to graduate courses in these fields dealing strictly with cancer.

Language Requirement—For the Master's degree, reading knowledge of one foreign language. For the Ph.D. degree, either (a) two foreign languages or (b) one foreign language and the option of a collateral field of knowledge.

Master's Degree—The master of science degree in cancer biology requires at least two academic years in residence and satisfaction of substantially the same basic course requirements in the fundamental fields as are listed for the Ph.D.

Doctor's Degree—Candidates for the Ph.D. degree with a major in cancer biology may offer toward the major graduate work in any one of the following fields: cytology and organology, bacteriology, pathology physiology, and genetics. Attendance at the seminar in cancer biology is required of all students in cancer biology. The thesis must deal with the field of the major.

Courses

140f,w,s. Seminar in Cancer Biology. (1 cred.) Bittner
141f,w,s. Problems in Cancer Biology. (Cred. and hours ar.) Bittner
207f,w,s. Research in Cancer Biology. (Cred. and hours ar.) Bittner

CHEMISTRY

Professor
Lloyd H. Reyerson, *assistant dean*

Work in the School of Chemistry is organized in two departments, Chemistry and Chemical Engineering. The Department of Chemistry is composed of four divisions—Analytical, Inorganic, Organic, and Physical Chemistry.

The candidate for a higher degree is expected to show, in addition to the completion of the prescribed work, a maturity acquired by intensive personal study of the literature and of the methods of chemistry.

Prerequisites—For a major in chemistry, all candidates must offer the substantial equivalent of the courses in inorganic chemistry, analytical chemistry, organic chemistry, and physical chemistry required of under-

graduate students in the first three years of the chemistry curriculum, at least one year of college physics, and one year of college mathematics.

For a minor in chemistry, students must present at least 12 credits of general inorganic chemistry and qualitative analysis, 5 credits of quantitative analysis, and 2 quarters of organic chemistry or its equivalent.

Minor—The choice of the particular courses to be presented in fulfillment of a minor in graduate work will be made after consultation with the student's adviser.

Language Requirement—In the School of Chemistry, candidates for the Master's degree must have a reading knowledge of German or French; German is preferred. For the Doctor's degree two foreign languages are required, one of which must be German.

Examinations—Written and oral preliminary examinations in chemistry for the Doctor's degree will be given at only two periods during each year. Normally, these will be during the first two weeks of fall and spring quarters. The exact schedule will be announced at the beginning of these two quarters.

Master's Degree—Work for the Master's degree is offered under Plan A. Plan B is occasionally permitted with approval of graduate group committee.

Doctor's Degree—Candidates for the doctorate must satisfactorily complete the following courses before the fifth quarter in residence: In.Ch. 260, Or.Ch. 261, An.Ch. 262, P.Ch. 263, and (for minors in Chemical Engineering only) Ch.En. 264.

CHEMICAL ENGINEERING

Professor
Neal R. Amundson, *head*
Norman H. Ceaglske
Edgar L. Piret
Arthur E. Stoppel

Associate Professor
Herbert S. Isbin

Assistant Professor
Arthur J. Madden
George W. Preckshot

Prerequisites—For major work, the Bachelor's degree in chemical engineering or its equivalent. If he has not met this requirement, the student must pursue such additional preparatory studies as may be prescribed by his adviser.

For minor work, mathematics including integral calculus, physics, organic and physical chemistry.

Major and Minor Work—For the Master's degree under Plan A, the student must present a thesis based on experimental work.

Major candidates for the Master's or Doctor's degree must have completed, as undergraduate or graduate, a year's work in physical chemistry equivalent to P.Ch. 101-102-103 with laboratory.

Language Requirement—For the Master's degree, a reading knowledge of German. In special cases approved by the department, French or another language may be submitted. For the Doctor's degree, two foreign languages, one of which must be German. The second language must have the approval of the department.

Examinations—The written and oral preliminary examinations in chemical engineering for the Doctor's degree will be given at least twice each year, normally during the first two weeks of fall and spring quarters.

Master's Degree—Offered under Plan A. Plan B is occasionally permitted with approval of graduate group committee.

Doctor's Degree—The Department of Chemical Engineering offers work leading to the Ph.D. degree.

[Professional degrees in engineering—These degrees are all administered by the Institute of Technology.]

Courses

100f. Chemical Engineering Stoichiometry. (3 cred.; prereq. quantitative chemistry) Ceaglske

101f. Unit Operations.** Principles and methods of operation, and uses of the unit operation equipment. Fluid flow and filtration. Lectures and problems. (3 cred.; prereq. completion of two years' work in the Institute of Technology or equiv.) Stoppel, Earle

102w. Unit Operations.** Continuation of 101. Discussions and problems on heat transfer, evaporation, humidification, and air conditioning. (5 cred.; prereq. 101; lect. and rec.) Stoppel, Earle

103s. Unit Operations.** Continuation of 101 and 102. Drying, distillation, absorption, extraction, crystallization, etc. (5 cred.; prereq. 102) Stoppel, Earle

111f. Unit Operations Laboratory. (1 cred.; prereq. 101)

112w. Unit Operations Laboratory. (1 cred.; prereq. 102)

113s. Unit Operations Laboratory. (1 cred.; prereq. 103)

117w,118s. Chemical Engineering Equipment Design.** Fundamental principles in the design of chemical engineering equipment. (3 cred. per qtr.; prereq. 103) Isbin

119f-120w. Chemical Engineering Thermodynamics. Principles of the fundamental laws of energy as applied to chemical engineering problems. (3 cred.; prereq. 103; 2 lect., 2 rec. hours per week) Preckshot, Earle

121f. Chemical Engineering Economics.** Economics and business considerations controlling chemical engineering industries: statistical analysis of these industries, raw and finished products, principles of plant location, layout and design, unit operation costs, principles of management, operation, and control. (3 cred.; prereq. 131, 132)

131f. Inorganic Technology.** Applications of unit operations common to chemical industries, chemistry involved, equipment used, marketing of products, utilization of by-products, use of trade journals. (3 cred.; prereq. for chem. engrs., 103; lect. and rec.) Madden

132w. Organic Technology.** Similar to 131 but covering organic field. (3 cred.; prereq. for chem. engrs., 103, 131; lect. and rec.) Madden

153f-154w-155s-156su.* Special Problems. Investigations of problems of chemical engineering interest. (3 or more cred. per qtr.) Staff

161f-162w-163s. Nuclear Reactor Design. An engineering approach to the development and application of nuclear reactor theory, including basic nuclear chemistry and physics, mathematical developments and special techniques, design, operation, and control of homogeneous and heterogeneous reactors, emphasis on heat transfer and fluid flow problems, and nuclear reactor economics. (3 cred. per qtr.; prereq. #; 3 lect. per week) Isbin

171f. Instrumentation and Control. Theory and application of instrumentation and control with particular emphasis on application to the chemical in-

** Full graduate credit as major work will not be allowed for these required undergraduate courses.

dustry, including some theory of servomechanisms. (3 cred.; prereq. ‡) Ceaglske

172w. Instrumentation and Control. (Follows 171) (3 cred.; prereq. 171; 2 lect. and 3 lab. hours) Ceaglske

176f. Applied Electrochemistry. Laws and phenomena of electrochemistry, including electroplating, batteries, electric furnaces, and electrochemical products. (4 cred.; prereq. P.Ch. 103, and ‡; class and lab. work) Madden

181f-182w-183s.‡ Senior Research. Independent laboratory work combined with library research and presentation of oral and written reports on a comprehensive problem. (3 cred. per qtr.; prereq. honor point average greater than 1.5; 9 lab., 1 rec. hours per week) Staff

187w. Chemical Engineering Inspection Trip. Visits to representative chemical engineering industries between winter and spring quarters. (2 cred.) Staff

201f-202w-203s.‡ Seminar. Presentation and discussion of papers concerning the newer developments in chemical engineering. (1 cred. per qtr.) Piret, Amundson

205f-206w-207s. Advanced Unit Operations. Fundamentals and new developments in unit operations. Theory and applications to equipment and process design including economic balance problems. (3 cred. per qtr.; prereq. 103; offered 1954-55, alternates with 208-209-210) Piret

208f-209w-210s. Advanced Unit Operations. The principles of chemical engineering and their application to industrial problems. Survey of the literature. (3 cred. per qtr.; prereq. 103; offered 1955-56, alternates with 205-206-207) Piret, Madden

211f-212w-213s. Process and Plant Design. Several phases of chemical engineering training including unit operations, reaction kinetics, economic balance and market survey are combined to develop, from laboratory and literature data, an economic and technically sound industrial process for a projected chemical product. Equipment and plant layout prepared. Cost analyses. (3 cred. per qtr.; prereq. 103; offered 1955-56, alternates with 231-232-233) Isbin

214f-215w-216s. Advanced Mathematics for Chemical Engineers. Numerical analysis; ordinary and partial differential equations; Fourier series and special functions; finite difference equations; partial differentiation; matrix methods; operational methods. Theory of heat conduction and diffusional operations. (3 cred. per qtr.; prereq. differential equations) Amundson

217s. Analysis of Chemical Engineering Problems. Critical analysis of current chemical engineering literature. (3 cred.; prereq. ¶216) Staff

218f-219w.‡ Advanced Topics in Chemical Engineering. (3 cred. per qtr.; prereq. ‡) Staff

220s. Advanced Chemical Engineering Thermodynamics. An advanced course covering chemical engineering applications. (3 cred.; prereq. 119-120 and ‡) Preckshot

221w-222s. Reaction Kinetics in Chemical Engineering. Applications of the principles of reaction kinetics to chemical engineering process development. (3 cred. per qtr.; prereq. ‡) Piret

225f-226w-227s. Fluid Flow and Related Topics. A fundamental course covering advanced topics in viscous and turbulent fluid flow, eddy diffusion, and heat transfer. (3 cred.; prereq. ‡) Amundson

264f. General Survey of Chemical Engineering. (1 cred.; prereq. ‡) Staff

301f-302w-303s.* Research in Chemical Engineering. Unit operations, reaction kinetics, electrochemistry, unit processes, and others. (Cred. ar.) Amundson, staff

ANALYTICAL CHEMISTRY

Professor
Izaak M. Kolthoff, *chief*
Edward J. Meehan
Ernest B. Sandell

Courses

101w-102s. Quantitative Analysis. General principles, methods, and procedures of gravimetric and volumetric analysis. Typical problems are assigned and attention is given to proper laboratory practice. (5 cred. per qtr.; prereq. In.Ch. 13) Meehan

103s. Quantitative Inorganic Microanalysis. Representative methods of micro- and semi-microanalysis, gravimetric, volumetric, and colorimetric. (3 cred.; prereq. 1-2; limited to 16 students) Sandell

104f. Qualitative Inorganic Microanalysis. Use of microscope; technique of handling small amounts of materials. Inorganic qualitative analysis by crystal reactions and spot tests. (3 cred.; prereq. 1-2) Sandell

105w. Polarizing Microscope. Its use and application to chemistry. Identification of substances. (3 cred.; P.Ch. 101; limited to 16 students) Sandell

106f-107w-108s. General Technical Analysis. Analysis of commercially important materials such as iron, steel, nonferrous alloys, ores, and glass. Use of microscope in technical problems. (2 or 3 cred. per qtr.; prereq. 1-2) Sandell

109f,w,s. Rock Analysis. Laboratory course covering the technique of rock analysis. (3 cred.; registration limited; prereq. 1-2)

122s. Advanced Analytical Chemistry. Condensed review of modern fundamentals of gravimetric and volumetric analysis. (2 cred.; prereq. quantitative chemistry) Meehan

123f.* Advanced Analytical Chemistry. Analysis of complex materials by modern methods. (3 cred.; prereq. 1-2 or #) Meehan

127f-128w.* Theoretical and Practical Fundamentals of Instrumental Methods. (3 cred. per qtr.; prereq. P.Ch. 103; 3 lect. hours per week) Meehan and staff members of Department of Chemistry

131f. Application of Indicators in Neutralization Reactions and pH Determinations. (3 cred.; prereq. 1-2, P.Ch. 103) Kolthoff

132w. Electrometric Measurements and Titrations. Applications of potentiometric and conductometric methods in analytical work. (3 cred.; prereq. 1-2, P.Ch. 103) Kolthoff

133s.* Voltammetry and Amperometric Titrations. The dropping mercury electrode (polarograph) and the platinum microelectrode. (2 cred.; prereq. P.Ch. 103) Kolthoff

134f,w,s,su.* Voltammetry and Amperometric Titrations. Laboratory for 133. (2 cred.) Kolthoff

135f-136w-137s.* Seminar: Modern Problems in Analytical Chemistry. (1 cred. per qtr.; prereq. 1-2, P.Ch. 103) Kolthoff

138s. Advanced Volumetric Analysis. (3 cred.; prereq. 131) Kolthoff

140w. Water Analysis. Analysis of potable water with interpretation of results. (2 cred.; prereq. 1-2) Sandell

201f-202w-203s.* Selected Topics in Analytical Chemistry. (Cred. ar.) Kolthoff, Meehan, Sandell

262f. General Survey of Analytical Chemistry. A course of independent reading under the guidance of the staff. This course is a prerequisite to candidacy for the Ph.D. degree in any field of chemistry and must be completed by the end of the fall quarter of the second year of residence. (1 cred.; prereq. #) Kolthoff

301f-302w-303s.* Research in Quantitative Analysis. (Cred. ar.) Kolthoff, Sandell, Meehan

INORGANIC CHEMISTRY

Associate Professor
Paul R. O'Connor, *chief*

Professor
Gladstone B. Heisig
J. Lewis Maynard

Associate Professor
Robert C. Brasted
Otto H. Johnson
Thomas D. O'Brien
Norville C. Pervier

Assistant Professor
Z. Z. Hugus, Jr.
Alfred R. Pray

Prerequisites—For major or minor work, a Bachelor's degree with a major in chemistry including one year each of organic and physical chemistry, together with calculus, physics, and German. An average of B or better is required.

Language Requirement—German is required for the Master's and Doctor's degrees. French is required for the Ph.D. degree, but another language may be substituted by petition.

Master's Degree—Offered under Plan A or Plan B.

Doctor's Degree—Candidates must maintain better than a B average.

Courses

103f.* Atomic Structure and the Properties of the Elements Based Thereon. (3 cred.; prereq. An.Ch. 1-2, Or.Ch. 62) O'Brien

104w.* The Chemistry of the Representative Elements. (4 cred.; prereq. An.Ch. 1-2, Or.Ch. 62) Brasted

105s.* Coordination Compounds. (3 cred.; prereq. An.Ch. 1-2, Or.Ch. 62) Maynard

106w.* The Chemistry of the Less Familiar Elements. (3 cred.; prereq. An.Ch. 1-2, Or.Ch. 62; offered 1954-55 and alternate years) O'Brien

107s.* Oxidation-Reduction Systematics. (3 cred.; prereq. P.Ch. 103; offered 1954-55 and alternate years) Hugus

108s.* Nonaqueous Systems. Reactions in the principal nonaqueous systems—both protonic and aprotonic. (3 cred.; prereq. P.Ch. 103 or ‡; offered 1955-56 and alternate years) Pray

111f.* Silicon and Related Elements. Review of current studies on boron, silicon, germanium, tin, and lead with emphasis on recent silicon chemistry. (3 cred.; prereq. An.Ch. 1-2, Or.Ch. 62; offered 1955-56 and alternate years) Johnson

112f.* Radioactivity and Nuclear Chemistry. (3 cred.; prereq. P.Ch. 103; offered 1954-55 and alternate years) O'Connor

113w. Advanced Inorganic Chemistry. (3 cred.; prereq. ‡; offered on demand, see quarter *Class Schedule*) Staff

120f-121w-122s. Advanced Inorganic Laboratory Methods. Such topics as advanced qualitative analysis, synthetic inorganic chemistry, radiochemical techniques. (Cred. ar.; prereq. ‡) Staff

134f-135w-136s. Seminar. Modern problems in inorganic chemistry. (1 cred. per qtr.; prereq. P.Ch. 103) Staff

201f-202w-203s. Selected Topics in Inorganic Chemistry. (Cred. ar.; prereq. consent of chief of division) Staff

260f. Survey of Inorganic Chemistry. A course of independent reading required of all candidates for the Ph.D. degree in chemistry. Examination by the end of the fall quarter of second year in residence. (1 cred.; prereq. ‡) Staff

301f,su-302w-303s. Research in Inorganic Chemistry. (Cred. ar.) O'Connor, Heisig, Maynard, Brasted, Johnson, O'Brien, Pervier, Hugus, Pray

ORGANIC CHEMISTRY

Professor
Lee I. Smith, *chief*
Richard T. Arnold
C. Frederick Koelsch
Walter M. Lauer

Associate Professor
William E. Parham

Assistant Professor
Stuart W. Fenton
Wayland E. Noland

Prerequisites—For major work, Bachelor's degree, with minimum average of B, from an approved curriculum involving four years of chemistry and including one year each of organic and physical chemistry together with the necessary supporting subjects (integral calculus, physics, and German). For minor work, one year of organic chemistry and an approved course in physical chemistry.

Language Requirement—German is required for the Master's degree. For the Ph.D. degree German and French are required, but another language may, by petition and with the approval of the division, be substituted for French. Native languages, except German or French, are in general not acceptable substitutes.

Master's Degree—Offered under both Plan A and Plan B.

Doctor's Degree—To merit admission to candidacy for this degree, a student must meet the prerequisites outlined above, must maintain an average grade considerably above B, and meet all the other requirements of the Graduate School. The research may, in so far as facilities permit, be taken with any member of the division.

Courses

101w. Intermediate Organic Chemistry. A survey course which considers important modern topics: unusual types of aliphatic, aromatic and heterocyclic compounds, natural products, and industrial processes. (3 cred.; prereq. 63, 64, or equiv.) Lauer

102f. Organic Qualitative Analysis. Elementary Course. Reactions of typical functional groups and an introduction to the methods of organic qualitative analysis. (4 cred.; prereq. 63, 64, or equiv.) Fenton

105f-106w-107s.* Advanced Organic Chemistry. An advanced descriptive course containing an introduction to the literature of organic chemistry. (3 cred. per qtr.; prereq. 63, 64 or equiv.) Smith

110f. Organic Qualitative Analysis, Advanced Course. Identification of pure organic compounds, separation and identification of constituents of mixtures. (4 cred.; prereq. 102 or equiv.; registration limited to 20) Koelsch

116w.* Heterocyclic Compounds. Discussion of typical classes of heterocyclic compounds, ring-closures, and the like. (3 cred.; prereq. 63, 64; offered 1955-56 and alternate years) Parham

130s. Organic Quantitative Analysis. Methods of proximate and ultimate analysis of organic compounds with special attention to semimicro methods. (3 cred.; prereq. 63, 64, An.Ch. 1-2; registration limited to 15) Lauer

139f,w,s. Advanced Organic Chemistry Laboratory Work. Advanced laboratory problems including some original work. Students are urged to take this course during the winter quarter; consent of the instructor is required to take it at any other time. (2 to 5 cred.; prereq. 63, 64; registration limited to 20) Noland

140f,w.* Aromatic Compounds. Discussion of the chemistry of typical aromatic compounds, including derivatives of benzene, naphthalene, anthracene, phenanthrene, and other polynuclear hydrocarbons, together with a consideration of certain heterocyclic compounds which show aromatic charac-

ter. The properties of these compounds will be illustrated by examples chosen from the sterols and the alkaloids. (3 cred.; prereq. 63, 64; offered alternately in fall and winter quarters) Parham (winter 1954-55) Koelsch (fall 1955-56)

141f.* Reagents in Organic Chemistry. Discussion of typical reagents used in organic reactions; their limits of applicability, methods of use, and types of substances with which they react. (3 cred.; prereq. 63, 64; offered 1954-55 and alternate years) Koelsch

142s.* Chemistry of Natural Products. Discussion of the organic chemistry of important classes of natural products. (3 cred.; prereq. 63, 64; offered 1955-56 and alternate years) Fenton

163f,s. Elementary Organic Chemistry. Discussion of important classes of organic compounds, both aliphatic and aromatic together with some heterocyclic compounds. (2 cred.; prereq. 62; 3 lect., 1 quiz hour per week) Parham

201f-202w-203s.* Organic Chemistry Seminar. (1 cred. per qtr.; 1 hour per week; required of all students taking major work in organic chemistry) Staff

205f-206w.* Theoretical Organic Chemistry. Structure, reaction mechanisms, relation of physical properties to constitution, and other topics of a theoretical nature. (3 cred. per qtr.; prereq. 107) Lauer

212s.* Physico-organic Chemistry. Contributions made to organic chemistry by kinetic and equilibrium studies of organic reactions, including mechanisms and catalytic and ionotropic reactions; and an introduction to the current electronic formations of organic reactions. (4 cred.; prereq. 107, P.Ch. 103, and calculus, or ♯) Fenton or Noland

261f. General Survey of Organic Chemistry. A course of independent reading under the guidance of the staff. This course is a prerequisite to candidacy for the Ph.D. degree in any field of chemistry and must be completed by the end of the fall quarter of the second year in residence. (1 cred.; prereq. ♯) Smith

301f-302w-303s. Research in Organic Chemistry. (Cred. ar.; prereq. 110, consent of division) Staff

PHYSICAL CHEMISTRY

Associate Professor
William N. Lipscomb, *chief*

Professor
Bryce L. Crawford, Jr.
Izaak M. Kolthoff
Robert S. Livingston
Lloyd H. Reyerson

Associate Professor
Paul R. O'Connor
John E. Wertz

Assistant Professor
Rufus W. Lumry
Stephan Prager

Candidates for an advanced degree in the Graduate School who are not majoring in chemistry may offer P.Ch. 101-102-103, 104-105-106, or 107-108 in partial or complete fulfillment of the course requirements for a minor in physical chemistry.

Courses

101f-102w-103s.* Physical Chemistry. General survey of the subject. (3 cred. per qtr.; prereq. An.Ch. 1, 2 [or An.Ch. 7 for physicists], Phys. 7, 8, 9, differential and integral calculus; 3 lect., 1 rec. hours per week) Crawford (1954-55), Livingston (1955-56)

104f,su-105w,su-106s,su.* Physical Chemistry Laboratory. (1 or 2 cred. per qtr.; prereq. 101 for 104, 102 for 105, 103 for 106 or ¶; 1 rec., 5 lab. hours per week) Lumry (1954-55), Prager (1955-56)

107f,su-108w,su. Elementary Physical Chemistry. (Premed.) (3 cred. per qtr.; prereq. 2 years of college chemistry, 1 year of college physics, Math. 15-16 or 6-7; 2 lect., 1 rec., 3 lab. hours per week) Lipscomb

110f.* Experimental Research Techniques, I. Physical manipulations, including the use of tools and machines as well as a course in glass blowing with demonstrations and practice by the student. (2 or 3 cred.; prereq. 103 and ♯; offered 1955-56 and alternate years) Wertz

111w. Experimental Research Techniques, II. Materials of research, high vacuum techniques, characteristics of thermionic tubes, rectifiers, amplifiers, oscillators, photocells. (2 or 3 cred.; prereq. 110; offered 1955-56 and alternate years) Wertz

112s. Advanced Physicochemical Experiments. Precise measurements in various fields such as thermochemistry, conductance, surface tension, magnetic susceptibility, dielectric constant, characteristics of the photographic plate and ionization potentials of a gas. (2 or 3 cred.; prereq. 111; offered 1955-56 and alternate years) Wertz

116f. Thermodynamics and Chemistry. A detailed study of the principles of thermodynamics and their application to physical and chemical phenomena. (4 cred.; prereq. 103 and calculus; 3 lect. hours per week) Wertz (1954-55), Crawford (1955-56)

117s. Fundamentals of Reaction Kinetics. Empirical analysis of rate measurements, collision theory, transition state theory, chain reactions. (3 cred.; prereq. 103; 3 lect. hours per week) Livingston (1954-55), Lumry (1955-56)

118w.* Advanced Physical Chemistry. Methods of determining molecular structure with simple applications. Chemical and physical properties in terms of the nature of chemical bonds. (3 cred.; prereq. 103; 3 lect. hours per week) Lipscomb (1954-55), Lumry (1955-56)

119s. Kinetics of Reactions, Selected Topics. Effect of solvents and electrolytes on reaction velocity, diffusion processes; induced reactions; homogeneous and heterogeneous catalysis. (3 cred.; prereq. 117; 3 lect. hours per week) Livingston

128f.* Colloid Chemistry. The fundamental principles of colloid chemistry, surface chemistry, electrokinetic phenomena, lyophobic and lyophilic colloids. (3 cred.; prereq. 103; 3 lect. hours per week) Reyerson

129w.* Adsorption and Catalysis. The fundamental principles of adsorption at the different interfaces and the application of these principles to heterogeneous catalysis. (3 cred.; prereq. 128; 3 lect. hours per week) Reyerson

130s.* Colloids in Industry. The important applications of colloid chemistry to many of the fields of chemical industry. (3 cred.; prereq. 128; 3 lect. hours per week; offered 1954-55 and alternate years) Reyerson

131s.* Colloidal Processes. A survey of the important colloidal processes; coagulation, sol-gel transformation, thixotropy and dilatancy. (3 cred.; prereq. 128; offered 1955-56 and alternate years) Reyerson

132f-133w-134s. Colloid Chemistry Laboratory. (1 or 2 cred. per qtr.; prereq. 128 or ¶; hours ar.) Reyerson

175s.* Photochemistry. General survey, including a discussion of spectroscopy, with particular reference to the visible and ultraviolet absorption spectra of molecular gases. (3 cred.; prereq. 103, Phys. 9; 3 lect. hours per week; offered 1954-55 and alternate years) Livingston

180f-181w. Experimental Techniques in Physical Chemistry. This course is primarily designed for physical chemistry minors and others interested in properties of molecules related to optical and infrared spectra, refractive index, polarimetry, diffraction analysis, and other related experimental techniques. (Cred. ar.; prereq. ♯) Livingston

204f-205w-206s. Atomistics. Kinetic theory of gases, statistical mechanics and quantum mechanics, and their application to the interpretation of the properties of matter in terms of its microscopic structure. (4 cred. per qtr.; prereq. 103 and calculus; 3 lect. hours per week) Prager (1954-55), Lipscomb (1955-56)

217w-218s. Thermodynamics and Chemistry. A detailed study of the principles of thermodynamics and their application to physical and chemical phenomena. (4 cred. per qtr.; prereq. 116; 3 lect. hours per week) Wertz

221f-222w-223s. Colloid Seminar. (Cred. ar.) Reyerson

250f-251w-252s. Physical Chemistry Seminar. (1 cred. per qtr.; required of all graduate students majoring in physical chemistry) Livingston, staff

253f-254w-255s. Seminar in Molecular Spectroscopy. (Cred. ar.) Crawford

256f-257w-258s. Seminar in Molecular Structure. (Cred. ar.) Lipscomb

259f-260w-261s. Seminar in Chemical Kinetics. (Cred. ar.) Livingston

263f. General Survey of Physical Chemistry. A course of independent reading under the guidance of the staff. This course is a prerequisite to candidacy for the Ph.D. degree in any field of chemistry, and an examination must be taken by the end of the fall quarter of the second year in residence. (1 cred.; prereq. ‡) Staff

265f-266w-267s. Seminar in Magnetochemistry. (Cred. ar.) Wertz

268f-269w-270s. Seminar in Physical Chemistry of Polymers. (Cred. ar.) Prager

271f-272w-273s. Seminar in Physical Chemistry of Biological Systems. (Cred. ar.) Lumry

290f-291w-292s. Selected Topics in Physical Chemistry. From time to time, when the demand exists, advanced seminars are held in subjects such as quantitative theory of valence, advanced thermodynamics, polymers, transport processes, magnetochemistry, and structural and related properties of solids. (Cred. ar.) Crawford, Lipscomb, Livingston, Lumry, Prager, Reyerson, Wertz

301f-302w-303s. Research in Physical Chemistry. Thermodynamics, electrochemistry, photochemistry, reaction kinetics, tracer techniques, molecular structure, colloids, adsorption, crystal structure. (Cred. ar.) Staff

CHILD WELFARE

Professor
John E. Anderson
Elizabeth M. Fuller
Dale B. Harris
Merrill F. Roff

Associate Professor
Mildred C. Templin

Prerequisites—For graduate work, an undergraduate major in either psychology, sociology, education, home economics or the equivalent, and at least 12 hours in psychology, 8 hours in sociology, and 3 hours in statistics. Where the background lies in other fields, such as nursing or medicine, special adjustments may be made.

Language Requirement—For the Master's degree, one foreign language. For the Ph.D. degree, two foreign languages or, with the adviser's approval, one foreign language and either (a) a special research technique of 15 credits in mathematics at the Senior College or graduate level, or (b) a collateral field of 15 graduate credits in education, home economics, social work, sociology, speech, speech correction, or in educational psychology or psychology (if the minor is in another area), or in any of the basic science fields in medicine, or (c) a collateral field of 15 credits in graduate journalism or English courses that give specific practice in writing for publication.

Master's Degree—Offered under both Plan A and Plan B.

Doctor's Degree—Work leading to the Ph.D. degree is offered.

Courses

130f. Motor, Linguistic, and Intellectual Development of the Child. The scientific literature. (3 cred.; prereq. 12 cred. in psychology or equiv.) Anderson, staff

131w. Personality, Emotional, and Social Development of the Child. The scientific literature. (3 cred.; prereq. 12 cred. in psychology or equiv.) Anderson, staff

132s. Later Childhood and Adolescence. Growth: mental, social, and emotional development. (3 cred.; prereq. 12 cred. in psychology or equiv.) Harris

140f,w. Behavior Problems in Younger Children. Types, origin, development, and treatment. (2 cred.; prereq. 12 cred. in psychology, educational psychology, or sociology) Blodgett

141w,s. Behavior Problems in Older Children and Adolescents. Types, origin, development, and treatment. (2 cred.; prereq. 12 cred. in psychology, educational psychology, or sociology) Blodgett

142s. Psychology of Atypical Children. Physical and mental deviations and handicaps. Personal, social, and vocational adjustment. (3 cred.; prereq. 12 cred. in psychology) Blodgett

143f. Problems of Mental Deficiency. Diagnosis, care, training; social and vocational problems; legal aspects. (3 cred.; prereq. 12 cred. in psychology or equiv.) Blodgett

150f-151w-152s.‡ Childhood Education. 150: History and philosophy. 151: Organization and administration. 152: Methods and materials. (2 cred. per qtr.; prereq. 12 cred. in education or equiv.) Fuller

160w. Physical Growth and Motor Development. From early fetal life to maturity. (2 cred.; prereq. 12 cred. in psychology or equiv.) Roff

166f. Maturity and Aging. Developmental changes in the aging and the aged; adjustment and care. (2 cred.; prereq. 12 cred. in psychology, education, or sociology) Anderson

170w. Parent Education. Programs, materials, methods, and organization. Demonstration of group procedures. (3 cred.; prereq. 15 cred. in child welfare or home economics or psychology or education or public health or sociology) Cummings

185s. Children in a Changing World. Effects of social change, depressions, war, and catastrophes upon children. (3 cred.; prereq. 12 cred. in psychology, education, or sociology) Templin

190s. Use and Interpretation of Tests for Children. Survey of mental testing for the social worker, teacher, etc. (2 cred.; prereq. 12 cred. in psychology, educational psychology, or sociology) Roff

200f,w. Observation and Experimental Study of Children. Introduction to research and practice. Supervised observations of children in various agencies. Discussion of projects. (2 cred.; required of all entering graduate students; prereq. 12 cred. in psychology, 3 cred. in statistics) Harris, Templin

210s. Advanced Developmental Psychology. Principles governing the development, organization, and integration of behavior. (3 cred.; prereq. 130-131 or equiv., #) Anderson

220f-221w-222s.‡ Seminar in Current Research. Report on research in progress or completed. (1 cred. per qtr.) Roff

223f-224w-225s. Seminar in Developmental Theory. Efficacy of theories in interpreting developmental material. (1 cred. per qtr.; prereq. #) Anderson

226s. Seminar in Projective Methods with Children and Adolescents. Demonstrations, critical analysis, and discussions of use in research and clinic. (2 cred.; prereq. #) Harris

227s. Multiple Factor Analysis. Mathematical rationale and concrete applications. (2 cred.; prereq. 3 qtrs. of statistics and mental measurement) Roff

230f-231w-232s.‡ Seminar in Recent Literature. Reviews of current scientific articles. Attendance of candidates for graduate degrees required. (1 cred. per qtr.) Anderson

233w-234s. Research Methods. Experimental, observational, and statistical procedures in the study of children. (2 cred. per qtr.; prereq. 12 cred. in psychology or educational psychology, including statistics) Roff

240f-241w-242s.‡ Practicum in Behavior Problems. Supervised experience in the application of diagnostic and remedial procedures to children's behavior problems. (Cred. ar.; prereq. 140-141, #) Harris, Blodgett

250f,w,s. Internship in Professional Work with Children. Practical experience under qualified supervision in clinics, institutions, and agencies. (Cred. ar.; prereq. consent of department) Anderson, staff

260f. Seminar: Forecasting and Predicting Development. (2 cred.; prereq. ♯; offered 1954-55 and alternate years) Roff

261w. Seminar: History of Child Development. (2 cred.; prereq. ♯; offered 1954-55 and alternate years) Anderson

262s. Seminar: Language Development and Thought. (2 cred.; prereq. ♯; offered 1954-55 and alternate years) Templin

265f. Seminar: Motor Development. (2 cred.; prereq. ♯; offered 1955-56 and alternate years) Roff

266w. Seminar: Social Development and Group Behavior. (2 cred.; prereq. ♯; offered 1955-56 and alternate years) Templin

267s. Seminar: Socialization in the Family. (2 cred.; prereq. ♯; offered 1955-56 and alternate years) Harris

270f-271w-272s.*‡ Readings and Research in Child Development. Reports based on independent readings or projects in child development or childhood education that are approved by the listed instructors. (Cred. ar.; required of M.A. Plan B students, but open to other graduate students with consent) Anderson, Harris, Roff, Fuller, Templin

274w-275s. Technique and Field Work in Parent Education. Methods of teaching parent groups. Organization of groups. Lesson plans, observations, and field work. (Cred. ar.; prereq. 170, ♯) Cummings

290w-291s. Mental Examination of Preschool Children. Training and practice in administering and interpreting individual tests. 290: Minnesota, Merrill-Palmer, Arthur. 291: Stanford-Binet Tests. (4 cred. per qtr.; prereq. 12 cred. in mental measurement, ♯; registration limited) Blodgett

CIVIL ENGINEERING

Professor
Lorenz G. Straub
Paul Andersen
Miles S. Kersten
John F. Ripken
George J. Schroepfer
Joseph A. Wise

Associate Professor
Edward Silberman
Theodor W. Thomas

Assistant Professor
Alvin G. Anderson
Jesse E. Fant
Walter T. Graves

Language Requirement—For the Ph.D. degree, two foreign languages, one of which must be German.

Master's Degree—Offered under Plan A; in special cases, Plan B may be accepted when approved by the Civil Engineering graduate faculty. Plan B petitions should preferably be submitted the first quarter of the student's residence, but not later than the end of the quarter in which he will have 15 credits in the Graduate School.

Doctor's Degree—The department offers work leading to the Ph.D. degree.

[Professional degrees in engineering—These degrees are administered by the Institute of Technology.]

Courses

SURVEYING

109. Geodetic Surveying. Location of boundaries by geodetic methods. State-wide coordinate system. Establish and compute state-wide coordinates for monuments on the campus to first- and second-order accuracies. (3 cred.; prereq. 23 or ♯) Fant

110. Adjustment of Surveys. Least squares adjustments; theory and computation as applied to triangulation nets, traverse nets, and level circuits. (2 cred.; prereq. 23 or ♯) Fant

111. Land Surveying. Study of Minnesota Public Land Survey. Field survey of a city block. Field survey and subdivision of a section of land. Preparation of standard plats and descriptions. (3 cred.; prereq. 23 or ♯) Fant

112. Aerial Surveying and Photogrammetry. Theory and methods of making planimetric and topographic maps from aerial and terrestrial photographs. (3 cred.; prereq. 23 or ♯) Fant

RAILWAY ENGINEERING

(See "General," page 84.)

STRUCTURAL ENGINEERING

130. Statically Indeterminate Structures. Method of moment area. Williot Diagram. Slope-deflection method. (3 cred.; prereq. 33, M.&M. 128) Andersen

131. Structural Analysis. Moment distribution method. (2 cred.; prereq. 130) Andersen

132. Structural Design. Continuous structures of steel and concrete. (2 cred.; prereq. 131) Andersen

137. Structural Laboratory. Theoretical and experimental analysis of structural members and models. (3 cred.; prereq. 130) Graves

140. Advanced Structural Laboratory. A continuation of 137. Calculated and experimental influence lines for frame structures including gabled bents. Secondary stresses for trusses. (3 cred.; prereq. 137) Wise

141. Reinforced Concrete. Principles of reinforced concrete. Theory of beams, slabs, and columns and the application to simple structures. (3 cred.; prereq. 33) Wise

142. Reinforced Concrete Design. Continuation of 141 with special emphasis on the practical features of the design of buildings, bridges, retaining walls, etc. (3 cred.; prereq. 130, 141) Wise

143. Arch Analysis and Design. Analysis and design of steel and reinforced concrete arches. (3 cred.; prereq. 131, 142) Andersen

147. Foundations. Design and construction of footings, cofferdams, and caissons for bridges and buildings. Piers and abutments. Underpinning of buildings. Exploration and testing of foundation sites. Excavation and removal of materials from foundation sites. (3 cred.; prereq. 32) Andersen

232. Advanced Structural Problems in Sanitary Engineering. Theory of domes, tanks, dams, culverts, and elliptical sewer sections. (3 cred.; prereq. 132) Graves

233.* Advanced Problems in Foundations. Lateral earth pressure theories. Design of sheet piling. Bearing piles and cofferdams. (3 cred.; prereq. 132, 147) Andersen

234*-235.* Advanced Theory of Structures. Applications of the theory of indeterminate stresses to the more complex problems of structural analysis. Continuous and swing bridges, simple and multiple arch and suspension systems, wind stresses in tall building frames, secondary stresses. (3 to 5 cred. per qtr.; prereq. 132, 142) Andersen, Wise

236.* Advanced Structural Design. Effects of shrinkage and plastic flow. Eccentrically loaded concrete sections. Nonsymmetrical bending. Torsion. (3 to 5 cred.; prereq. 132 or 235) Andersen

237-238-239. Structural Model Analysis. Development and use of structural models for the solution of specific problems. (3 cred. per qtr.; prereq. 137) Wise

240-241-242. Advanced Structural Laboratory. Experimental determination of principal strains by use of three or four intersecting gaugelines; plastic flow and shrinkage; prestressed reinforced concrete; moment redistribution; theory of limit design; theory of similitude; statistical data. Vierendell trusses. (3 to 5 cred. per qtr.; prereq. 140) Wise

243.* Dynamics of Structures. Vibrations of beams, trusses, and frameworks. Impact, and effect of suddenly applied forces. Forces on structures due to earthquakes, shocks, and explosions. Fatigue of materials. (3 cred.; prereq. 132) Wise

244.* Dynamics of Structures Laboratory. Laboratory work in vibrations of beams and trusses. (3 cred.; prereq. 243) Wise

245. Advanced Problems in Bridge Design. Selection of type and span. Secondary stresses and problems associated with rigidity of joints. (3 cred.; prereq. 132) Graves

247*-248-249. Seminar in Structures. Special topics in the higher theory of structures. (3 to 6 cred. per qtr.; prereq. 132, 142)

HIGHWAY ENGINEERING AND SOILS MECHANICS

146. Concrete and Concrete Materials. Theory of design and control of concrete mixtures. Practice in control tests of concrete and concrete materials. (3 cred.; prereq. M.&M. 141; lect., lab.) Thomas

148-149-150. Advanced Concrete. Short research problems in concrete. (2 cred. per qtr.; prereq. 146; 149 and 150 by special arrangement) Thomas

151.* Advanced Highway Laboratory. Special experimental studies of highway materials. (3 to 5 cred.; prereq. 52) Thomas

152.* Highway Design. Study of the basis for design, design of intersections, street grades, pavement design, plans and specifications. (3 cred.; prereq. 52) Thomas

153. Soils in Highway Engineering. Classification, soil maps, surveys, physical tests, compaction, design of graded mixes, and soil stabilization. (3 cred.; prereq. 53) Kersten

156. Highway Traffic Engineering. Traffic surveys, traffic control, highway safety. (3 cred.; prereq. 52) Thomas

157. Highway Economics. Annual highway costs; effect of highway location and design on motor vehicle operating costs. Allocation of highway costs to motor vehicle owners and general public. Economics of highway administration, finance, and taxation. (2 cred.; offered by special arrangement)

158. Airport Design. Field layout, capacity drainage, lighting, and studies of sub-bases, bases, and surfaces for aprons, runways, and taxiways. (3 cred.; prereq. 52) Kersten

159. Soil Mechanics. Seepage, consolidation, strength theory. Settlement analysis; stability of slopes; bearing capacity. (3 cred.; prereq. 53) Kersten

251-252.* Advanced Soil Mechanics Laboratory. Consolidation; permeability; direct shear; triaxial compression; California bearing ratio; and other special laboratory problems in soil mechanics. (3 cred. per qtr.; prereq. 159 or ¶) Kersten

HYDRAULIC ENGINEERING

160. Applied Hydraulics. Pipe flow, compound pipe systems, network analysis. Centrifugal pumps, analysis and problems. Characteristic curves, pump constants, selection and economic factors. Open channel flow design, hydraulic elements, nonuniform flow computations, losses, irrigation, and drainage problems. (3 cred.; prereq. 102 or 103 and 104; 2 lect., 4 lab. hours per week)

161. Hydrology. A study of the fundamental aspects of hydrology as the basis for hydraulic engineering work. Sources of basic data, common curves. Precipitation, types, variations, rainfall depth computations, storm rainfall, intensity-duration-frequency. Losses. Groundwater and infiltration. Run-off, characteristics, components, variations, estimating supply, storage. Flood flows, Unit Graph analysis, flood control. Erosion, transportation, silting. Water use and rights. (3 cred.; prereq. 101 or 102 or 103; 2 lect., 4 lab. hours per week)

164. Water Conservation. Weather variations and cycles, variable stream flow and water levels with respect to control in problems of public water supply,

sewage disposal, water power, navigation, floods, and low water. National and state water conservation policies with discussion of typical problems. (3 cred.; prereq. 161 or equiv.; offered when staff permits)

166. Water Power. Stream flow and water power estimates. Storage problems: analysis, design and selection of water power structures and equipment. Types and purposes of dams. Turbine analysis. Transmission lines. Cost and value of water power. (3 cred.; prereq. 161)

263. Advanced Hydraulic Engineering Problems. Special hydraulic problems in laboratory, drafting room, and field. (3 to 5 cred.; prereq. 183, 190, 192, or equiv., and #) Straub

MUNICIPAL ENGINEERING

167. City Planning. Physical elements of the city: topography, drainage, geology. Public works and structures. Internal and external transportation. Zoning. Subsurface structures. Aesthetic features of the city. (3 to 5 cred.; offered when staff permits)

169. Public Works Engineering. An introduction to the engineering phases and relationships of public works. Historical survey. Federal, state, and local administration problems. Present trends and practices. The need for adequate public planning design and construction. Responsibilities of the engineer. Typical problems. (3 cred.; offered by special arrangement) Schroepfer

SANITARY ENGINEERING

170. Water Supply. Sources of water supply, characteristics of water; quantities and rates; quality of water, collection, distribution, and water purification; test methods. Selection of equipment. Laboratory problems in analysis and design. Inspection trips. (3 cred.; prereq. 161, M.&M. 129) Schroepfer, Johnson, Ziemke

171. Sewerage and Sewage Treatment. Sources and quantities of sewage; sanitary, storm, and combined sewer systems; materials and methods of construction; sewer appurtenances; pumping equipment; physical, chemical, and biological characteristics of sewage. Disposal by dilution. Domestic sewage and industrial waste treatment. Laboratory problems in analysis and design. Inspection trips. (3 cred.; prereq. 161, 170) Schroepfer, Johnson, Ziemke

172. Sanitary Laboratory. The biological, bacteriological, physical, and chemical analyses of water, sewage, air, coagulant chemicals, disinfectants, sewage sludge, etc. (3 cred.) Schroepfer, Ziemke

173.* Sanitary Engineering Problems (Water). Investigations of problems in water supply to supplement 170. Collection, distribution, and purification. Economic studies. (3 cred.; prereq. 170) Schroepfer

174.* Sanitary Engineering Problems (Sewage and Industrial Wastes). Investigations of problems in sewage treatment and industrial wastes disposal to supplement 171. Stream pollution, stream standards, economic studies of various types and degrees of treatment. (3 cred.; prereq. 171) Schroepfer

175.* Industrial Waste Disposal. Investigation of various types of industrial wastes and methods of disposal. Economic studies. (3 cred.; prereq. 174) Schroepfer

176-177-178. Sanitary Engineering Seminar. Required of senior and graduate students. Reports and discussion on assigned topics in the field of sanitary engineering with occasional talks by practicing sanitary engineers on subjects of interest. (1 cred. per qtr.) Schroepfer

178. Public Health Engineering. Sanitary problems associated with the location, construction, and operation of water supplies, purification works, and distribution systems, with the treatment and disposal of sewage, excreta, and waste, and with the production, pasteurization, and distribution of milk. Public health engineering methods as applied to sanitary problems in urban and rural communities including schools, institutions, camps, bathing places, dwellings, etc. (3 cred.; lect., field, and lab. demonstrations)

261*-262.* Water and Sewage Plant Design. Design of water purification and sewage treatment works. (3 to 5 cred. per qtr.; prereq. 171) Schroepfer

264. Sanitary Engineering Unit Operations. Lectures, laboratory studies, and plant-scale studies on screening, sedimentation, chemical coagulation, aeration, filtration, disinfection of water with chlorine, disinfection of air, heat transfer, handling of material, drying, incineration, and digestion. (3 cred.) Schroepfer

276.* Advanced Sanitary Engineering (Water). Principles of water collection, distribution, and purification. Inspections and investigations of water works systems. Advanced study of certain phases of purification. (3 to 5 cred.; prereq. 173; hours ar.) Schroepfer

277.* Advanced Sanitary Engineering (Sewage and Industrial Wastes). Principles of sewage collection and treatment, and of industrial waste disposal. Inspection and investigation of sewage works systems. Advanced study of certain phases of sewage treatment. (3 to 5 cred.; prereq. 174) Schroepfer

GENERAL

124. Transportation. History of transportation in the U.S. from the establishment of the Interstate Commerce Commission. Operating statistics for railroad, air, highway, waterway, and pipeline transportation. Operating characteristics of steam and Diesel-electric locomotives. (3 cred.; prereq. 24)

280*-281*-282.* Civil Engineering Research. Original work in concrete, structural steel, soils, hydraulics, municipal, sanitary, or transportation problems. Investigations, reports, tests, designs. (3 to 5 cred. per qtr.; prereq. ♯)

CLASSICS

Professor	Associate Professor	Assistant Professor
Norman J. DeWitt	William A. McDonald	Donald C. Swanson

Language Requirement—For the Master's degree, reading knowledge of one modern foreign language, preferably German. For the Ph.D. degree, two modern foreign languages, preferably German and French.

Master's Degree—Offered under both Plan A and Plan B, in either Greek or Latin (see also pages 9-13).

Doctor's Degree—Work for the Doctor's degree will ordinarily be concentrated in either Greek or Latin, with a minor in Latin or Greek respectively. Some other subject may be offered as a minor, but in any case the candidate will be expected to complete at least the prerequisites for graduate study, as listed, in both Greek and Latin.

Note—For information on work in comparative literature, see page 23.

Courses

GREEK

Prerequisites—Any three of the courses numbered 51, 52, 53, 73, or the equivalent.

121f-122w-123s.† Advanced Prose Composition. (3 cred. per qtr.; prereq. 24 cred. in Greek) McDonald

171f,§§172w,§§173s.*§§ Independent Reading. (3 cred. per qtr.; prereq. consent of department)

§§ Since the authors to be read vary from term to term and from year to year, this course may be repeated for credit.

One of the following courses will be offered each year, according to the needs of the students:

201f-202w-203s.* Seminar: Greek Literary Bibliography and Criticism. (3 cred. per qtr.; offered 1955-56) Swanson

211f-212w-213s.* Seminar: Greek Epic. (3 cred. per qtr.) McDonald

221f-222w-223s.* Seminar: Greek Drama. (3 cred. per qtr.) McDonald

LATIN

Prerequisites—Course 81-82-83, or the equivalent.

111f-112w-113s.† Advanced Prose Composition. (2 cred. per qtr.; prereq. 73) DeWitt

133s. Vulgar Latin. Development of Latin into Romance. (3 cred.; prereq. consent for advanced students of either Latin or Romance) Swanson

171f,§§172w,§§173s.*§§ Independent Reading. (3 cred. per qtr.; prereq. consent of department)

One of the following courses will be offered each year according to the needs of the students:

201f,202w,203s.* Seminar: Cicero. (3 cred. per qtr.) DeWitt

211f,212w,213s.* Seminar: Latin Epic. (3 cred. per qtr.) McDonald

221f-222w-223s.* Seminar: Lyric Poetry. (3 cred. per qtr.; offered 1954-55) DeWitt

241f,242w,243s.* Seminar: Introduction to Classical Philology. (3 cred. per qtr.) Swanson

CLASSICS COURSES (FOR WHICH NO LATIN OR GREEK IS REQUIRED)

106f-107w. Introduction to the Study of Language. (3 cred. per qtr.; prereq. any 2 courses numbered above 50 in a foreign language) Swanson

108s. Cultural Aspects of Language. (3 cred.; prereq. any 2 courses numbered above 50 in a foreign language) Swanson

122w. Introduction to Greek Archaeology. (3 cred.) McDonald

123s. Introduction to Roman Archaeology. (3 cred.) McDonald

124f,s. Technical Terminology. (3 cred.) McDonald, Swanson

191f,192w,193s. Classical Literary Traditions. (3 cred. per qtr.; prereq. 9 cred. in literature, English or foreign) DeWitt

DAIRY HUSBANDRY

Professor
James B. Fitch
Willes B. Combs
Samuel T. Coulter
Thor W. Gullickson
Harold Macy
William E. Petersen

Associate Professor
Ned D. Bayley
James J. Jezeski
Joseph C. Olson, Jr.

Assistant Professor
Howard A. Morris
Elmer L. Thomas

Prerequisites—For a major in dairy production, a sufficient preparation in chemistry, genetics, and animal physiology; for a major in dairy products, bacteriology, chemistry, physics, and economics; for a major in dairy bacteriology, chemistry, physics, bacteriology, and dairy products. When the preparation appears inadequate additional courses may be required.

§§ Since the authors to be read vary from term to term and from year to year, this course may be repeated for credit.

For a minor in dairy husbandry, the head of the department must be satisfied as to the student's preparation.

Major—With the approval of the adviser, certain courses in agricultural biochemistry, bacteriology, genetics, agricultural economics, and animal husbandry may be accepted as part of the major.

Language Requirement—Candidates for a Master's degree may petition for exemption from the language requirement, except majors in dairy bacteriology. For the Ph.D. degree, either (a) two foreign languages or (b) one foreign language and the option of a special research technique or a collateral field of knowledge.

Master's Degree—Offered under both Plan A and Plan B.

Doctor's Degree—Work for the Ph.D. degree is offered in connection with other supporting departments.

Courses

101f. Milk Production. Problems of the dairy farmer. (3 cred.; prereq. 1) Fitch

103w. Dairy Stock Feeding. Application of principles of nutrition to feeding dairy animals. (3 cred.; prereq. 101, An.Hu. 56) Gullickson

104f. Dairy Stock Selection. Problems in selection of dairy cattle. (3 cred.; prereq. 9 or ¶9, 117) Bayley

105f-106w.* Seminar. Bibliographical methods and study of dairy literature. Reports on assigned subjects and reviews of recent scientific investigations. (1 cred. per qtr.; prereq. 3 courses in dairy husbandry) Petersen

107f. Condensed Milk Products. Manufacture of condensed milk products with special reference to the physical and chemical processes and engineering problems involved. (3 cred.; prereq. 1, 2, 50, Ag.Bi. 10; lect., lab.) Coulter, Morris

108w. Dry Milk Products. Manufacture of dry milk products with special reference to the physical and chemical processes and engineering problems involved. (3 cred.; prereq. 107; lect., lab.) Coulter, Morris

109s. Market Milk. (Formerly D.H. 51) Processing and distribution of market milk and related products with emphasis on the physical, chemical, and bacteriological problems involved; organization, design, equipment, and operation of milk plants; problems of public control. (3 cred.; prereq. 1, 2, 50, Ag.Bi. 10; lect., lab.) Thomas

110w. Ice Cream and Frozen Dairy Foods. Manufacture of ice cream with special reference to the chemical and physical processes involved. (3 cred.; prereq. 1, 2, 50, Ag.Bi. 10; lect., lab.) Combs, Thomas

111f. Butter. Manufacture of butter with special reference to the chemical and bacteriological processes involved. (3 cred.; prereq. 1, 2, 50, Ag.Bi. 10; lect., lab.) Coulter, Thomas

112s. Cheese. Manufacture of cheese, with special reference to the chemical, bacteriological, and physical processes involved. (3 cred.; prereq. 1, 2, 50, Ag.Bi. 10; lect., lab.) Combs, Morris

113s. Technical Control of Dairy Products. Lectures and laboratory. Chemical and bacteriological laboratory methods used in technical control of milk and its products. (3 cred.; prereq. 50, 111, or 112, Ag.Bi. 10) Coulter, Jezeski

116s. Milk Secretion. Anatomy and physiology of milk secretion and factors influencing the quality and quantity of milk. (3 cred.; prereq. physiology, 9 cred., and Ag.Bi. 103) Petersen

117s. Dairy Cattle Breeding. Application of the principles of genetics to the improvement of dairy cattle. (3 cred.; prereq. Agro. 31) Bayley

118s. Milk Production and Secretion. Management and nutritional problems of interest to veterinary students; physiology and biochemistry of lactation. (3 cred.) Petersen

119s. Dairy Herd Management. (Formerly D.H. 52) Demonstration of management practices with dairy cattle. One or more trips to specialized dairy farms. (2 cred.; prereq. 101, 103) Foreman

150w. Dairy Bacteriology. Microbiology in relation to milk production and the processing of milk and dairy products. (3 cred.; prereq. Bact. 53; lect., lab.) Olson

151s. Advanced Dairy Bacteriology. (Formerly D.H. 115) Investigation of specific problems in the microbiology of milk and dairy products. (3 cred.; prereq. 150 or equiv., 111 or 112) Jezeski

202f,*203w,*204s,*208su,210su. Research in Dairy Production. Facilities for study and investigation of subjects pertaining to dairy cattle. (Cred. ar.; open in Summer Session only to those who have had preliminary graduate work) Fitch, Petersen, Bayley, Gullickson

205f,*206w,*207s,*209su,211su. Research in Dairy Manufacturing. Opportunity and facilities for study and investigation of problems concerning dairy products. (Cred. ar.; open in Summer Session only to those who have had preliminary graduate work) Combs, Coulter, Thomas, Morris

212f,*213w,*214s,*215su,216su. Research in Dairy Bacteriology. Opportunity and facilities for investigation and advanced study of problems involving the microbiology of milk and dairy products. (Cred. ar.; open in Summer Session only to those who have had preliminary graduate work) Jezeski, Olson

DENTISTRY

For staff and courses of study offered, see *Graduate Medical Bulletin.*

ECONOMICS AND BUSINESS ADMINISTRATION

Professor
Richard L. Kozelka
Francis M. Boddy
Oswald H. Brownlee
George Filipetti
Richard K. Gaumnitz
Ernest A. Heilman
Walter W. Heller
Herbert G. Heneman, Jr.
Leonid Hurwicz
Edwin H. Lewis
Carl L. Nelson
Edmund A. Nightingale
Andreas G. Papandreou
John J. Reighard
J. Warren Stehman
John G. Turnbull
Roland S. Vaile
Dale Yoder

Associate Professor
Arthur M. Borak
John A. Buttrick
Robert J. Holloway
Joseph P. McKenna
Harlan M. Smith
Ben B. Sutton
Lloyd Ulman
John T. Wheeler

Assistant Professor
Edward Coen
Franz Gehrels
C. Arthur Williams

Prerequisites—A minimum of 9 quarter credits in economics, including the principles of economics, is required before any course work may be counted toward either a graduate major or minor in economics. All candidates must have maintained an average of B or better in their undergraduate work in economics.

In their preliminary preparation candidates for the M.A. in economics will be expected to meet the following requirements:

either

a. Twelve credits in economics or business administration courses at the Senior College level,

or

b. Preparations at the elementary level in accounting, money and banking, principles of economics, and statistics.

Candidates for the Ph.D. in economics or business administration will be expected to meet both of these requirements.

Master of Arts

For a major in economics or business administration the candidate must include Econ. 143, 144 and either 103 or 124 unless these courses or their equivalents have been completed in the undergraduate program.

A final oral examination is required.

Plan A

1. For the purposes of this plan the courses in economics and business administration are to be considered as one department.

2. A foreign language is required only if the thesis is written in economic history, economic theory, money and banking, public finance, or statistics.

Plan B

1. For the purposes of this plan the courses in economics and business administration may be considered as four separate fields, namely: accounting, economics, general business administration, and statistics. Normally it will be expected that all candidates under this plan will take at least 9 credits of work outside of these fields.

2. The 9 credits earned in courses requiring independent work and the preparation of written reports shall be made a part of an approved program only on recommendation by the candidate's adviser and the instructor for the course.

3. Reading knowledge of a foreign language is not required.

Master of Business Administration

This degree is offered for students who desire graduate training in business administration. Those who have received the Bachelor's degree from a recognized school of business may expect to complete the work in one year; those who are graduates of other professional schools or of liberal arts colleges may expect that it will take two years.

Prerequisites—Candidates must meet the prebusiness requirements of the School of Business Administration in accounting, money and banking, principles of economics, and statistics. Psy. 1-2 (General Psychology) is a prerequisite for specialization in advertising, foreign trade, industrial relations, insurance, merchandising, and transportation; and Math. 20 (Mathematics of Investment) is a prerequisite for specialization in accounting and insurance. Preparation in these prebusiness subjects, if not completed as part of the candidate's undergraduate program, may be completed after entrance upon the work for this degree by taking the appropriate courses without graduate credit.

Requirements—Candidates will be expected to take, either as undergraduates or as graduate students, at least one course in several subject areas chosen to give a broad training in business administration. Some of these will not carry graduate credit even though taken while a graduate student, and therefore will not count toward the formal credit requirements for the degree. The specific requirements will, in general, be met by the following courses or their equivalents, due attention being given to course prerequisites: accounting (B.A. 130 or 139), business finance

(B.A. 156), business law (B.A. 51), economic theory (Econ. 143, 144), government regulation (Econ. 175), industrial management (B.A. 184 and 187), marketing (Econ. 185), money and banking (Econ. 142), industrial relations (B.A. 167), public finance (Econ. 189), and statistics (Econ. 5).

A final oral examination is required.

Plan A and Plan B

The degree is offered under both Plan A and Plan B, subject to the usual regulations governing those plans, with the following exceptions:

1. The same departmentalization of the courses in economics and business administration is recognized as under the master of arts degree, Plan B.

2. A foreign language is not required.

Doctor of Philosophy

1. Those who wish to become candidates for this degree are strongly urged first to obtain the Master's degree.

2. All doctoral programs for majors in either economics or business administration must be approved by the candidate's adviser and the chairman of the departmental graduate committee before they are submitted to the Social Science Group Committee.

3A. Major in economics:

a. Students are required to pass two written examinations in economic theory;

b. Students also are required to pass a written examination in either European economic history or the history of economic thought;

c. In addition, students must pass written examinations in three of the following fields: international economics, manpower economics, marketing, monetary theory, public finance, statistics, European economic history, history of economic thought. (Of the last two, only the one not used for requirement b may be used for requirement c.)

3B. Major in business administration:

a. At least 21 credits in the student's major program must be in the 200 group of courses;

b. Students must pass a written examination in economic theory, two in a field of concentration chosen from Group A below, and three in additional fields of which at least one must be in Group A and at least one in Group B. With the consent of the adviser, an examination in an additional Group A field may be substituted for the second examination in the field of concentration.

Group A	Group B
Accounting	Economic theory
Business finance	European economic history
Industrial management	History of economic thought
Insurance	International economics
Manpower management	Manpower economics
Marketing	Monetary theory
Transportation	Public finance
	Statistics

4. For either major, students must, within a reasonable time after successful completion of the written examinations, take an oral examination. This examination may cover any work in the student's approved graduate program with the exception of the thesis. Successful completion of this examination admits the student formally to candidacy for the degree.

5. For either major, reading knowledge of two foreign languages is required, or one foreign language and an acceptable research technique. At present, calculus to the equivalent of Math. 50-51 is accepted as evidence of proficiency in a research technique.

6. The written examinations will be given only at stated periods, generally in March, June, September, and December.

*Courses****

ECONOMICS

Note—The following courses in other departments carry credit also in economics: Hist. 180-181-182, Selected Readings in Economic History; Hist. 221-222-223, Graduate Seminar in Economic History.

100. Foundations of Mathematics for Social Scientists. Sets. Relations. Partially ordered systems. Functional relations. Elements of logical calculus. Groups. Matrices. Applications mostly in economics, decision and game theory, some in statistics. (3 cred.; prereq. Math. 7, 30 or ♯) Hurwicz

101. Econometrics I. Elements of probability. Basic concepts in statistical decision theory. Relationship to game theory and other types of decision problems. Prediction and inference. Likelihood methods. Problems of specification. Models underlying statistical analysis in economics and certain other fields (simultaneous equation systems; factor analysis models). Identification. (3 cred.; prereq. 5, 100 or ♯; Math. 50-51 advised) Hurwicz

102. Econometrics II. Statistical inference in models, arising in economics and certain other fields, involving multivariate distributions. Least squares method, regression theory and their relationship to simultaneous equation and factor analysis problems. Specification error. Identification. Time series problems. Aggregation. Examples: production functions, demand functions, factor analysis. This course covers some of the same ground as 101, but on a more advanced level. (3 cred.; prereq. Math. 50, and Econ. 101 or ¶Math. 123 or ¶Econ. 123, or ♯) Hurwicz

103. Advanced Price Theory. Theories of choice as applied to firms and resource owners, and the usefulness of such theories in predicting market behavior. (3 cred.; prereq. 144 or equiv.) Boddy

104. Market Structure and Price Theory. Application of price theory to industry behavior. Includes analysis of inter-industry competition; price and output policies under conditions of imperfect competition. (3 cred.; prereq. 103) Boddy

105. The History of Economic Thought: Before 1870. This course and the next are designed to acquaint the student with the principal economic writings of the past so that contemporary theory may be seen in perspective. Throughout, particular theories are related to the problems and policies of the times. This course concentrates primarily on the classical economists, Marx, and the beginnings of neoclassical economics. (3 cred.; prereq. grade of B or better in 143 and 144 or equiv. or ♯) Buttrick

106. History of Economic Thought: After 1870. A continuation of 105, this course traces the development of neoclassical economics through the 1930's. Sepa-

** No courses are starred for work under Plan B. Students working toward the Master's degree under Plan B may, by arrangement with the instructor, have any course so planned as to include the necessary Plan B paper.

rate attention is given to the origins of macrotheory. (3 cred.; prereq. grade of B or better in 143 and 144 or equiv. or ‡) Buttrick

108. City Planning. (Same as Arch. 104)

110. Price Policy. Selected topics in managerial and economic problems concerning market price and price policy. Methods by which prices are set under actual market conditions, administered prices, price leadership, international cartels, and government intervention. (3 cred.; prereq. 185 or equiv.) Vaile

120. Economic Development. This course is designed to explore the conditions necessary for increasing income, the measurement of economic growth, and problems of "underdeveloped" areas. The principal focus is on capital formation. (3 cred.; prereq. grade of B or better in 143 and 144 or equiv. or ‡) Buttrick

121. Introduction to the Theory of Statistics. This course is designed to acquaint the nonspecialist with some of the basic concepts and methods of classical statistics. For those interested in further study, it serves as a preparation for the more systematic and intensive treatment in 122-123. It deals largely with the discrete probability distributions (thus avoiding the need for calculus) and is focused on problems of hypothesis testing and estimation. (3 cred.; prereq. Math. 7 or equiv. or ‡) Allen

122. Theory of Statistics I. Primarily one-variable problems. The normal and related univariate distributions. Some large sample theory, including the law of large numbers. Likelihood methods in hypothesis testing and estimation; applications to regression and analysis of variance. Confidence intervals. Sequential methods. (3 cred.; prereq. 121 and Math. 51 or ¶51 or ‡) Allen

123. Theory of Statistics II. Primarily an extension to the many-variable case of the concepts treated in 122. Analysis of covariance. Discriminant analysis and statistical selection. Distribution-free methods. (3 cred.; prereq. 122, Math. 51 or ‡) Allen

124. Theory of Employment, National Income, and the Price Level I. Determination of the equilibrium values for real output, employment, the price level, and the rate of interest under specified assumptions regarding the demand for and supply of money, the demand for and supply of labor, technical conditions of production, and the investment and consumption functions. (3 cred.; prereq. 143 or equiv.) Brownlee

125. Theory of Employment, National Income, and the Price Level II. Effects of governmental monetary and fiscal policies upon the equilibrium levels of output, employment, prices, and interest rates. An introduction to dynamic analysis. (3 cred.; prereq. 124) Brownlee

126. Economic Problems of Latin America. Development of economic resources; influence of foreign economies: organization for production; state of the industrial arts; domestic markets and transportation; government finance; present tendencies in respect to economic progress, economic security, and social control. (3 cred.; prereq. 7)

127. Economics of the U.S.S.R. The rise of the Soviet economic system. The development of the economic organization of the state, and of the planning and control of the use of resources and the distribution of product. The performance of the economy in agriculture and industry under the five-year plans. Internal and external economic policy. Public finance, income distribution, and economic incentives under the Soviet system. (3 cred.; prereq. 20 cred. in social science including 7) Boddy, Holloway

128. Economics of Western Europe. The structure and organization of the economy of countries in Western Europe. The analysis of current internal and external economic problems and policies. Recent developments in production, public finance, income levels, and income distribution. The course will commonly emphasize one particular country of Western Europe, not necessarily the same from year to year. (3 cred.; prereq. 20 cred. in social science including 7) Heller

140. Cooperative Movement. History and philosophy of various cooperative developments. Similarities and contrasts between agricultural marketing cooperatives, consumer cooperatives, trade unions, and others. Consumer cooperatives as a medium for economic control. (3 cred.; prereq. 7)

142. Monetary and Banking Policy. Advanced course in money and banking policy viewed from the social standpoint with primary reference to the problems of the Federal Reserve system. Selected problems in monetary policy; monetary reconstruction and monetary reform. (3 cred., §64; prereq. 3, 143 or equiv.) Smith and others

143. Economic Analysis: Income and Employment. The determinants of national income, employment, and price level, with particular attention to aggregate consumption and investment. (3 cred., §80; prereq. 7) Boddy, McKenna, others

144. Economic Analysis: Firms and Households. The analysis of individual decision making, by firms and households, under conditions of monopoly, competition, and monopolistic competition. (3 cred., §81; prereq. 7) Brownlee, Smith, others

145. International Finance and Foreign Exchange. Mechanics of international payments. The forces which may upset the equality of a country's foreign payments and receipts, and the alternative methods—fiscal and monetary policy, gold standard, flexible exchange rates, import or exchange controls—by which a balance may be restored. The role in this connection of the International Monetary Fund. (3 cred.; prereq. 142 or equiv.) Coen

149. Business Cycles. Analysis of factors involved in business fluctuations. Comparison of theories of their causes. Examination of proposals for the stabilization of employment, production, and capital formation. Introduction to the statistical data and methods of business forecasting. (3 cred.; prereq. 142 or equiv. or ♯) Smith

155. The Modern Corporation. Incorporation. Various types of corporate securities and their uses. Financial plans for industrial, utility, and other types of corporations. Financial affairs of an established business. General financial problems of the holding company, consolidations, mergers, and reorganizations. (3 cred., §75; prereq. 3, 7) Stehman, others

160. Readings in Economics. A course of special readings to be arranged with the student to cover areas in economics especially useful to the student's program and objectives but not available in the regular course offerings. (Cred. ar.; prereq. consent of adviser and instructor in field covered)

161. General Manpower Economics and Labor Problems. (1) Marketing of manpower resources; (2) institutional structure of labor markets; (3) economic and social problems arising out of labor marketing processes; (4) methods, procedures, and proposals for solving these problems. Includes the basic materials of 73 plus advanced discussion and special assignments. (3 cred., §73; prereq. 7) Yoder, others

162. Labor Movements. Analysis of the development of labor movements in Europe and the United States. Examination of the origins of labor movements, their growth, the problems under various forms of government, and analysis of the economic and social consequences of these developments. (3 cred.; prereq. 161 or equiv.) Ulman

163. Union Government and Policies. Analysis of (1) the structural nature; and (2) the operation of contemporary American unions. Nature of internal administration and government of unions, and the economic and social issues arising out of relationships with managements as found in matters of hours, wages, and other conditions of employment. (3 cred.; prereq. 161 or equiv.) Ulman

164. Labor Legislation: Collective Bargaining. An analysis of (1) employer-employee-union relationships and their social control; emphasis is placed upon the action of legislative, executive, and judicial branches of the government; and (2) the economic and social implications of issues arising in this area. (3 cred.; prereq. 161 or equiv.) Turnbull

166. Settlement of Industrial Disputes. Major consideration of the economic impact and implications of principal methods of settling labor disputes,

including mediation, conciliation, fact-finding, and voluntary and compulsory arbitration. (3 cred.; prereq. 161 or equiv.) Turnbull

169. Labor Legislation: Economic Security. Analysis of (1) origins and development of economic and social problems of the worker; (2) executive, legislative, and judicial attempts to deal with these problems; and (3) economic and social consequences of the developments. Treatment of "protective labor legislation," involving child labor, hours and wages, industrial accidents and illness, old age, and unemployment. (3 cred.; prereq. 161 or equiv.) Turnbull

172. Economics of Transportation. The economics of the agencies of modern transportation, including rail, water, highway, air, and pipe line. Relative advantage of each agency, national transportation policy, regulation, rate making, taxation, coordination of services. (3 cred., §B.A. 71; prereq. 20 cred. in social science including 7) Nightingale

175. Government Regulation of Market Behavior. A study of the administrative and legislative controls in the United States in the following areas: general restraints of trade and monopoly, regulation of the standards of fair competition, licensing and regulation of entry into trade and professions, and the regulation of public utility rates and services. Emphasis will be on the economic and legal analysis of federal regulation, but state and local regulation will also be studied. (3 cred., §85; prereq. 144 or equiv.) Boddy

176. Introduction to International Economics. Techniques of international economic analysis. The approach, while primarily theoretical, will indicate the relevance of the theory to current problems. The balance of payments; foreign exchanges; free trade versus protection; techniques of trade control; international commercial policies; contemporary international economic problems and institutions. (3 cred.; prereq. 7) Coen

178. Economics of Consumption. The nature of human wants; origins and personal distribution of money income and purchasing power; demand and price; standards and levels of living; relationship of consumption to the population problem and possibilities for improvement in the plane of consumption. (3 cred.; prereq. 7)

179. Economic Problems of the Far East. Survey of recent economic developments in the Far East especially in China and Japan. The ways in which these developments illustrate and are governed by economic principles. Economic regionalism, problems of population and migration, control of raw materials, industrial efficiency, internal economic institutions, and international commercial policies as they occur in the Far East. (3 cred.; prereq. 7) Vaile

185. Economics of Marketing. (1) Role of market distribution in our total economy; (2) costs of market distribution; (3) regional specialization and market distribution; (4) public, quasi-public, and corporate control of market distribution; (5) role of the consumer in market distribution. (3 cred., §77; prereq. 7 or equiv.) Vaile, others

186. International Economic Problems. Examination of current issues of international economic policy. (3 cred.; prereq. 176)

189. Economics of Public Finance. A survey of public expenditures, budgeting, taxes, debts, and fiscal policy, with emphasis on economic effects. Special attention is given to tax principles, practices, and policies. (3 cred., §191-192, B.A. 58; prereq. 7) Heller

190. National Income Analysis. The conceptual framework for the study of income flows, the use of statistical materials within this framework, and the use of the results for measurement and welfare. (3 cred.; prereq. 143 or equiv.) McKenna

191-192. Public Finance. Analysis of public expenditures and budgeting, fiscal policy, debt management, and taxation in terms of economic effects, fiscal process, and social policy. Topics include: expenditure theory; budgetary process; alternative budgetary policies; debt burden; the taxing process; taxation, incentives, and markets; tax incidence; technical problems of income, profits, and sales taxation; defense finance. (3 cred. per qtr., §189, B.A. 58; prereq. 7) Heller

193. State and Local Taxation. Main problems of state and local finance and proposed solutions, including coordination of national, state, and local fiscal policy and administration. (3 cred.; prereq. 189 or equiv.) Borak

195. Fiscal Policy. (1) Theoretical framework and goals of fiscal policy; (2) the potential contribution of taxation, government expenditures, and debt transactions as instruments for achieving full employment, price stability, and economic growth; and (3) institutional limitations to the use of fiscal policy. (3 cred.; prereq. 20 cred. in social science, including 189 and 142 or equiv.) Heller

196. Advanced International Price Theory. Use of geometrical methods of analysis to compare the effects of free trade and protection on the size and rate of growth of world output, and on the distribution of income between countries and within a country. Customs unions. International investment. (3 cred.; prereq. 176) Coen

197. Business Cycles and the Structure of Production. (3 cred.; prereq. 149)

200. Seminar in Employment Theory. (3 cred.; prereq. 125) Brownlee

202. Methodology in Economics. (3 cred.) Papandreou

205. Seminar in Economic Structure and Behavior. (3 cred.) Papandreou

206. Seminar in Market Prices. (3 cred.) Vaile

210. Seminar in Business Cycle and Employment Theory. (3 cred.)

213. General Equilibrium Theory. (3 cred.; prereq. 104, 142) Papandreou

214. Theory of Monopolistic Competition. (3 cred.; prereq. 104) Boddy

215. Welfare Economics. (3 cred.; prereq. 104) Brownlee

216. Topics in Mathematical Economics. (3 cred.; prereq. Math. 50-51 desirable, 100 or equiv., or ♯) Hurwicz

217. Seminar in Statistical Inference and Econometrics. (3 cred.; prereq. 102 or equiv. or ♯) Hurwicz

233-234.† Seminar in Public Finance. (3 cred. per qtr.) Heller

235. Federal Tax Policy. (3 cred.) Heller

243-244.† Seminar in Money and Banking. (3 cred. per qtr.) Smith

251-252.‡ Seminar in Industrial Relations. (3 cred. per qtr.) Yoder

253. Seminar in Labor Marketing. (3 cred.) Heneman

254. Seminar in Trade Unionism. (3 cred.) Ulman

255. Seminar in Economic Security. (3 cred.) Turnbull

299. Graduate Research. (Cred. ar.) Staff

BUSINESS ADMINISTRATION

109. Business Policy. Problems of a general administrative character: integration of management, methods of analysis and budgetary control used to establish policies with respect to recurring and new developments. Case studies and student reports. (3 cred.; prereq. Econ. 144 or equiv.) Reighard

111. Purchasing. Purchasing of materials, supplies, and equipment is considered as a major function in business. Basic principles of purchasing in industrial, governmental, and institutional organizations. Topics include quantity and quality decisions, forward buying, evaluation of purchasing procedures, and pricing policies. (3 cred.; prereq. Econ. 185 or equiv.) Holloway

112. Time Series Analysis and Quality Control. Covers (1) the explanation and criticism of statistical techniques applied to time series analysis; (2) index numbers; and (3) statistical control of quality. (3 cred., §74; prereq. Econ. 5 or equiv.) Gaumnitz, others

113. Sales Management. The management of selling activities including sales policies and planning, sales promotion, sales organization, and channels of distribution, selection, training and compensation of salesmen, control of sales performance, sales budgets, and cost control. Extensive use of case materials. (3 cred.; prereq. Econ. 185 or equiv.) Lewis

114. Retail Store Management. Comprehensive treatment of retailing principles and methods; relation of retailing to other parts of the economy; and prob-

lems associated with the operation of stores of various types. (3 cred.; prereq. Econ. 185 or equiv.)

115. Life and Disability Insurance. Functions of life and disability insurance; types of contracts; terms of contracts; government life insurance and social security; programming; group, industrial, fraternal, and savings bank life insurance; premiums and reserves; dividends; investments; underwriting and reinsurance; regulation and taxation; some legal aspects; current problems. (3 cred.; prereq. Econ. 50) Williams

116. Fire and Marine Insurance. Role of fire and marine insurance in a multiple-line era; functions of fire, inland marine, and ocean marine insurance; types of contracts available and their principal provisions; loss settlements; rates and reserves; underwriting and reinsurance; regulation and taxation; current problems. (3 cred.; prereq. Econ. 50) Williams

117. Casualty Insurance. Role of casualty insurance in a multiple-line era; functions of casualty insurance; some principles of the law of negligence and the law of contracts; the major provisions of the principal contracts in general liability, workmen's compensation, automobile, aviation, theft, boiler and machinery, glass, credit, and title insurance and fidelity and surety bonding; rating methods including class rating, schedule rating, experience rating and retrospective rating; reserves; underwriting and reinsurance; regulation and taxation; current problems. (3 cred.; prereq. Econ. 50) Williams

118. Auditing Principles and Procedures. Class instruction in auditing principles and procedures is combined with a laboratory in which a set of working papers and an audit report are prepared. (4 cred.; prereq. 151) Lund, others

119. Correlation. Normal correlation, homogeneity, significance tests, treatment of nonlinear relationships, with applications. (3 cred.; prereq. Econ. 5 or equiv.)

130. Managerial Cost Accounting. Cost accounting and analysis from the point of view of its use by management in making decisions and setting policies, and in establishing controls over costs. (3 cred., §66, 152; prereq. Econ. 26 or equiv.) Wheeler, others

131. Distribution Cost Accounting. Principles and procedures involved in handling cost accounting in retailing, wholesaling, and the distributive divisions of manufacturing enterprises. (2 cred.; prereq. 153) Wheeler

133. Standard Costs. Methods of standard costs. The meaning of standards. The setting of standards for materials, labor, and overhead. Analysis of and accounting for variations. Development and application of standards to distribution as well as to production activities. (3 cred.; prereq. 153) Wheeler

134. Income Tax Accounting. Principles involved in determining taxable net income and the computation of federal and state income taxes for individuals, partnerships, and corporations. (4 cred.; prereq. 150) Reighard, Nelson

135. Auditing and Public Accounting. Independent auditing in relation to function, fraud prevention, types of investigation, accepted standards, regulations of S.E.C. and A.I.A., problems and ethics of professional practice. Study of case and problem material. (3 cred.; prereq. 118) Reighard

136. Controllership Functions and Procedures. The place and functions of the controller and internal auditor in business enterprises. Examination of the accounting systems and methods related to such functions as internal check and audit control of routine transactions. (3 cred.; prereq. 151) Reighard

139. Corporate Statements. Preparation of corporate statements and analysis from management, investment, and credit viewpoint. Report required analyzing statement of an assigned corporation. (3 cred., §65, 151; prereq. Econ. 26 or equiv.) Heilman

141. Real Estate. Valuation of urban real estate; consideration of problems of real estate financing, rent control, housing, land development, zoning, and other factors affecting real estate values. (3 cred.; prereq. Econ. 7) Sutton

146. Investments. A general or "cross cut" survey of the external and internal factors influencing the prices of securities, and of the principles of an invest-

ment policy for the individual investor. Emphasis on objective analysis from source materials of factors explaining price differentiation. (3 cred.; prereq. Econ. 155 or equiv.) Stehman

148. The Securities Market. Consideration of behavior over time or "longitudinal" analysis of prices of individual and groups of securities. Emphasis on relationship of economic conditions to security values, particularly the effects of cyclical fluctuations. (3 cred.; prereq. 146) Sutton

150. Intermediate Accounting I. Principles and procedures involved in the valuation of assets and the determination of periodic income. (3 cred.; prereq. Econ. 26 or equiv.) Heilman, Nelson, Lund, others

151. Intermediate Accounting II. Principles and procedures involved in the valuation of liabilities and stockholders' interest, analysis of financial statements. (3 cred., §65, 139; prereq. 150) Heilman, Nelson, Lund, others

152-153. Cost Accounting. Practices and procedures. Principles and methods of handling material, labor, and overhead costs. Procedures in job order and process cost systems. Introduction to budgets, standard costs, and cost analysis. (3 cred. per qtr., §66, 130; prereq. Econ. 26 or equiv.) Wheeler, Myers

154. Budgetary Control. Fundamentals of establishing and operating a budget. Budgetary control and the relationship to break-even analysis. (3 cred.; prereq. 153) Wheeler

156. Finance Management. Duties of the financial manager of a modern business. Various sources from which capital may be secured, the best use of a company's funds, and special financial problems of the typical business. (3 cred.; prereq. Econ. 155 or equiv.) Stehman

157. Top Management Functions. (3 cred., §182G; prereq. 187 or equiv.) Filipetti

158. Governmental Accounting. Government budgets and fund accounting. (2 cred.; prereq. 151) Heilman

159. Advanced Accounting. Branch accounting, consolidated statements, estates and trusts, concerns in financial difficulties, and other specialized problems. (3 cred.; prereq. 151, Math. 20) Heilman, Nelson, Lund, others

160. Readings in Business Administration. A course of special readings arranged with the student to cover areas in business administration especially useful to the student's program and objectives, but not available in the regular course offerings. (Cred. ar.; prereq. consent of adviser and instructor in field covered)

167. Introduction to Industrial Relations. Survey of policy and practice in manpower management. The course provides a professional viewpoint toward major functions, including policy formulation, determination of labor needs, job analysis, recruitment, selection, training and safety, service rating, employment stabilization, collective bargaining, and wage and salary administration. (3 cred.; prereq. Econ. 161 or equiv.) Yoder, others

168. Advanced Personnel Administration. Administrative aspects of industrial relations in both unions and managements. Mechanisms and practices of manpower management policy determination and review. Development and use of personnel records and reports. (3 cred.; prereq. 167 or ¶167 with adviser's approval) Heneman

170. Methods Analysis and Work Measurement. Process and operation analysis, work simplification, motion study, and micromotion study principles and applications. Work measurement, job standardization, time study, motion-time analysis. Production standards and their application for planning and control purposes. (3 cred.; course given by Industrial Engineering Division, Institute of Technology, primarily for students in School of Business Administration; prereq. 187 or equiv.)

171. Motion Study Applications. Laboratory projects selected from, and contributory to, improvement of basic clerical, office practice, and merchandising procedures, emphasizing application of motion economy principles. Final report required for each project. (3 cred.; prereq. 170)

173. Market Analysis and Research. A survey of the techniques used in market research. Selected problems in the analysis of sales records, sales forecasting, estimating sales potentials, sampling consumer demand, determining

the factors which influence demand for specific goods. (3 cred.; prereq. Econ. 185 and 5 or equiv.) Holloway

174. Transportation: Services and Charges II. Principles of traffic management and their application within the individual firm. Analysis of the principles relating to construction, interpretation, and application of rail, motor, water, express, and air freight classifications and tariffs. Analysis of railway freight structures. Problems relating to the determination of charges on typical movements within and between major railway freight-rate territories. (3 cred.; prereq. Econ. 172 or equiv.) Nightingale

177. Foreign Trade. Export and import procedures and practices. Organization for exporting, channels of distribution, foreign trade promotion, financing shipment, insurance, tariffs and governmental export and import regulations. Character and development of United States trade. (3 cred.; prereq. Econ. 7) Holloway

180-181-182. Senior Topics Courses. Intensive study of problems in respective fields of specialization.

180A. Readings in Accounting Literature. Discussion and reports on selected topics in practice and theory as found in current accounting literature. (3 cred.; prereq. 12 cred. in accounting at Senior College level) Reighard

181-182B. Business Finance. Individual research and discussion of important current financial developments. (3 cred. per qtr.) Stehman, Sutton

180-181-182C. Marketing. 180C: Selected topics in market research methods and problems. (3 cred.; prereq. 173) Holloway. 181C: Selected topics in management problems dealing specifically with sales forecasting, sales analysis, and the analysis of distribution costs. (3 cred.; prereq. Econ. 185 or equiv.) Lewis. 182C: Selected topics in retail store management. (3 cred.; prereq. 114)

180-181-182D. Industrial Relations. Designed to develop familiarity with and evaluation of professional procedures and techniques in each of the major functions of manpower management. Individual and group projects prepare the student for employment in industrial relations at the staff level. (3 cred. per qtr.; limited to majors in industrial relations and others who have satisfactorily completed 167 or equiv.) Yoder

180-181-182F. Statistics. Intensive study of such topics (to be announced each quarter) as: survey sampling, estimation, hypothesis testing, acceptance sampling and quality control, design of experiments, sequential analysis. (3 cred. per qtr.; prereq. Econ. 123 or ¶123 or ♯) Allen

180-181-182G. Production Management. Problems in management; studies in the technique of executive control in manufacturing enterprises; field research and surveys in organization and methods of management of Upper Midwest industrial concerns. (3 cred. per qtr. [cred. may not be received for both 182G and 157]; prereq. 187 or equiv.) Filipetti

180-181-182I. Transportation. 180I: Advanced industrial traffic management. Transportation rates and practices and the individual firm. 181I: Motor and air transportation. 182I: Regulation and management of transportation agencies. Intensive analysis of recent leading decisions of the Interstate Commerce Commission and Civil Aeronautics Board. (3 cred. per qtr.; prereq. 174 or ♯) Nightingale

182H. Insurance. Two-thirds of the course will consist of a thorough study of group insurance including group life (term and permanent plans), group casualty (disability income and medical expense coverages), and group annuities (fixed and variable amounts). Each type of group insurance will be analyzed as follows: need for the coverage and economic implications; state regulation and underwriting requirements; policy provisions; cost analysis. In the remaining one-third of the course, each student will report on the results of independent study in the insurance area of his special interest. (3 cred.; prereq. 6 cred. in insurance or Econ. 50 and ♯) Williams

183J. Practice or Internship Course. Students engaged in outside work on the Cooperative Plan may receive graduate credit for this course provided the individual case has approval of the student's adviser, the member of the

graduate faculty by whom the outside work is supervised, and the chairman of the Graduate Committee of the School of Business Administration. (Cred. ar.) Staff

184. Scientific Management in Industry. The origin and development of the movement to apply the methods of science to management of industrial enterprises; the effects upon individual plant management and the influence upon "rationalism" in industrial society. (3 cred.; prereq. 187 or equiv.) Filipetti

187. Administration of Production. This nontechnical course develops the production function of business from the general management viewpoint. (3 cred., §89; prereq. Econ. 7) Filipetti

188. Advertising. The use of advertising in business together with an analysis of its economic effects. The planning and preparation of an advertising campaign including the advertising budget, choice of media, preparation of copy and layouts, and copy testing. (3 cred., §87; prereq. Econ. 185 or equiv. and Psy. 156) Lewis

194. Advanced Advertising Procedure. Problems and case work in advertising research. Preparation and criticism of advertisements and of advertising campaigns. (3 cred.; prereq. 188 or equiv.) Longstaff

198. Internship in Public Accounting. (See 183) Staff

199. Internship in Internal Accounting. (See 183) Staff

211. Seminar in Marketing. (3 cred.) Vaile

236. Business Finance Seminar. (3 cred.) Stehman

258. Seminar in Cost Accounting. (3 cred.) Wheeler

259. Case Studies in Specialized Accounting. (3 cred.) Wheeler

260. Tax Accounting Problems. (3 cred.) Nelson

261-262. Advanced Accounting Problems. (3 cred. per qtr.) Nelson

263. Seminar in Accounting Theory—Valuation and Principles. (3 cred.) Heilman

264. Seminar in Accounting Theory—Income Determination and Statement Presentation. (3 cred.) Nelson

265. Accounting Under Government Regulation. (3 cred.) Heilman

270. Seminar in Transportation. (3 cred.) Nightingale

281. Seminar in Industrial Management. (3 cred.; prereq. 184 or 180G and 182G) Filipetti

299. Graduate Research. (Cred. ar.) Staff

EDUCATION

Professor

Walter W. Cook
John E. Anderson
Clifford P. Archer
Gertrude M. Baker
Robert H. Beck
Guy L. Bond
Nelson L. Bossing
Leo J. Brueckner
Willis E. Dugan
Ruth E. Eckert
Marcia Edwards
Roxana R. Ford
Elizabeth M. Fuller
Paul R. Grim
Ruth E. Grout
Cyril J. Hoyt
Palmer O. Johnson
Louis F. Keller
Robert J. Keller
George H. McCune
William J. Micheels
Horace T. Morse
Mervin G. Neale
Carl L. Nordly
Paul M. Oberg
Milo J. Peterson
Ralph A. Piper
Raymond G. Price
Ella J. Rose
Dora V. Smith
Louise A. Stedman
C. Gilbert Wrenn

Associate Professor

Emma Birkmaier
Clarence H. Boeck
Otto E. Domian
William H. Edson
Frederick E. Ellis
Ned A. Flanders
Carl V. Goossen
Paul S. Ivory
Donovan A. Johnson
Harry W. Kitts
Warren G. Meyer
Gordon M. A. Mork
Howard F. Nelson
Maynard C. Reynolds
Tracy F. Tyler
Marjorie U. Wilson

Assistant Professor

Arnold F. Caswell
Theodore W. Clymer
Theda Hagenah
Eloise M. Jaeger
Helen M. Slocum
Edith West

Lecturer

Gerald B. Fitzgerald

Prerequisites—For major work in education, at least 6 quarter credits in psychology and also a total of not less than 18 quarter credits of undergraduate work in education including Ed. 51A-B-C or Ed. 55A-B or Ed. 71A-B-C or the equivalent. For minor work, at least 6 quarter credits in psychology and also a total of not less than 18 credits of undergraduate work in education.

Language Requirement—For the Master's degree, none. For the Ph.D. degree, either (a) two foreign languages or (b) one foreign language and the option of a special research technique or a collateral field of knowledge.

Master's Degree—PLAN A majors may be chosen as follows:

The student, with the approval of his adviser, may select a group of courses in one of the following fields, excluding the field of his minor, centering about his special interest in education:

Agricultural education
Curriculum and instruction**
Education**
Educational administration**
Educational psychology**
History and philosophy of education
Home economics education
Industrial education
Music education
Physical education

Minors may be chosen as follows:

1. From any of the foregoing groups of courses when such grouping is not included in the major.

2. From any other field of study offered at the University of Minnesota in which satisfactory courses of graduate character are available and which is obviously related to the major field.

3. Students majoring in fields other than education may choose education or any of its subdivisions enumerated above as a minor when it appears that such a minor is appropriately related to the major field.

Under PLAN B, which encourages a wider selection of courses, the student will select a field of concentration in which he will attain from 21 to 27 credit hours. The field of concentration differs from a major in that it encourages the choice of a somewhat wider range of courses related to the student's interest. As in the case of the major, however, the student will indicate his field of concentration according to the general arrangement of courses required for a major. This arrangement is as follows:

Agricultural education
Curriculum and instruction**
Education (in special cases)**
Educational administration**
Educational psychology**
History and philosophy of education
Home economics education
Industrial education
Music education
Physical education

Additional Courses—The student may elect the additional courses required to complete the total of 45 credits from areas of education not included in the field of concentration and from any other fields of study offered at the University of Minnesota in which satisfactory courses of graduate character are available and which are obviously related to the student's interest. Further work in subject-matter areas is encouraged.

Notes to Applicants for Admission to Graduate School—Be sure to indicate the exact major field in which you are interested. Where neces-

** See Notes to Applicants for Admission to Graduate School on this same page.

sary, state also the main emphasis within the major field, as in the following examples:

Educational administration (specify whether elementary school principal, secondary school principal, or school superintendent.)

Educational psychology (specify whether guidance and counseling, measurement, research, or another main interest.)

Curriculum and instruction (specify whether your general interest is at the elementary or secondary level, or in a principal teaching field such as business and distributive education, English education, etc.)

Education (at the M.A. level this major is planned only for those secondary school teachers who desire a combination of education fields for their area of concentration, with most, or all, of the related work taken in specific teaching fields, such as English, mathematics, or science.)

Specialist in Education Certificate—A two-year program for school superintendents leads to the certificate Specialist in Education. In the first year, the student completes the requirements for the M.A., majoring in educational administration. The second year's program includes workshops on the improvement of instruction in the elementary and secondary schools, school building planning, and state school administrative problems; advanced courses in educational psychology; field research; and graduate courses dealing with school-community problems and educational philosophy.

Students admitted for the second year of this program whose Master's degree programs did not include all the work of the M.A. in educational administration at the University of Minnesota must meet such requirements before receiving the Specialist certificate. Students transferring from other institutions will meet regular Graduate School entrance and candidacy requirements. The minimum residence requirement is one year (45 credits), with no longer than ten years allowed for the completion of the last 45 credits of the two-year program.

The approval of individual programs and the examination procedures are the same as for the M.A. degree. Although a student who later becomes a doctoral candidate may include in his program courses completed for the Specialist in Education certificate, ordinarily candidates for this certificate will not be considered as beginning work leading to the Ph.D. degree.

Doctor's Degree—Major work will be chosen in the following manner:

With the approval of his adviser the student will select a group of courses, excluding the field of his minor, centering about his special interest in education. Major fields are:

Education
Educational administration
Educational psychology

Minors may be chosen as follows:

1. From one of the following fields not represented in the major:

Agricultural education
Curriculum and instruction
Education
Educational administration
Educational psychology
History and philosophy of education
Home economics education
Industrial education
Physical education

2. Any other field of study offered in the University of Minnesota in which satisfactory courses of graduate character are available and which is obviously related to the field of major interest.

3. Students majoring in fields other than education may choose education, or any of its subdivisions enumerated under 1, as a minor when it appears that such a minor is appropriately related to a major field.

[**Master of Education Degree**—Advanced work leading to the professional degree of master of education is offered by the College of Education in agricultural education, art education, elementary education, English education, home economics education, industrial education, music education, natural sciences, physical education, recreation leadership, rural education, and social studies. Students interested in any of these programs should secure a *Bulletin of the College of Education* and consult an adviser.]

Courses

AGRICULTURAL EDUCATION (Ag.Ed.)

Prerequisites—Preparation in agricultural subjects satisfactory to the Department of Agricultural Education.

104f,w,s. Planning Program. Developing a program of agricultural education in a community school. Integration with total school program. Administrative relationships and professional improvement. (2 cred.; prereq. ‡) Peterson

106w. Young Farmer and Adult Education in Agriculture. The organization, objectives, and techniques for conducting continuing programs for out-of-school farm youth and adult farm people; occupational opportunities and establishment in farming; analysis of farm businesses as a basis for balanced programs of instruction. (4 cred.; prereq. 81) Kitts

121. Enterprise Analysis. Analyzing the farm business as a basis for identifying problems. Planning learning experiences to improve farm management at the high school, young farmer, and adult levels. (3 cred.; prereq. ‡; offered when staff permits) Kitts, Peterson

141f. Supervised Farm Practice in Vocational Agriculture. Selection, planning, supervising, and summarizing of individual farming programs. Adaptation to meet needs of high school F.F.A. students, young farmers, and adults. (3 cred. per qtr., total 9 cred.; prereq. 10 cred. in education, and ‡) Kitts, Peterson

145w. The Integrated Course of Study in Agriculture. Philosophy, organization, and administration of instruction in agriculture departments in the secondary schools. (2 cred.; prereq. 10 cred. in education) Peterson

154w.* Rural Education and Community Leadership. An appraisal of community educational agencies; the process of and responsibilities for community leadership; the role of the school in the rural community; coordination of the school with nonschool educational agencies. Special problem required. (3 cred.) Peterson

156s.* Rural Education Through Extension Methods. Role of the Agricultural Extension Service in rural education; methods and techniques of instruction in nonschool educational programs. Special problem required. (3 cred.) Kitts

221f,w,s. Field Problems. Making investigations, gathering data, and formulating plans regarding agricultural education. (3 cred.) Peterson, Kitts

232f,w,s.* Research in Agricultural Education. Introduction to investigational work in problems of teaching agriculture in high schools. Experience in selecting problems, preparation of bibliographies, analyzing and interpreting data, and preparing manuscripts. (Cred. ar.; prereq. 15 cred. in education) Peterson, Kitts

250f,w,s. Supervision of Vocational Agriculture. Supervision of vocational agriculture at the secondary level. Objectives, functions, responsibilities of state and local supervision; role of supervision in the teaching-learning process; organizing supervisory activities; aids to effective supervision. (1 to 3 cred.; prereq. #) Peterson, Kitts

283f,w,s. Organization and Administration of Educational Programs in Agriculture. Philosophy, purposes, and objectives of educational programs in agriculture at the national, state, and local levels. (3 cred. per qtr., maximum 9; prereq. graduate student in field of agriculture other than agricultural education) Peterson

286w. Current Issues in Agricultural Education. Analysis and discussion of significant issues. Opportunity for intensive study of problems related to local school programs. (Cred. ar.; prereq. #) Peterson, Kitts

291f,w,s. Seminar in Agricultural Education. (Cred. ar.) Peterson, Kitts

ART EDUCATION (Ar.Ed.)

151w-152s-153. Curriculum Building in Art Education. Functions of art in society for educational potentialities toward social improvement. Selection, evaluation, and organization of subject matter for the purpose of creating original teaching units, projects, etc. (3 cred. per qtr.; 153 offered 1955-56 and alternate years) Hastie, Gayne

156s. Intercultural Education Through Art. Approaches to international understanding and cooperation through recognition of aesthetic contributions of diverse peoples to American life. (3 cred.) Gayne

158s. Art Education in Europe. Examination of current practices, problems, and achievements in art education in countries of Western Europe with particular reference to sources for and comparisons with practices in American art education. (3 cred.) Gayne

184f. Advanced Course in the Teaching and Supervision of Art in the Elementary School. Improving current practices through critical evaluation and utilization of research findings and introduction of new materials. Development of closer cooperation between classroom teachers and art education specialists. (3 cred.) Gayne

185s. Advanced Course in the Teaching of Art in the Secondary School. For experienced teachers of art and advanced students planning to teach in secondary schools. Emphasis on general research and critical examination of high school art programs. (3 cred.) Hastie

189f. Application of Aesthetic Theory in Education. Contemporary theories of art, their psychological and philosophical foundations with experimental evidence. Open to teachers, supervisors, and administrators concerned with making art function in general education at all levels. (3 cred.) Hastie

284w. Research in Art Education. Application of research techniques to the field of art education, with experience in locating, defining, and studying basic problems through the use of objective tools of research. (3 cred.)

295f,w,s. Problems in Art Education. Individual specialization and creative projects selected. Projects may include advanced studio practice or technical solution of problems involving research or reading in a chosen field. (Cred. ar.; registration by special consent of major adviser) Gayne, staff

296f,w,s. Seminar in Art Education. Reports, evaluation of problems, recent literature. Participation by art education staff and guest specialists from related departments and from off campus. (0 to 1 cred.; open to advanced students in education) Art Education staff

CURRICULUM AND INSTRUCTION (Ed.C.I.)

General Courses

104s. Adult Education. A survey course of the field of adult education dealing with agencies, programs, philosophies, history, and trends. Each student may devote some time to a field of special interest. (3 cred.) Nolte

105f,w,s. Audio-Visual Materials in Education. Characteristics, advantages, limitations, and practical schoolroom use of visual materials of nonprojection and projection types. Practice in operation of audio-visual equipment. (3 cred.)

106w. Coordinating an Audio-Visual Education Program. For persons having part-time or full-time responsibility for an audio-visual program. Criteria of equipment, facilities, and materials; in-service training of teachers; and special problems encountered in small and large systems. (3 cred.; prereq. 105 or ‡)

107f,w,s. Radio and Television in Education. Effective use of radio and television in the classroom. Production, techniques of classroom use, selection of equipment, teaching appreciation, and the administration of radio and television in the schools. (3 cred.; prereq. 9 cred. in education) Tyler

107f-108w,‡ Radio and Television in Education. Same content as 107 but expanded somewhat. (2 cred. per qtr.; offered 1955-56 and alternate years) Tyler

109f,w,s. Audio-Visual Materials and Equipment Laboratory. Practice in planning and making materials for audio-visual education and in the use of machines and equipment. (3 cred.; prereq. 105 or ¶105 or ‡)

117s. Rural Education for Administrators and Teachers. (3 cred.) Archer

133f. Consumer Education in the Schools. Need for consumer education. Organizing a program in the school. Contribution of various subject-matter areas at secondary and elementary levels. (3 cred.) Price

145f. Reading Difficulties. Study of reading difficulties: their causes, prevention, and correction. Remedial practices in reading useful to the classroom teacher, school counselor, and reading specialist. (3 cred.; prereq. 143 or 144 or equiv.) Bond

151w. Diagnosis and Treatment of Learning Difficulties. Evaluation of the results of teaching; diagnosis of pupil difficulty; development and prevention; tests as aids to teaching; following up a testing program. (3 cred.) Brueckner

171f,w,s. Curriculum Laboratory Practice. Practice in the analysis and construction of units, courses of study, and curricula according to needs, interests, level, and specialization. (0 to 3 cred. per qtr.; prereq. 170A or B, ‡) Archer, Bossing

174f,w,s-175f,w,s-176f,w,s. Clinical Methods and Practice in Speech Pathology. Case history and analysis; testing and diagnosis of speech defects; techniques and work programs for treatment; practical clinical work. (3 cred. per qtr.; prereq. Spch. 61, Spch. 67, Spch. 119, Spch. 162, Spch. 163 or ¶Spch. 163) Bryngelson

205f,w,s.* Problems in Audio-Visual Education. (Cred. ar.; prereq. ‡)

207f,w,s.* Problems in Radio-Television Education. Individual problems for students whose work in 107 has indicated an aptitude and interest in the field. (1 to 3 cred. per qtr.; prereq. 107) Tyler

215f,w,s.* Problems in the School Health Education Program. For advanced students who wish to pursue independent study and experimentation in school health education. (Cred. ar.; prereq. ‡) Grout

216f,w,s.* Field Work in the School Health Education Program. Practical field experience in school health education under the supervision of qualified health educators. Details worked out in accordance with individual needs. (Cred. ar.; prereq. ‡) Grout

217f,w,s. Seminar in the School Health Education Program. Discussion and reports on current problems in school health education. (Cred. ar.; prereq. ‡) Grout

227f,w,s.* Problems in Rural Education. (Cred. ar.; prereq. 117) Archer

243s. Recent Research in Reading. Critical analysis of methodology and findings of current research in the field of reading. Appraising research methods, population limitations, and educational implications. (3 cred.; prereq. ‡) Bond

271f,w,s.* Problems in Curriculum Construction. Special problems in the field of the student's individual choice. (3 to 6 cred. per qtr.; prereq. #) Archer, Birkmaier, Bossing, D. Johnson

273f,w,s.* Problems in Reading. Recent problems, issues, studies, and findings. For those with previous training in reading who have a special problem or who wish to survey the most recent literature. (3 cred. per qtr.; prereq. 143 or 144 or #) Bond, Reynolds

Elementary Education

102f. Teaching the Social Studies in the Elementary School. Primarily for teachers in service. (3 cred.; prereq. Ed. 71C or equiv.)

119w. Elementary School Curriculum. Principles underlying the selection and organization of subject matter for courses in the elementary school and a survey of the methods, problems, and findings of research by subjects. (3 cred.; prereq. Ed. 71C or equiv.) Goossen

143f. Teaching and Supervision of Reading in the Elementary School. Objectives, materials, and teaching procedures in lower and intermediate grades; survey of current practices and curricula; class and individual projects; observation of reading techniques and materials in the demonstration school. (3 cred.; prereq. 9 cred. in education) Bond

146. Current Developments in Language Expression in the Elementary School. Materials, methods, and current philosophies of language instruction in the elementary school. (2 cred., §64; prereq. Ed. 71C or equiv.) Archer

149w. Teaching and Supervision of Arithmetic in the Elementary School. Functions of arithmetic instruction; curriculum studies; development of socialized units; measurement and diagnosis; experimental research on methods of arithmetic instruction; literature on arithmetic. (3 cred., §62A or §62B; prereq. Ed. 71C or equiv.) Brueckner

150f. Supervision and Improvement of Instruction. Functions and duties of a supervisor as related to the improvement of instruction; specific supervisory technique, objective analysis of classroom activity; concrete applications to present-day problems; case studies. (3 cred.; prereq. Ed. 71C or equiv.) Brueckner

153f.s. Supervision and Teaching of English in the Elementary Schools. Improvement of instruction in language, spelling, and handwriting. (3 cred.; prereq. Ed. 71C or equiv.) Archer

157f,w,s. Practice in Supervision. Individual research on special supervisory problems, especially for supervisors in training. (3 cred. per qtr.; prereq. #) Brueckner

170A. Curriculum and Course of Study Construction. Principles and methods for the selection and organization of units, courses of study, and curricula at the elementary school level. (3 cred.; prereq. 119 or #) Goossen

173As. Organizing Units of Instruction in the Elementary School. Principles and procedures involved in the organization of units, utilizing natural science and social studies in the development of skills in reading and study, oral and written composition, arithmetic, and the arts. (3 cred.; prereq. 119 or teaching experience) Goossen

181w. Foundations of Elementary School Methods. Survey of current philosophy and research which form the bases for improvement of elementary school instruction. (3 cred.; prereq. 9 cred. in education) Brueckner

226f,w,s. Seminar in Elementary School Problems. (2 cred.) Archer, Bond, Brueckner, Clymer, Goossen

261f,w,s.* Special Problems in the Improvement of Instruction. Primarily for students majoring in supervision and others qualified to make intensive studies of specific problems related to school supervision. (Cred. ar.; prereq. #) Brueckner

263w.* Research in Arithmetic Instruction. Recent research in curriculum, gradation of subject matter, methods, materials, and supervision of arithmetic. (3 cred.) Brueckner

264s.* Research in Educational Diagnosis. Recent research in methods of diagnosis in education, and techniques of preventive and remedial teaching. (3 cred.) Brueckner

265f,w,s.* Research in Supervision. Recent research in supervision, teacher rating, surveys of instruction, and school and community relations. (Cred. ar.; prereq. #) Brueckner

Secondary Education

113f,w. High School Curriculum. Viewpoints and curriculum issues, reorganization trends, typical research findings by subjects, and analysis of state and local curricula. (3 cred.; prereq. Ed. 55A-B or equiv.) Bossing

114s. Development of the Core Curriculum. Development of the core curriculum idea; its philosophical, psychological, and educational bases; problems involved in the organization, administration, and teaching of the Core Curriculum; the function and preparation of the core teacher. (3 cred.) Bossing

122s. Literature for Adolescents. Background for pupil guidance in extensive reading in junior and senior high schools. (2 cred.; prereq. Ed. 55B or junior-senior high school teaching experience) Smith

125w. Occupational Information Laboratory. Experience in using, reviewing, and evaluating occupational information. Study of sources and types of material, occupational filing plans, and practical techniques at the secondary school level. (3 cred.; prereq. #) Dugan

131f. Advanced Course in Teaching the Technical Business Subjects. Recent research and trends in teaching the technical business subjects. (3 cred.) Price

132s. Teaching the Basic Business Subjects. Recent trends and developments in teaching junior business training, economic geography, marketing, business law, consumer education, and bookkeeping. (3 cred.) Price

134w. Materials and Methods in Consumer Education. Development of teaching units; emphasis on teaching methods, and recent aids and materials. (3 cred; prereq. #) Price

135s. Group Procedures in Guidance. Problems of group work in guidance in secondary schools. Content and materials for home room groups, occupations units, and other guidance courses in junior and senior high school. (3 cred.; prereq. 9 cred. in education, E.Psy. 133 or #) Dugan

136f. Organization and Administration of Distributive Education. Principles, practices, and legislation followed in developing cooperative part-time, extension part-time, and evening school programs under Smith-Hughes and George-Barden Acts. Basic course for teacher-coordinators and vocational administrators. (3 cred.) Meyer

137A. Materials and Methods in Cooperative Part-Time Classes. Related vocational materials and methods for cooperative part-time distributive, office, miscellaneous trades, and diversified occupations classes. (3 cred.) Meyer

137B. Advanced Materials and Methods in Cooperative Part-Time Classes. Individual and group work on related vocational materials. New methods of teaching cooperative part-time distributive, office, miscellaneous trades and diversified occupations classes. (3 cred.; prereq. #) Meyer

138. Training Store and Office Supervisors. Supervisory training problems and elementary training techniques used in stores and offices. Enables coordinator to conduct short unit courses for store and office supervisors. (3 cred.) Meyer

139w. Coordination Techniques. Practical problems encountered by the coordinator in his daily work concerning the cooperative part-time program. Guidance and selection; placing of students in work stations; assisting job adjustments; developing the training program. (3 cred.) Meyer

141s. Cooperative Part-Time Work Experience Programs. Planning, organizing, curriculum building, plant and equipment, promoting and evaluating cooperative part-time distributive, office, miscellaneous trades, and diversified occupations programs. (3 cred.) Meyer

142. Business and Distributive Programs for Adults. Selection and training of evening school instructors; planning and promoting evening school distributive education classes. (3 cred.) Meyer

144w. Teaching of Reading in Secondary Schools. Teaching procedures, objectives, and materials, with special consideration for the teaching of reading in the various subject-matter fields. (3 cred.; prereq. 9 cred. in education) Bond

154. Materials and Methods in Adult Distributive Education Classes. Survey of course outlines, reference materials, and teaching aids. Construction of units of instruction. (3 cred.) Meyer

155w. Materials Laboratory for Social Studies Teachers. A seminar in the study of printed and audio-visual materials, with reference to their use in social studies classes. (3 cred.; prereq. #) McCune, West

156s. Trends in Business Education. Historical development of business education; trends in philosophy, curriculum, and teaching procedures. (3 cred.) Price

161s. Curriculum Construction in Business Education. Curriculum problems in business education, including organization, with emphasis on preparation of teaching units. (3 cred.; prereq. 113) Price

168f. Current Developments in the Social Studies. A survey of contemporary literature, curricular trends, and developments in methods. (3 cred.) McCune

169w. Extracurricular Activities. Types of activities in junior and senior high schools; aims and values; practices in organizing, administering, and supervising; methods of evaluation. (4 cred.; prereq. Ed. 55A-B or equiv.) Bossing

170B. Curriculum and Course of Study Construction. Principles and methods for the selection and organization of units, courses of study, and curricula. (3 cred.; prereq. 113 or 119 or #) Bossing

173B. Organizing Units of Instruction in the Secondary School. Development of principles and procedures for construction and teaching of units of instruction. (3 cred.; prereq. 113 or #) Bossing

191s. Advanced Course in the Teaching and Supervision of Secondary Mathematics. Present practices in methods, materials, and curriculum development in secondary mathematics; principles of learning applied to mathematics; review of research; preparation and evaluation of units, tests, and materials of instruction. (3 cred.) D. Johnson

201f,w,s.* Problems in Teaching the Social Studies. Each student concentrates on one problem intensively and gives oral reports and a final written report. (3 cred. per qtr.; prereq. 155, 168, 204 or #) Morse, McCune, West

204w. Social Studies Curriculum. Review of techniques and practices of curriculum-making in the social studies at all grade levels. (3 cred.)

222f,w,s. Seminar: Current Problems in the Techniques of High School Instruction. Required of candidates for M.A. or Ph.D. in the secondary field. (Cred. ar. or no cred.; prereq. Ed. 55A-B and senior methods) Bossing, R. Keller, Mitchell, Smith

225f,w,s.* Special Problems in Supervision of Instruction in Secondary Schools. Primarily for graduate students and supervisors in schools who are qualified to make intensive studies. (Cred. ar.; prereq. #) R. Keller

238f,w,s.* Problems in Distributive Education. Investigation of particular problems in the field of distributive education. (Cred. ar.: prereq. #) Meyer

239f,w,s.* Problems in Business Education. Special investigations in the field of the student's interest. (Cred. ar.; prereq. #) Price

266s. Supervision of High School Instruction. The present status of high school supervision; its proper scope and function. Combines principles and their application to improving high school instruction. (3 cred.; prereq. E.Psy. 293 or #) R. Keller

287f.* Advanced Course in the Teaching of Science. A study of recent developments in the teaching of science and a critical evaluation of the investigations dealing with science teaching. (3 cred.) P. O. Johnson

294f,w.* Advanced Course in Curriculum and Methods in Secondary School English. Evaluates present content and method in the light of research and

recent trends in teaching. (2 cred. per qtr.; prereq. Ed.T. 75A-B-C or equiv.) Smith

296f,w,s.* Special Problems in Teaching English. Special research problems in the field of the student's individual choice. (Cred. ar.) Smith

Higher Education

184f. Supervision of Student Teaching. Designed for persons planning to supervise or administer student teaching and other professional laboratory experiences in elementary and secondary education. (3 cred.; prereq. 15 cred. in education or #) Grim

228f,w,s.* Problems of Higher Education and Teacher Education. Problems of college curricula and instruction, organization and administration. Offered as a seminar one quarter a year and as an individual problems course each quarter. (Cred. ar.; prereq. #) Eckert, Grim

250f,w. Higher Education in the United States. The development of, present status of, and outlook for American colleges. Topics considered include: purposes of higher education; types of program provided; trends in curriculum, instruction, and administration; evaluation of outcomes. (3 cred.; prereq. a year of graduate study in any field or 18 cred. in education) Eckert

251w. Curriculum Trends in American Colleges. Basic principles involved in the development of college programs. Examination of the curriculum as a whole with critical study of certain recurrent problems in designing general education courses and sequences. (3 cred.; prereq. a year of graduate study in any field or 18 cred. in education) Eckert

252s. Effective College Teaching. A review of philosophical and psychological bases of instruction, followed by careful study of methods currently employed to encourage, guide, and appraise students' learning. The college teacher's status and services are also examined. (3 cred.; prereq. a year of graduate study in any field or 18 cred. in education) Eckert

253f,w,s. Seminar on the Improvement of College Instruction. Planned for instructors, teaching assistants, and mature graduate students from various departments of the University and instructors from other institutions. Current problems, research, and trends in the area of instruction. Offered with cooperating staff of various teaching departments. Emphasis determined by immediate and future needs of the students enrolled. (Cred. ar. or no cred.; prereq. #) Eckert, Wrenn, others

254f,w,s. Directed Experience in College Instruction. An individualized program under guidance of an instructor or department. Planned to provide understandings, procedures, and skills related to application of instructional theory, curriculum development, observation, and evaluation practices. Offered with cooperating staff of various teaching departments. (Cred. ar.; prereq. #) Eckert, Wrenn, others

284f,w,s.* Problems in Student Teaching. Research problems in the supervision, organization, and administration of student teaching and laboratory experiences on the elementary and secondary levels. (3 to 9 cred.; prereq. #) Grim

285w,286s. The Professional Education of Teachers. For instructors, administrators, and personnel workers in teacher educating institutions. First quarter is general and can be taken independently; second quarter is for persons planning to work in the professional curriculum of teacher education. Status of teacher education, selection, curriculum, certification, graduate programs, trends, and research. (3 cred. per qtr.; prereq. for 285: 15 cred. in education including 184 and 250 or H.Ed. 182 or E.Psy. 250 or #; prereq. for 286: 285 or #) Grim

EDUCATIONAL ADMINISTRATION (Ed.Ad.)

General Courses

124f. Public School Administration. Organization, administration, and general support of public schools in state and local school districts. (3 cred.; prereq. 9 cred. in education) Neale

210s. Financial Aspects of Public School Business Administration. Financial program planning, budgeting, accounting, cost finding, income and expenditure control; and the preparation and analysis of financial reports. (3 cred.; prereq. 227) Neale

225f. Pupil Personnel Administration. Child accounting records and reports, attendance department, school census, pupil adjustment and progress, pupil health and safety, and legal aspects of pupil personnel administration. (3 cred.; prereq. 124) Neale

226s. School Plant Planning and Management. Plant program planning and financing, including operation and maintenance of public school buildings. (3 cred.; prereq. 227) Neale

227w. Teacher and Employee Administration. Selection and placement of school employees, salary schedules, conditions of service, records and reports, and legal aspects of teacher and employee personnel administration. (3 cred.; prereq. 225) Neale

228f,w,s.* Special Problems in Educational Administration. Designed primarily for superintendents and principals qualified to make intensive studies of specific problems related to the administration of a school system. (1 to 3 cred. per qtr.; prereq. 225) Neale

230f. Public Relations for Schools. Theory and practice of educational interpretation. Principles involved; machinery and personnel; techniques of working with groups; the teacher's contacts with the community; the role of the pupil; professional and lay organization. (3 cred.; prereq. 225) Neale

235f,w,s. Seminar in Educational Administration. Enrollment limited to candidates for Master's degree under Plan A and candidates for Ph.D. degree in educational administration. (No cred.) Neale

236f,w,s. Field Study in Educational Administration. Part of the requirements for the certificate, Specialist in Education. The 10 credits which may be earned will be based on a written report covering an approved field study. Students may register for the general planning and organization of their study without credit. (0 to 10 cred.; prereq. #) Neale

Elementary Education

115w. Organization of the Elementary School. Problems relating to the organization for instruction and classification of pupils in elementary schools with critical examination of current practices. (3 cred.; prereq. 9 cred. in education) Goossen

200f. Seminar in Elementary School Administration. Especially for elementary school principals. Problems of administration and organization of instruction in the elementary school. (3 cred.) Archer, Goossen

Secondary Education

133f. Basic Procedures in Student Personnel Work. Basic principles and current practices in development and operation of a student personnel program. Emphasis on broad areas of guidance services and related techniques. (3 cred., §E.Psy. 133; prereq. 9 cred. in education) Dugan

167f. Junior High School. Sources of the movement; purposes, functions, and limitations; types of reorganization; fundamental problems of reorganization; reorganization of subject matter. (3 cred.; prereq. 9 cred. in education) Bossing

218f,w,s. Recent Literature in Secondary Education. Seminar on current problems and literature in secondary education. (Cred. ar.) Bossing, Mitchell

263f. Organization of the Secondary School. Organization of secondary school units, internal organization for administration and supervision. (3 cred.) R. Keller

264w. Administration of Instructional Activities in the Secondary School. Curriculum, teacher selection, schedule making, extracurricular activities, guidance, pupil control. (3 cred.) R. Keller

265s. Administration of Noninstructional Activities in the Secondary School. Housing, forms, records, marks, finance, reports, and community relationships. (3 cred.) R. Keller

270f,w,s.* Special Problems in Secondary Education. Primarily for those qualified to undertake research. (Cred. ar., maximum 9 cred.; prereq. ♯) Bossing, R. Keller

Higher Education

253. Administration in Higher Education. Control, faculty and employee personnel administration, budget making and administration, financial accounting and reporting, protection of college funds, public relations. (3 cred.; offered when staff permits) Darley, Morse

274w. The Junior College. Present status of the junior college, its development, functions, organization, curriculum, and probable trends. (3 cred.) R. Keller

290. Financing Higher Education. (3 cred.; prereq. ♯; offered when staff permits) Neale

291. Public Relations for Colleges and Universities. (3 cred.; prereq. ♯; offered when staff permits) Neale

EDUCATIONAL PSYCHOLOGY (E.Psy.)

General Courses

116f. Introduction to Statistical Methods. Simpler statistical techniques in educational work. Comprehension of literature using elementary statistical concepts and methods. Not equivalent to E.Psy. 216, 216A. (3 cred.; prereq. ¶116A or ♯; not open to Master's or Ph.D. degree candidates who will take more than one quarter of statistics)

116Af. Introduction to Statistical Methods—Laboratory. (See E.Psy. 116) (2 cred.)

120f,s. Basic Principles of Measurement. Principles of measurement applied to the construction and evaluation of tests and to the interpretation of scores. (3 cred.; prereq. 60 or equiv.) C. Hoyt, D. Johnson

125f,w. Group Dynamics in Education. Survey of selected literature on group dynamics; practical application of social-psychological concepts to the analysis of group behavior. (3 cred.) Flanders

126s. Analysis of Behavior in Groups. Practice in the analysis of group behavior by laboratory experimentation; individual projects with class help. (3 cred.; prereq. 125) Flanders

133f. Basic Procedures in Student Personnel Work. (See Ed.Ad. 133) (3 cred., §Ed.Ad. 133; prereq. 9 cred. in education) Dugan

140w. Instruments and Techniques of Measurement. An intensive study of selected instruments for measuring intelligence, achievement, interests, attitudes, and personality traits with emphasis upon their use in educational guidance, personnel work, administration, and supervision. (3 cred.; prereq. 120 or equiv.) Edson

142f,w. Individual Mental Testing. Revised Stanford-Binet and Wechsler-Bellevue Adult or Wechsler Intelligence Scale for Children. Student supplies materials for at least one test. Full day or two mornings per week required for practice administration of tests. (3 cred.; prereq. 120 or equiv.) Reynolds

143s. Advanced Individual Mental Testing. Development of proficiency in administering and interpreting three or four selected individual mental tests. (3 cred.; prereq. 142 and ♯) Reynolds

148w,s. Clinical Diagnosis of Reading Difficulties. Psychology of reading difficulties; emphasis on clinical diagnosis of reading problems, their relationship to psychological factors, and their clinical remedial correction. (3 cred.; prereq. Ed.C.I. 145 and 9 hours of psychology or educational psychology) Bond, Reynolds

150f,w,s. Clinical Practice in Remedial Teaching. Practice in remedial tutoring of individual children who have experienced difficulty in school learning. (3 cred.; prereq. Ed.C.I. 145 or Ed.C.I. 151, ♯) Bond, Clymer, Reynolds

151f,w,s. Clinical Practice in Educational Diagnosis. Practice in diagnosis of school learning problems. Includes measurement, interview technique, preparation of case reports, etc. Work with children referred to the Psycho-Educational Clinic. (3 cred. per qtr.; prereq. 142, Ed.C.I. 145, and ♯) Bond, Reynolds

159f,s. Personality Development and Mental Hygiene. Survey course emphasizing understanding of personality development and mental hygiene for self and others. 159f for seniors and first year graduate students only—special reference to elementary and secondary classroom conditions. 159s for graduate students only—attention given to basic theory, group and individual procedures in treatment. (3 cred.) Wrenn

182f. Education of Exceptional Children. Overview of the field of special education. Especially for classroom teachers, counselors, supervisors, and administrators; also the initial course for students working for special class certificates. (3 cred.; prereq. Ed. 55B or Ed.C.I. 71C or equiv.) Reynolds

183s. Education of Gifted Children. Abilities and characteristics of intellectually gifted children and adults. (2 cred.; prereq. Ed. 55B or Ed.C.I. 71C or equiv.) Bond

184s. Education of the Slow-learning Child. (2 cred.; prereq. 182) Reynolds

Note—Courses 185, 186, 187 pertaining to the education of the auditorially handicapped child, the visually handicapped child, and the crippled child are offered periodically in Summer Sessions.

208w.* Methods in Educational Research. Methods and techniques employed in the investigation and report of educational problems. Suggested for all candidates for degrees. (3 cred.) P. O. Johnson

216f-217w-218s. Statistical Methods in Education. Designed to lay the foundations of statistical theory and to give practice in applying the theories in the solution of educational and psychological problems. (3 cred. per qtr.) P. O. Johnson

216Af-217Aw-218As. Statistical Methods in Education—Laboratory. For students who wish more experience in the solution of problems and the use of machines than is obtained in the lecture course 216-217-218. (2 cred. per qtr.) P. O. Johnson, Moonan

219s. Design and Analysis of Statistical Investigations. Functional approach to principles of efficient design of experiments and other types of observational programs; improved sampling techniques and appropriate methods of analyzing observational results. (3 cred.; prereq. 218, ♯) P. O. Johnson

219As. Design and Analysis of Statistical Investigations—Laboratory. Applicational extension of 219. (2 cred.; recommended for all students taking 219; prereq. 218, ♯; sections limited to 16 students) P. O. Johnson, Moonan

220w-221s. Advanced Theory of Measurements. Principles underlying construction and use of psychological and educational measuring instruments and the limitations of tests for purposes of measurement in experimentation and evaluation of students' work. (2 cred. per qtr.; prereq. 60 or 120, 216 or equiv.; offered when staff permits)

225w. Diagnosis as a Phase of Counseling. An advanced course covering personality concepts involved in diagnosis, principles of diagnosis, and practice in essential diagnostic skills and in recognition of common diagnostic errors. (3 cred.; prereq. 140 or ¶140, and one of the following: 133, 250, or Psy. 130) Wrenn

226s.* Interviewing Procedures in Counseling. An advanced course covering various approaches in counseling, practice in interviewing skills, concepts of therapy, analysis of student and counselor attitudes in counseling. (3 cred.; prereq. 225 or equiv.) Wrenn

233f,w,s.* Problems in Guidance and Personnel Work. Investigation of particular problems in the personnel field on an individual basis. No class meetings. (1 to 9 cred.) Dugan, Wrenn

240f,w,s.* Problems in Measurement. Intensive study and individual research in problems of educational measurement. (3 cred. per qtr.) P. O. Johnson

243f,w,s.* Problems in Statistics for Students in Education and Psychology. A problems course devoted to recent developments in statistical science with special reference to their application to educational and psychological problems. (3 cred. per qtr.) P. O. Johnson

253f,w,s.* Research Problems. (Cred. ar.; prereq. #) Staff

260f,w,s. Educational Psychology Seminar. For all Ph.D. majors in educational psychology. Purposes include: integrating course work in all areas of educational psychology and related fields, analyzing new developments, and presenting Ph.D. dissertation outlines. (No cred.) Staff

280f,w,s. Practicum in Group Leadership. Supervised practice in leading a discussion or activity group. (3 cred.; prereq. #) Flanders

290s. Individual Differences. A study of group and individual differences and their relations to educational practice. (3 cred.) Flanders

293w.* Psychology of Learning. Principles and research in human learning and their implications for curriculum and instruction. (3 cred.; prereq. 12 cred. in psychology and educational psychology) Mork

294s.* Recent Theory and Research in Human Learning. (3 cred.; prereq. #) Mork

Secondary Education

134w. School Counseling Procedures. Emphasis upon basic principles and practices related to the work of counselors in the public schools. Lectures, discussion, audio-visual aids, practice in case study analysis and interviewing. (3 cred.; prereq. 120, 133, #) Dugan

158s. Psychology of Adolescence. Study of changes characterizing the transition from childhood to adult life. (3 cred.; prereq. Ed. 55B or equiv.)

282f,w,s. Practice in High School Personnel Work. Experience in counseling, testing, and related personnel work procedures in the high school program. (3 cred.; prereq. #) Dugan

Higher Education

250f. College Student Personnel Work—Development and Administration. For advanced students planning to become personnel workers, teachers, or administrators in college or university. Place of student personnel program in the institution, administration, coordination, and evaluation of program. (3 cred.; prereq. one course in higher education or #) Wrenn

251f,w,s. College Student Personnel Work. Weekly seminar discussions of specialized phases of college student personnel and noneducational personnel work. 251f: student activities. 251w: personnel services. 251s: coordination with nonacademic personnel procedures. (1 to 3 cred. per qtr.; prereq. 250 or other course in higher education) Wrenn

254s.* Measurement and Evaluation in Higher Education. A consideration of the examination program in American institutions of higher learning; principles of examination construction at the college level; the design of investigations and the critical evaluation of investigations in higher education. (3 cred.) P. O. Johnson

281f,w,s. Practice in Personnel Work. Supervised experience in counseling at college and adult levels. Student Counseling Bureau section, three consecutive quarters beginning fall; other assignments any quarter. (3 cred. per qtr.; prereq. 225-226, or #) Wrenn, Hagenah

HISTORY AND PHILOSOPHY OF EDUCATION (H.Ed.)

Courses

101f. Historical Foundations of Modern Education. Historical analysis and interpretation of important elements in modern education derived from the Greeks, Romans, the Middle Ages, and the Renaissance. (3 cred.; offered when demand warrants) Ellis

110w,s. Intercultural Education. A study of racial, religious, and nationality problems with special reference to their importance for the schools. (3 cred.; offered when staff permits)

131w. Comparative Education. Compares European, Asiatic, and American systems and philosophies of education. Emphasis on exploring the possibilities of international education. (3 cred.) Beck

141f. Critical Issues in Contemporary Education. Designed to introduce graduate students to ideas involved in current theory and practice. (3 cred.) Beck

156. History of Ideas in American Education. Selected readings in American political, economic, and social development with reference to the emerging system of public education. (3 cred.) Ellis

178w. Education and Problems of American Democracy. An exploration of the possibilities of building a democratic discipline in the school. (3 cred.) Ellis

179f. Critical Thinking for Teachers. Examination of typical education materials for the purpose of increasing the ability of teachers to think more logically, to read and listen more critically, and to convey these abilities to students. (3 cred.)

180f,w,s. The School and Society. Selected readings in social science and philosophy give the student an opportunity to integrate points of view in thinking about the roles that the school plays in present-day society. (3 cred.; prereq. Ed. 55A-B or Ed. 71A-B-C) Beck, Ellis

182s. Comparative Philosophies of Education. An intensive examination of competing philosophies of education. (3 cred.; prereq. 141) Beck

241f,w,s.* Problems in the History and Philosophy of Education. For students interested in research and original work in these areas. (Cred. ar.; prereq. ♯) Beck, Ellis

242s. Seminar in Educational Philosophy. For advanced students of educational philosophy; critical study and discussion of special problems in educational philosophy. (3 cred.; prereq. ♯) Beck, Ellis

HOME ECONOMICS EDUCATION (H.E.Ed.)

Prerequisites—For a major or a minor in Home Economics Education, prerequisites that are satisfactory to the major advisers in this field must be presented.

Master's Degree—Requirements for the Master's degree (Plan A or B) will be found on pages 9-13 of this bulletin.

Doctor's Degree—Students with a primary interest in home economics education may become candidates for the Ph.D. with a major in education toward which they may count credits earned in home economics education courses. For general requirements see pages 13-21.

Courses

192f. Evaluation in Home Economics. Measuring progress toward important goals in different areas of home economics; available tests and other evaluation materials; construction and refinement of various evaluation instruments. Elementary statistical techniques useful to home economics teachers. (3 cred.; prereq. 91, 93, Ed. 55A-B) Rose

193Aw,s. Home Economics Curriculum. (Secondary level) Contributions of home economics at elementary and secondary levels; techniques employed in curriculum planning and reconstruction. (3 cred.; prereq. 94 or ♯) Rose

193Bw,s. Home Economics Curriculum. (College level) The place of home economics in higher education and problems which are acute today; curriculum offerings; teaching schedules and load; appropriate reference materials. (3 cred.; prereq. ♯) Rose

194Af,w,s. Adult Education in Home Economics. Objectives of adult education in homemaking; problems affecting community and family life; methods of

helping adults and out-of-school youth in solving problems in home living. (3 cred.; prereq. 91, 93 or equiv.) Ford

194Bs. Adult Education in Home Economics. Planning a community program; teaching procedures; special problems. Planned for teachers and supervisors of adult education. (3 cred.; prereq. 91, 93 or equiv., 194A or ‡) Ford

195s. Space, Equipment, Furnishings, and Materials for Home Economics Departments. Study of remodeling old and planning new departments, and equipping and furnishing them. Review of research; investigation of special problems. (3 cred.; prereq. H.E. 49, H.E.Ed. 91, 93) Rose, Kafka

197f,w,s. Organization and Methods for Related Art Teaching. Aims to develop a working philosophy of related art. Courses planned and methods studied to relate art and home economics subject matter in various aspects of home and community life. (1 to 3 cred.; prereq. 91, H.E. 180 or equiv.) Esteros

243f,w,s. Trends in Home Economics. The place of home economics in the educational program today; the ways in which content and procedures are being modified to meet changing conditions. (3 cred.; prereq. ‡) Rose

292s.* Problems in Evaluation. A continuation of 192, with emphasis upon individual problems in the field of evaluation. (3 cred.; prereq. ‡)

293f,w,s.* Problems in Home Economics Education. Designed to meet the needs of advanced students for independent study of current educational problems. (1 to 9 cred.; prereq. 294 recommended, ‡) Rose, Ford, Esteros

294f,w,s.* Research Methods. Study of methods used in collection, treatment, and interpretation of data in areas of home economics; the writing of a technical report. (3 to 6 cred.; prereq. 192, ‡) Rose

295f,w,s.* Seminar in Home Economics Education. Discussion and reports on problems in the field of home economics education. (1 cred. per qtr.) Rose, Esteros, Ford

INDUSTRIAL EDUCATION (Ind.)

100f. Industrial Instruction. Concepts and techniques of instruction in three phases of industrial teaching—industrial arts, trade and industrial schools and classes, and training-within-industry programs. (3 cred., §70; prereq. 42, Ed. 55B)

101s. Tests in Industrial Subjects. Study and application of principles of evaluation to shop and drawing subjects. (3 cred.; prereq. Ed. 55B)

102w. The General Shop (not a shop course). Purpose of general shop organization; current practice as to types of shops, equipment, instructional materials and procedures, pupil personnel plans, etc. (2 cred.)

103w. Instructional Aids. Consideration of various instructional aids; planning, constructing, using. (3 cred.; prereq. 70 or equiv.)

105s. Administration of Industrial Education. General and vocational phases considered; objectives, programs, and practices; laws, rulings, and standards for aid; significant literature. (3 cred.; prereq. 61, 80 or equiv.)

106. Industrial Education Workshop. Provides opportunity for intensive study of problems in industrial education. Areas of concentration will vary with each successive offering. (3 to 6 cred.; prereq. teaching experience, ‡)

107f. Coordination. Province and duties of coordinators in trade schools, part-time programs, and cosmopolitan high schools. Information, guidance, and training for those having interest in this new type of school work. (3 cred.; prereq. 60, 61, or 125, or ‡)

109w. Conference Leading for Industry. Purposes, advantages, and limitations of conference method. Instruction in techniques of conference procedure. Experience in planning, leading, and evaluating conferences and in writing summaries. (3 cred.; prereq. ‡)

110s. Vocational Guidance. History of the educational and vocational guidance movement; typical public school means and methods; types and uses of occupational information; duties of the counselor; organization and relationships. (3 cred.; prereq. Ed. 55B)

111. Instructional Materials Laboratory for Nonmajors. An activity course for experienced elementary teachers, recreation leaders, and others needing manipulative skills and craftwork activities in their teaching; individual and group projects, study of instructional materials. (3 cred.; prereq. teaching experience or #)

115. Supervision of Industrial Education. Principles of creative supervision applied in industrial teaching; analysis of duties, organization for supervision. (3 cred.; prereq. 60, 80, or 105)

125s. Philosophy and Practice of Industrial Education. History, objectives, development, and current practices of the field. Industrial arts as general education, and school preparation and upgrading for trade teachers. (3 cred., §60, §61)

135f. Industrial Course Construction. Principles and techniques of course construction and unit development; experience in planning, organizing, and building a teaching guide. (3 cred., §40, §42)

136. Instructional Materials Laboratory. Provides intensive laboratory and shop experiences on new materials, processes, and equipment; leads to development of complementary instructional materials by individual enrollees. (3, 6, or 9 cred.; prereq. major, teaching experience, or #)

150. Vocational Education Surveys. Practices and techniques in the study of communities or areas for the establishment or improvement of occupational courses and facilities. (3 cred.; prereq. 105 or 125 or equiv.)

172. Part-time Education. Covers justification for part-time education; social and economic background; organization of classes, study of special student groups, courses of study; typical schools; comparative state legislation and plans, reimbursement. (3 cred.; prereq. 60, 61 or 125)

200f,w,s.* Research Problems. Independent work for the degrees, master of arts, Plan B, and master of education, Plan Y. Individual conferences. (3, 6, or 9 cred. per qtr.; prereq. approval of candidacy)

205f,w,s. Seminar in Industrial Education. (No cred.; required of all candidates for advanced degrees) Graduate staff

250f-251w. Literature of Industrial Education. Survey of printed reports; critical analysis; selection of thesis problems; formulation of work plans; reports of progress; organization and presentation; acquaintance with types of literature. (6 cred.; prereq. #)

MUSIC EDUCATION (Mu.Ed.)

103f. Psychological Foundations of Music Education. (3 cred.; prereq. #) Caswell

104s. Advanced Topics in Vocal Music Education. Designed for experienced teachers and qualified students, this course deals with special topics in vocal and choral music education. (3 cred.; prereq. #) Caswell

105w. Advanced Topics in Instrumental Music Education. Designed for experienced teachers and qualified students. (3 cred.; prereq. #) Ivory

224f,w,s. Research Problems. Individual projects; guidance; remedial procedures; interrelationships. (3 cred. per qtr.; prereq. knowledge of elementary statistics) Ivory

PHYSICAL EDUCATION (P.E.)

In this section are included courses in health education, physical education, and recreation. A student may emphasize any of these fields in selecting his courses. Additional offerings in health education are listed under Curriculum and Instruction.

101w. Principles of Physical Education. The aims and scope of physical education with special treatment of its place in education. (3 cred.; prereq. 55) L. F. Keller

103s. Physical Inspection. The responsibility of the physical education instructor in the examination of pupils, assisting the physician, follow-up pro-

cedures, and keeping of records. (3 cred.; prereq. 51, Anat. 57, P.H. 91, P.H. 92) Osell

105f. Conservation of Natural Resources. To develop an understanding of the importance of our natural resources and of their relation to recreation and outdoor education. (2 cred.; prereq. 64A-B) Chapman

107w. Camp Administration. To help prepare qualified personnel for responsibilities of camp administration. (3 cred.; prereq. 46, #) Osell, Ostrander, Thorpe

110w. Recreation Surveys. The techniques of and practice in making community recreation surveys. (3 cred.; prereq. 57, 58) Fitzgerald

111f. Recreation Areas and Facilities. A study of orientation, design, planning, and standards for recreation buildings and areas. (3 cred.; prereq. 57, 58) Giles

112s. Programming in Recreation. Principles of program planning for an organized offering of recreation opportunities. (3 cred.; prereq. 57, 58) Chapman

113w. Physical Education in the Elementary School. The elementary school child, curriculum, adaptations of instructional procedures, classification, evaluation, and the influence of modern educational thinking upon problems commonly met at this level. (3 cred.; prereq. experience with the elementary school age level or #) Baker

114s. Administration of the School Health Education Program. Curriculum construction, health supervision and guidance, relationships between public schools and governmental health organizations and agencies, and evaluation. Guidance in the solution of individual professional problems. (3 cred.; prereq. 83, P.H. 50 or equiv. or #) Slocum

115f. Recent Literature and Research in Mechanics of Movement. Techniques of mechanics and kinesiology of movement; consideration of a variety of skills; an evaluation of pertinent methods and devices used in current research; application to individual projects. (3 cred.; prereq. undergraduate course in kinesiology or #) Wilson

116s. Community Recreation Resources and Organizations. Presentation of community recreation agencies; interpretation of relationships among agencies in the field of recreation. (3 cred.; prereq. 110, 111, 112) Ostrander

117w. Advanced Course in School Health Instruction. Instructional problems in school health education at all levels. Application of course to individual problems. (3 cred.; prereq. 83 or #) Slocum

121s. Principles of Recreation Methods. Stresses leadership methodology in all aspects of recreation. (3 cred.; prereq. Ed.T. 84A-B-C) Fitzgerald

123f. An Advanced Course in Methods of Teaching Physical Education. Instructional procedures for the activity program. Method problems common in the various activities, as well as those peculiar to each activity; possible solutions for current instructional problems. (3 cred.; prereq. #) Baker

124s. Supervision of Physical Education. Function, organization, and administration of supervision in physical education; adaptations of accepted procedures for observation, guidance, and training of teachers in the field; problems peculiar to supervision of physical education. (3 cred.; prereq. #) Baker, Jaeger

125w. Curriculum Trends in the Professional Preparation of Teachers of Physical Education. Philosophy and objectives, characteristic curricular patterns and standards, present trends, and current needs and issues of the professional education curriculum. (3 cred.; prereq. teaching experience or #) Jaeger

130f. Contributions of Basic Sciences to Physical Education. Understanding of recent pertinent research in basic sciences. (3 cred.; prereq. #) Wilson

131f. Industrial Recreation. History, scope, place, and relationship of management-employee recreation. (3 cred.; prereq. #) Fitzgerald

135w,s. Tests and Measurements in Physical Education. Critical analysis of existing tests and testing methods in physical education including all curricular levels. Use of tests in physical activity programs. Application of the principles of test construction to specific problems. (3 cred.; prereq. 10 cred.

in physical education, E.Psy. 60 or equiv.) Wilson (w), for women, including elementary level; L. F. Keller (s), for men

141f. Introduction to Hospital Recreation. The general field of recreation in hospitals as background for the recreation leader, hospital administrator, and other personnel. (3 cred.; prereq. ♯) Chapman

142s. Leadership in Hospital Recreation. The purpose is to develop an understanding of the application of leadership methodology to recreation in hospitals. (3 cred.; prereq. 141) Chapman

143w. Programming in Hospital Recreation. All aspects of planning recreation programs for various types of hospital patients. (3 cred.; prereq. 141, 142) Chapman

155s. Instructional Aids in Health, Physical Education, and Recreation. Evaluation, construction, and use of instructional materials stressing audio-visual aids. (3 cred.) Piper

221s. Seminar in Physical Education. Discussion of individual projects and current problems in physical education. Consult adviser. (No cred.)

224f,w,s.* Research Problems in School Health Education, Physical Education, and Recreation. Individual problems in areas of philosophy, methods, curriculum, evaluation and measurement; all curricular levels. (Cred. ar.; prereq. ♯) Baker, Fitzgerald, L. Keller, Nordly, Piper, Wilson

236f. Recent Literature and Research in Physical Education and Recreation. Research methods applied to physical education and recreation; preparation of designs for research problems. (3 cred.) Nordly

238f. Administration of Physical Education in Colleges and Universities. Problems connected with the administration of the facilities and programs in physical education and athletics in institutions of higher education. Field trips and surveys of neighboring colleges. (3 cred.; prereq. 63 or ♯) L. F. Keller

240f. Legal and Financial Aspects of Recreation. Federal, state, and local recreation laws; sources of funds for public and private recreation agencies; and agency liability. (3 cred.) Fitzgerald

241w. Administration of Public Recreation. Basic principles in the administration of recreation as a government service. (3 cred.) Fitzgerald

242s. Community Organization for Recreation. Nature, scope, principles, and procedures in community organization with particular attention to those principles and practices that have reference to community organization for recreation. (3 cred.; prereq. ♯) Fitzgerald

244w. Construction and Administration of the Physical Education Curriculum. The application of principles of curriculum construction to physical education. Problems encountered in the attainment of objectives in the several phases of the program. (6 cred.; prereq. 63, 101 or equiv.) Nordly

250s. The Administration of Health Education, Physical Education, and Recreation. Current problems of school administrators. (3 cred.; not for physical education majors) Nordly, others

261As. Seminar in Contemporary Problems in Physical Education. Individual presentation and class discussion of (a) studies completed by class members; (b) contemporary problems selected by class members; and (c) National Conference Reports. (3 cred.; prereq. consent of adviser) Nordly, others

261Bf,w. Seminar in Contemporary Problems in Recreation. (Cred. ar.; prereq. consent of adviser) Fitzgerald, others

ELECTRICAL ENGINEERING

Professor
Henry E. Hartig
Loyst C. Caverley
John H. Kuhlmann
Joseph M. Pestarini
William G. Shepherd
Aldert van der Ziel

Associate Professor
LeRoy T. Anderson
Adrianus J. Dekker
Lawrence A. Harris
Sidney C. Larson
O. William Muckenhirn

Assistant Professor
James C. Barnes
Robert F. Lambert

Prerequisites—For work in electrical communication, industrial electronics, or power engineering, completion of the corresponding work required by the current *Institute of Technology Bulletin* of candidates for the B.E.E. or B.S. degree or equivalent.

Language Requirement—For the Ph.D. degree, either (a) two foreign languages or (b) one foreign language and the option of a special research technique.

Master's Degree—Offered under Plan A. Plan B will be accepted only on petition to, and action by, the Electrical Engineering Graduate Committee.

Doctor's Degree—The department offers work leading to the Ph.D. degree.

[Professional degrees in engineering—These degrees are administered by the Institute of Technology.]

Courses

Work Offered Toward the Minor Requirement for Graduate Students Not Majoring in Electrical Engineering

109. Electric and Magnetic Fields. Static and quasi-static electric and magnetic field theory, the dynamics of charged particles in fields. (3 cred.; prereq. M.&M. 26 or ♯) Staff

111-113-115. Electrical Engineering. Electric circuit analysis. (5 cred. for 111, 3 cred. per qtr. for 113 and 115; prereq. M.&M. 26 and Phys. 50) Anderson, others

112-114-116. Electrical Engineering Laboratory. Experimental study of electric circuits. (2 cred. for 112, 1 cred. per qtr. for 114 and 116; prereq. ¶111-113-115) Barnes

117-119. Engineering Electronics. Fundamental theory of electronic devices. (3 cred. per qtr.; prereq. 109 and 111; 3 rec. hours per week) Muckenhirn, others

118-120. Engineering Electronics Laboratory. (1 cred. per qtr.; prereq. ¶117-119; 2 lab. hours per week) Muckenhirn, others

121-123-125. Electrical Engineering. Principles and construction of electric machinery. (3 cred. per qtr.; prereq. 115, 116) Kuhlmann, Caverley, others

122-124-126. Electrical Engineering Laboratory. Laboratory study of electric machinery. (2 cred. per qtr.; prereq. ¶121-123-125; 3 lab. hours per week) Kuhlmann, Caverley, others

127-128-129. Transient Electrical Phenomena. Study of electric circuits during sudden changes of conditions. Classical and Laplace transform methods of analysis applied to electric circuits and machines, and use of the oscillograph in the analysis of these problems. (3 cred. per qtr.; prereq. 123, 162, I.T.M. 80; 2 lect., 2 lab. hours per week) Barnes

131-133-135. Electronic Circuit Design.** Study of practical circuits and components for design of industrial electronic applications, amplifiers, oscillators, etc. (3 cred. per qtr.; prereq. 163; 2 rec., 2 lab. hours per week) Anderson, others

132-134-136. Type Study of Electric Machines.** Uniformly applicable principles, prediction of performance, steady and transient behavior, direct current generators and motors, alternating current transformers, generators, and synchronous motors. (3 cred. per qtr.; prereq. 125) Caverley, others

** One sequence may be included in the major work by M.S. candidates who have satisfied the Electrical Engineering Department's requirements for the combined B.S. degree-graduate program (*Institute of Technology Bulletin*).

138-139-140. Power Systems.** Short-circuit currents in power networks; unbalanced loads in polyphase circuits, transformers, and motors; harmonics; stability of power systems under steady state conditions. Application of relay, oil circuit breakers, and lightning arresters to power systems for protection of apparatus and service. (3 cred. per qtr.; prereq. 125) Caverley

143-144-145. Electromechanical Vibrating Systems. Study of the steady state response of electromechanical systems. Electromechanical analogies. Transducers. Vibration damping, filters, and noise control. Introduction to mechanical wave motion. (3 cred. per qtr.; prereq. I.T.M. 80 and M.&M. 127 or Phys. 101) Lambert

157-158-159. Industrial Electronics.** Theoretical and laboratory study; applications to X ray, dialectric heating, precipitation, servomechanisms, etc. (3 cred. per qtr.; prereq. 163; 2 rec., 2 lab. hours per week) Murphy

161-162-163. Electric Communications. Theoretical and laboratory study of communication networks and lines. Transmission lines, four-pole network analysis, matching, corrective, and filter networks. Radio communication circuits, modulation. (4 cred. per qtr.; prereq. 119; 3 rec., 2 lab. hours per week) Staff

164-165-166. Communications.** Theoretical and laboratory study of selected topics in communications. Transistor theory and circuit applications, large-signal analysis, graphical methods, pulse circuits. Noise, elements of information theory, Fourier integral methods, pulse modulation. Net-work theory, system functions, complex frequency, Foster's theorem. Filter design. (3 cred. per qtr.; prereq. 163; 2 rec., 2 lab. hours per week) Staff

167-168-169. Radio Communication.** Maxwell's equations. U.H. frequency transmission and reception, microwaves, waves guides. (3 cred. per qtr.; prereq. 163; 2 rec., 2 lab. hours per week) Staff

190. Theory and Application of Nonsinusoidal Wave Forms. Transmission of pulses through linear networks, design of pulse amplifiers, generation of nonsinusoidal wave forms, time basis, cathode ray oscilloscopes. (3 cred.; prereq. 127, 163) Anderson

Advanced Courses in Electrical Engineering

187-188-189.* Communication Seminar. Study and discussion of current articles on communication or allied topics. (1 cred. per qtr.; prereq. #) Hartig

191-192-193.* Graduate Seminar. Discussions of problems in power circuits and machinery. (1 cred. per qtr.; prereq. #) Caverley

194-195-196. Servomechanisms. Transient and sinusoidal response of servomechanisms, stability analysis, synthesis of servosystems, nonlinearity, power requirement. (3 cred. per qtr.; prereq. 115, I.T.M. 80; 3 lect. hours per week in 194, 2 lect. and 2 lab. hours per week in 195 and 196) Murphy

197-198-199. Advanced Electrical Design. A study of the methods and procedures for the design of standard equipment for specific performance characteristics and for the design of special apparatus. Special problems in rotating machinery design including study of harmonics in air gap flux wave and their effect upon performance; study of starting of synchronous motors. Transformers for control and electronic applications including audio-transformers. (3 cred. per qtr.; prereq. 132-134-136) Kuhlmann

201-202-203. Advanced Industrial Electronics. Continuation of 157-158-159. (3 cred. per qtr.) Staff

204-205-206. Metadyne Statics and Linear Dynamics. Canonical currents, fundamental theorems, characteristics, classifications, commutation. Applications: metadyne transformers, generators, motors, complex metadynes, amplifier metadynes, pliodynes. Supplemental: Laplace transformation and matrix calculus. Periodics: generalization, permanent operation under alternating

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current, polar and chronometric diagrams, geometry on the Gauss plane. Applications: invariants in periodic operation, generalized resonance, commutation under alternating current. (3 cred. per qtr.; prereq. 132-134-136) Pestarini

207-208-209. Nonlinear Dynamics. Linear transients, applications concerning amplifier metadynes, nonlinear transients, approach through integration of special differential equations, approach through matrix calculus. Linear stability: stabilizing and stimulating power, energetic principles, stability criteria. Combinatory: some Cybernesis systems (servomechanisms), general theorems, system elements, combination of elements and their stability. Quasi periodic operation (Traction). Supplemental: matrix and tensor calculus. (3 cred. per qtr.; prereq. 204-205-206) Pestarini

211-212-213. Advanced Network Analysis. The study of networks by advanced methods. Particular emphasis on active networks, feedback, stability, and physical realizability, topics in design of impedance functions. Applications of general theorems to design of equalizers, input and output circuits, and interstage networks, applications to servomechanisms. (3 cred. per qtr.; prereq. #) Hartig

227-228-229. Stability of A.C. Power Systems. A study of A.C. power systems, including the system design factors which affect the problem of stability. The relation of both steady state and transient conditions to stable operation of power distribution systems. (3 cred. per qtr.; prereq. 138-139-140) Caverley

230-231-232. Introduction to the Properties of Solids. Classical statistical theory of matter, thermal properties of solids, metals and alloys, ionic crystals and their dielectric properties, wave mechanics and its application to the structure of atoms and molecules, the electron theory of metals. (3 cred. per qtr.; prereq. Phys. 101, 103, 105, or equiv.) Dekker

233-234-235. Fluctuation Phenomena. Introduction to the theory of fluctuating quantities with applications to electrical engineering. A study of circuit noise, vacuum tube noise and semiconductor noise, and their influence upon the performance of amplifiers, mixers, solid state devices, detectors, and sensitive measuring equipment. (2 cred. per qtr.; prereq. #) van der Ziel

236-237-238. Solid State Theory. Continuation of 230-231-232 on a more advanced level. The band theory of solids, metals, insulatory, and semiconductors, color centers in ionic crystals, photoemission, photoconductivity, luminescence, magnetic properties of solids. (3 cred. per qtr.; prereq. 230-231-232) Dekker

239-240-241. Solid State Devices. Applications of solid state theory to electronics. Study of the thermionic emission, secondary emission, photoemission, photoconduction, semiconductors, and semiconductor devices including transistors, piezoelectricity, dielectric and magnetic phenomena. (3 cred. per qtr.; prereq. 230-231-232)

255-256-257. Analysis of A.C. Power-Systems Circuits. Application of specialized network theorems and equivalent circuits to the study of A.C. generators, motors, transformers, and transmission lines. The study of the behavior of A.C. equipment under unbalanced conditions by the use of symmetrical components. Transients in machines and associated circuits. (3 cred. per qtr.; prereq. 138-139-140) Caverley

261-263-265. Advanced Communication. Applications of basic electromagnetic theory to problems in electrical engineering. Studies of antennas, free space transmission including refraction and diffraction phenomena, wave guides, and circuits. Static electric and magnetic fields with applications to the motions of charged particles. Interaction of electromagnetic fields with electron streams. (3 cred. per qtr.; prereq. Phys. 101-103-105 or equiv.) Shepherd

262-264-266. Communication Seminar. Study and discussion of current literature. (1 to 3 cred. per qtr.; prereq. #) Shepherd

267-268-269. Theory of Communication. Study of modern methods in information theory, rates, channel capacity, coding. Fourier integral methods, optimum linear filtering and prediction. Examination of amplitude, frequency and various pulse modulation schemes, their capacities and noise properties. (3 cred. per qtr.; prereq. #) Harris

272-273-274. Electromechanical Vibrating Systems and Engineering Acoustics. Theoretical discussion of the production of sound by electrically driven vibrating systems, sound transmission, reflection, absorption. Laboratory study of vibrating systems, pipes, horns, absorbing materials, sound pressure, articulation, reverberation, resonance, sound filters. (3 cred. per qtr.; prereq. ‡) Hartig, Lambert

275-276-277. Advanced Electric Design. Special problems. (3 cred. per qtr.; prereq. 132-134-136) Kuhlmann

287-288-289. Vacuum Tube Analysis. Theoretical study of the physics of vacuum tubes apart from circuit applications. Electron sources, field problems, electron dynamics in static fields, electron optics. Space-charge effects, diode, triode, and pentode characteristics. Electron beam production and focusing. Electron dynamics in time-varying fields, high-frequency effects, space-charge waves, klystrons, traveling-wave tubes, magnetrons and other microwave tubes. (3 cred. per qtr.; prereq. ‡) Shepherd

291-292-293. Electronics Seminar. Study and discussion of current literature. (1 to 3 cred. per qtr.; prereq. ‡) van der Ziel

ENGLISH

Professor	Associate Professor	Assistant Professor
Theodore Hornberger	Harold B. Allen	Elizabeth Atkins
Huntington Brown	Bernard R. Bowron	Frank Buckley
John W. Clark	Louis O. Coxe	Murray Krieger
James Gray	Elizabeth Jackson	Franz J. Montgomery
James T. Hillhouse	Leo Marx	G. Robert Stange
Tremaine McDowell	Robert E. Moore	Mary C. Turpie
Samuel H. Monk	William Van O'Connor	
Allen Tate	Leonard H. Unger	

Prerequisites—For major work, not less than 27 quarter credits in English literature, 12 of which must be of Senior College grade, including satisfactory courses in Chaucer and Shakespeare.

For minor work, not less than 18 quarter credits in English literature including a course in Shakespeare.

Candidates will ordinarily find it necessary to supplement their undergraduate work by a considerable amount of independent reading.

Before registering for their first quarter of graduate work, students should consult with the director of graduate study for the department, Mr. O'Connor. Thereafter they need confer only with their own advisers.

Requirements for the Degree of Master of Arts

Work for the Master's degree is offered under both Plan A and Plan B.

Major—The minimum requirement of 18 quarter credits in the major under Plan A and 21 to 27 credits under Plan B is interpreted to mean credits in courses in English listed under Language and Literature.

Under both plans, the candidate who has not previously had an elementary course in Old English (Anglo-Saxon) must include this subject in his program of graduate study.

All candidates for the M.A., Plan B, must take 213 and a sequence (three quarters) of a course numbered above 200.

Under both plans, the candidate will be given a written examination which calls for some acquaintance with each of the following periods of

English literature: Old and Middle English literature, Renaissance, seventeenth century, eighteenth century, and English or American literature of the nineteenth and twentieth centuries. While the examination is designed primarily as a test of knowledge, it affords opportunity for the display of critical judgment. The general written examination is given during each term except the second summer term. A specimen of the examination questions may be consulted in 219 Folwell Hall.

Language Requirement—The candidate must pass his examination in a foreign language before taking the general examination.

Candidates under Plan B must submit to their examining committees, at least one week in advance of the oral examination, three papers written in courses numbered above 100, either in the major field or in the related fields.

Minor (Plan A)—In addition to the option of electing work in some related field for a minor for the Master's degree, the candidate may select courses from one of the following groups as a minor:

Composition

Linguistics and Comparative Philology, including 100 (Old English), 102 (Old English Prose and Verse), 103 (Beowulf), 174 (American English), 204-205-206 (The Rise and Development of Standard English), and certain related courses.

Foreign Literature in Translation, including 123-124-125 (The Technique of the Novel), 147-148-149 (Middle English Literature Exclusive of Chaucer), 184-185-186 (The Interpretation of Drama), 234-235-236 (Studies in Medieval English Culture), and courses in foreign literature in translation offered by the foreign language departments.

American Literature, including all graduate courses in that subject.

Related Fields (Plan B)—The candidate under Plan B may select courses from the groups listed under the Plan A minor, but a substantial portion of his work must be taken outside the Department of English.

Language Requirement—Unless special exception is made upon petition the candidate is required to have a reading knowledge of one of the following languages: French, German, Latin, Greek.

Requirements for the Degree of Doctor of Philosophy

The program of course work for the Doctor's degree should be filled out by the candidate in consultation with a member of the Graduate Faculty during the first or second term after he has completed his work for the Master's degree, or, if he does not propose to take an M.A. degree, during his second or third term of graduate study.

Candidates who have not already taken the comprehensive written examination given to M.A. candidates must take it at a time to be designated after consultation with the director of graduate study.

Candidates may choose either of the following groups of courses in satisfaction of the requirements for the study of the English language: (1) Old English (100) plus 6 credits in Old English Prose and Verse (102)

and Beowulf (103); (2) Old English (100) plus 9 credits in The Rise and Development of Standard English (204-205-206).

Examinations—The candidate for the Doctor's degree is required to take the following examinations: (1) a written critical examination, (2) preliminary examinations (consisting of two parts, one written and one oral), and (3) a final oral examination.

During his second year of graduate work the candidate should take the three-hour written critical examination intended to test his ability to analyze and appraise specific works of literature, whether poetry, drama, or fiction. The examination is given during the fall, winter, and spring terms. The candidate should consult the director of graduate study not later than the first week of the term during which he proposes to take the examination. He will then be given the titles of several works which he is to study closely. Ordinarily he will be allowed to refer to the text he is analyzing during the examination.

The candidate must have completed, before the preliminary examinations, courses 200-201 (Advanced Chaucer) and 136 (Advanced Shakespeare), or their equivalents.

The candidate presenting himself for the preliminary examination is assumed to have the knowledge of the English and American language and literature implied by successful completion of the courses listed in his program, plus extensive independent reading. A list of works (and in the field of linguistics, of topics) with which the doctoral candidates are expected to be especially familiar may be secured in 219 Folwell Hall. All candidates, in addition to a mastery of the works and topics named in the departmental list, are expected to acquire a command of the principal scholarly and critical studies bearing upon these texts and topics.

The preliminary examinations consist of (1) a six-hour written examination (divided into sections of three hours each) covering works and topics specified in the departmental list and the relevant scholarship and criticism mentioned previously (except that the candidate omits on this examination his special field); and (2) an oral examination devoted to the minor subject and to six of the seven fields into which the study of English and American language and literature is divided by this department, as follows: (1) The English Language *or* Old English Language and Literature, (2) Middle English, (3) Renaissance, (4) The Seventeenth Century, (5) The Restoration and Eighteenth Century, (6) The Nineteenth and Twentieth Centuries, and (7) American Literature. The field which is omitted from these examinations is that within which the candidate proposes to write his Doctor's thesis.

Not later than the first week of the term during which the candidate proposes to take the preliminary examinations, he should notify the director of graduate study of his intention to do so. The Graduate School should be notified of the date, hour, and room for all oral examinations at least one week in advance.

Language Requirement—Reading knowledge of two of the following: French, German, Latin, Greek. Good reading knowledge of Latin is in all cases desirable, and in some cases may be indicated by the candidate's adviser as indispensable. The candidate must satisfy language requirements before taking the preliminary examinations.

The Graduate Minor in English

The candidate for the Master's degree (Plan A) taking a minor in English is expected to present a minimum of 9 credits in one of the seven fields, as listed, in connection with the oral preliminary examination for the Ph.D. or in the courses in critical analysis (120-121-122, 123-124-125, 184-185-186).

A minor sequence in English for the Doctor's degree must include one graduate course in Shakespeare and 9 credits in one of the graduate courses devoted to a chronological period of English literature.

In addition to satisfying the general requirements established by the Graduate School, the candidate for the Doctor's degree offering English as a minor must pass an examination (either written or oral, depending on the usual practice of the department of the candidate's major subject) covering *two* of the seven fields in connection with the oral preliminary examination for the Ph.D. If the candidate wishes, he may substitute the written critical examination taken by all Ph.D. candidates in English for his examination in *one* of the two required fields.

Note—For information on work in comparative literature, see page 23.

*Courses***

LANGUAGE AND LITERATURE

100f. Old English (Anglo-Saxon) An introduction to the sounds and grammar, with some prose reading. The relation to modern English is stressed. (4 cred.) Clark (1954), Allen (1955)

102w. Readings in Old English Prose and Verse. Introduction to Old English versification, and critical reading of texts. (3 cred.; prereq. 100) Clark (1954), Brown (1955)

103s. Beowulf. An introduction to the Old English poem, with reading of considerable portions of the text. (3 cred.; prereq. 100) Clark (1954), Brown (1955)

104f. Emerson and Thoreau. (3 cred.) Turpie

105w. Hawthorne and Melville. (3 cred.; offered 1955-56) Marx

106s. Whitman and Mark Twain. (3 cred.; offered 1955-56 and alternate years) Marx

109f-110w. The Romantic Poets of the Early Nineteenth Century. From Wordsworth to Keats. (3 cred. per qtr.) Jackson

111s. Henry Adams and Theodore Dreiser. (3 cred.; offered 1954-55 and alternate years)

113s. American Short Story. A historical examination of the American short story from the eighteenth century to the present. (3 cred.) Turpie

114s. The Midwest in Literature. (3 cred.; offered 1955-56 and alternate years) Buckley

115s-116f. The Development of English Prose Style. 115: Definition of six broad types of prose style on historical principles. 116: Studies in the styles of selected writers since 1700. (3 cred. per qtr.; 115 offered 1954-55, 116 offered when staff permits) Brown

120f-121w-122s. The Interpretation of Poetry. Certain technical aspects of poetry in relation to poetic meaning. See also Comp. 104-105-106 for the writing of poetry. (3 cred. per qtr.) Tate

** Unless otherwise noted, the prerequisite for all graduate courses is 6 credits in literature in this department, exclusive of A-B-C or the equivalent.

123f-124w-125s. The Technique of the Novel. Special studies in novels of the late nineteenth and twentieth centuries, with particular regard to structure. See also Comp. 101-102-103 for the writing of fiction. (3 cred. per qtr.: prereq. 6 cred. in literature in this department, exclusive of classics and A-B-C, and ♯) Gray

126f-127w. Drama. 1660-1870. History of English drama from the opening of the theaters in 1660. 126: The heroic play, tragedy, comedy of manners, beginnings of sentimental comedy. 127: Development of sentimentalism. The reaction: Goldsmith and Sheridan. Early nineteenth-century drama. (3 cred. per qtr.) Hillhouse

129s. Modern Drama, 1880 to the Present. A survey of the chief dramatists, English, American, and Continental, from the time of Ibsen. (3 cred.; prereq. 55-56 or 126-127) Hillhouse

130w-131s. English Poetry, 1832-1914. (3 cred. per qtr.; offered when staff permits) Montgomery

134s. The Origins of American Naturalism. (3 cred.; offered 1955-56) Bowron

135f. Spenser. Selections from the minor poems; *The Faerie Queene;* attention to classical and foreign influence on Spenser and his influence on later English poets. (3 cred.; offered when staff permits)

136f. Advanced Shakespeare. The work of the poet's maturity. Special attention to *Othello, King Lear, Antony and Cleopatra, Cymbeline, The Winter's Tale.* (4 cred.; prereq. 55-56) Brown

137f-138w-139s. The Nineteenth Century in English Literature. Napoleonic wars, industrial revolution, Darwinism, imperialism and democracy, aestheticism; prose of social criticism from Hazlitt to Morris; problem of the poet's responsibility from Shelley to Yeats. (3 cred. per qtr.) Stange

142f-143w. Twentieth-Century Literature. Survey of British and American literature from 1890 to 1952, studied for theme and technique and as part of literary and intellectual history. (3 cred. per qtr.) O'Connor

147f-148w-149s. Middle English Literature Exclusive of Chaucer. A historical, critical, and linguistic survey, including some reading in translations of medieval English writers of Latin. (3 cred. per qtr.; prereq. 75 or 175 or equiv., 100 or equiv. [or ¶100]; offered 1955-56 and alternate years)

151s. Recent Poetry. Development of twentieth-century poetry in England and America. Yeats, Hardy, Housman, Robinson. Movements in the second decade—Georgians, Imagists, etc.; Lawrence, Sandburg, Frost, Eliot, Jeffers, younger poets. (4 cred.) Jackson

154f-155w. The American Novel. History of the American novel from the beginning to the present. (3 cred. per qtr.) Bowron

156s. The American Drama. Survey of American drama in the eighteenth and nineteenth centuries. (3 cred.; offered 1955-56 and alternate years) Hornberger

159w-160s. Colonial Literature in America. Covers the period from 1608 to 1783. (3 cred. per qtr.; offered when staff permits)

162w. Milton. The minor poems, *Areopagitica, Paradise Lost,* and *Samson Agonistes.* (3 cred.; prereq. 21-22 or 55-56) Unger

165f,w. Introduction to Modern English. A scientific approach to the sounds and grammar of present-day English, with some attention to syntax; implications for a reasonable attitude toward English usage in America. (3 cred.) Allen

166w. Historical Backgrounds of Modern English. A study of those distinctive aspects of the sounds and grammar of Early Modern, Middle, and Old English which are significant for the language of the present day. (3 cred.; prereq. 165) Allen

170w. Shakespeare's Later Contemporaries. Selected plays of Chapman, Jonson, Dekker, Marston, Webster, Heywood, Beaumont and Fletcher, Middleton, Ford, and Shirley. (3 cred.; offered 1954-55 and alternate years) Brown

174s. American English. The development of a distinctive vocabulary and pronunciation of American English; differences between it and British English;

dialects in the United States. (3 cred.; prereq. 6 cred. in English literature, including language, above A-B-C) Allen

175s. Chaucer. The reading of *The Canterbury Tales* with introduction dealing with the grammar and literary forms of fourteenth-century English. (4 cred., §75 or equiv.; prereq. 100 or ¶100) Jackson

176f-177w. The History of English Verse. Origin and development of standard forms—ballad stanza, heroic couplet, blank verse, sonnet, etc. Discussion of metrical technique. (3 cred. per qtr.; offered when staff permits) Jackson

178w. The South in Literature. (3 cred.; offered 1954-55 and alternate years) Tate

180s. The Influence of Poe. The influence of Poe on the French "Symboliste" school and the influence of this school on modern literature, chiefly poetry, in English. (3 cred.; offered 1954-55 and alternate years) Tate

181s. Recent Trends in Literary Criticism. Criticism and scholarship; structure and form; science and literature; imagination and myth; isolation of the artist; political emphasis; experiments with language. (3 cred.; offered 1955-56 and alternate years) O'Connor

182w. The Far West in Literature. Expansion beyond the Mississippi as a force in American thought and letters: the literature of exploration and travel; the Pacific Coast regional movement; Mark Twain. (3 cred.; offered when staff permits)

183f. The Poetry of T. S. Eliot. (3 cred.; offered 1954-55 and alternate years) Unger

184f-185w-186s. The Interpretation of Drama. Same as Spch. 184-185-186. Critical analysis of plays: modern, Renaissance, and ancient. (3 cred. per qtr.; prereq. 6 cred. in literature in this department, exclusive of classics and A-B-C or equiv.; 55-56 recommended) Reisman (f), Coxe (w,s)

187f-188w-189s. Eighteenth-Century Literature. Survey of English literature from 1700 to 1790. (3 cred. per qtr.) Moore (1954-55), Monk (1955-56)

191f. Imagery and Symbolism in English and American Literature. A study of manifold literary influences, from the seventeenth century onward, upon T. S. Eliot and other twentieth-century writers. (3 cred.) Atkins

193f. The Poetry of Yeats. (3 cred.; offered 1955-56 and alternate years) Unger

194f-195w-196s. Elizabethan Literature: Prose, Poetry, Drama. 194: From the beginning of the Tudor period to about 1580, with attention to the Medieval origins of the drama. 195: From the early work of Spenser and Sidney to the mid-nineties. 196: The decade centering in the last year or two of the Queen's reign. (3 cred. per qtr.) Brown

197f-198w-199s. Seventeenth-Century Literature. 197-198: A survey of the prose and nondramatic poetry of the century, exclusive of Milton, down to 1660. 199: Dryden and his contemporaries. (3 cred. per qtr.) Unger

200w-201s. Advanced Chaucer. The more important poems apart from *The Canterbury Tales;* Chaucer's biography and literary reputation. The treatment will be primarily literary and historical, linguistic proficiency being presumed. (3 cred. per qtr.; prereq. 75 or 175 or equiv.) Clark

202f-203w. Elizabethan Nondramatic Literature. 202: Tudor prose: "courtesy books" (Eliot, Ascham), voyages (Drake, Raleigh), criticism (Gascoigne, Sidney, and others), fiction (Lyly, Sidney, Nashe), history (More, Fox, Holinshed, and others), tracts and essays (Nashe, Bacon, and others). 203: Tudor lyric and narrative poetry. (3 cred. per qtr.; offered when staff permits)

204f-205w-206s. The Rise and Development of Standard English. An inductive study of the development of the English vocabulary and lexicography (204), historical phonology (205), and historical morphology and syntax (206), with some attention to the history of attitudes toward usage. (3 cred. per qtr.; prereq. 100 or equiv.) Allen

207. Dr. Johnson and His Circle. Particular attention to Boswell and to Johnson's influence on his contemporaries. (3 cred.; prereq. consent of department; offered 1955-56 and alternate years)

210f-211w-212s. Studies in Seventeenth-Century Literature. Selected authors to 1660 exclusive of Milton and the dramatists; emphasis on style and on ideological questions. (9 cred.; offered 1955-56)

213f,s. Bibliography and Methods of Literary Research. Examination of basic library reference works, scholarly and critical journals, bibliographies of periods and prominent literary figures; exercises and problems in methods and exposition of research. (2 cred.) O'Connor

225f-226w-227s. Elizabethan Drama. Elizabethan and Jacobean dramatists, from Lyly to Shirley. Problems assigned may involve Shakespeare, and in general his contemporaries will be studied less for their own sake than for the light they shed upon him. (3 cred. per qtr.; offered 1954-55) Brown

228f-229w-230s. Eighteenth-Century Novel. The rise and development of the novel as a form of literature; the use made of the novel as a medium of religious, social, and political theory. (3 cred. per qtr.; offered 1955-56) Hillhouse

231f-232w-233s. Shakespeare's Tragic and Comic Art. (3 cred. per qtr.; offered when staff permits) Brown

234f-235w-236s. Studies in Medieval English Culture. (3 cred. per qtr.; prereq. 75 or 175; offered 1954-55) Clark

240f-241w-242s. The Canterbury Tales. (3 cred. per qtr.; offered 1955-56 and alternate years) Clark

243f-244w-245s. Nondramatic Literature of the Sixteenth Century. Renaissance prose and poetry, with special attention to Spenser and his contemporaries. (3 cred. per qtr.; offered when staff permits) Brown

246f-247w. English Literary Criticism. A study of the basic historical texts, also an examination of those principles and issues which have special relevance for modern criticism. (3 cred. per qtr.; offered 1954-55 and alternate years) O'Connor

253f-254w-255s. American Romanticism I: New England. Bryant, Hawthorne, Emerson, Thoreau, and their contemporaries. (3 cred. per qtr.; offered 1955-56 and alternate years)

256f-257w-258s. Spenser and Milton. (3 cred. per qtr.; prereq. 3 cred. above 50 in medieval or Elizabethan literature and 3 cred. in literature of the period 1600-1660; offered 1955-56) Brown

259f-260w-261s. Nineteenth-Century Novel I. The Gothic romances and the Revolutionary novel, the realistic novel of national manners, and Jane Austen, Sir Walter Scott, Dickens. (3 cred. per qtr.; offered 1956-57) Hillhouse

262f-263w-264s. Nineteenth-Century Novel II. Thackeray and the Brontës; George Eliot and Trollope; Hardy and Meredith. (3 cred. per qtr.; offered 1954-55) Hillhouse

265f-266w-267s. American Romanticism II. Cooper, Poe, Whitman, and Melville. (3 cred. per qtr.; offered 1954-55) McDowell

274f-275w-276s. The Age of Queen Anne. The literature of the first half of the eighteenth century in the light of critical theories and currents of thought. (3 cred. per qtr.; offered when staff permits) Monk

277f-278w-279s. American Realism. Mark Twain; Howells and his contemporaries; Henry James. (3 cred. per qtr.; prereq. ‡; offered when staff permits)

281f-282w-283s. Studies in the English Romantic Movement. (3 cred. per qtr.; offered 1955-56 and alternate years) Stange

284f-285w-286s. Dryden and His Age. (3 cred. per qtr.; offered 1955-56 and alternate years) Monk

287f-288w-289s. Studies in Victorian Literature. (3 cred. per qtr.; offered 1954-55 and alternate years) Stange

290f-291w-292s. Studies in Critical Theory. An intensive study, from the point of view of the philosophy of criticism, of the works of certain great critics. (3 cred. per qtr.; 291-292 not offered 1954-55) Tate

297f-298w-299s. Independent Reading. (3 cred. per qtr.; prereq. M.A. degree or equiv.) Graduate staff

Attention is also called to the following courses, in which foreign languages or literatures are studied but for which no specific foreign-language courses are prerequisites: Clas. 106-107-108, 191-192-193; Ital. 164; Russ. 101-102-103; Scan. 161-162, 171-172-173.

COMPOSITION**

101f-102w-103s. The Writing of Fiction and Poetry. A study of the principles of composition in these arts. Class meetings are devoted to the analysis of examples drawn from standard sources, meetings in the first two quarters to fiction, those in the third to poetry; but the student's compositions may be in either form in any quarter. Writing by students is criticized in individual conferences. For a second year of writing of fiction, consult Mr. Gray; for additional training in the writing of poetry, consult Mr. Tate. (3 cred. per qtr.; no prereq. for students registered as English majors in the Graduate School; prereq. for all others ‡) Coxe, Unger

117s. Playwriting. (3 cred.; prereq. Spch. 115-116 or ‡) Coxe

200f-201w-202s. Graduate Seminar in Writing. (3 cred. per qtr.; prereq. ‡) Tate

Note—Students interested in major work in American Studies will find a description of this work on pages 22 and 52.

ENTOMOLOGY AND ECONOMIC ZOOLOGY

Professor
Clarence E. Mickel
Alexander A. Granovsky
Alexander C. Hodson
William H. Marshall
Alvah Peterson
A. Glenn Richards

Associate Professor
Laurence K. Cutkomp
Mykola H. Haydak
Lloyd L. Smith, Jr.

Assistant Professor
Torfine L. Aamodt
James R. Beer
Edwin F. Cook

Instructor
Allan R. Barr

Lecturer
Frederick G. Holdaway

Prerequisites—Twenty-seven credits in zoology and entomology. Depending on the proposed field of specialization within the department, such courses as bacteriology, plant pathology, or biochemistry may be accepted in partial fulfillment of this requirement.

Language Requirement—For the Master's degree, either German or French. In special cases, where other languages are needed for development of the thesis, other Romance languages, the Scandinavian languages, and Russian may be substituted by petition. For the Ph.D. degree, two foreign languages, usually German and French. Substitutions may be made for French under the conditions already specified.

Master's Degree—Offered under Plan A. In exceptional cases Plan B may be followed by petition approved by the major advisers of the department.

The written examination for this degree will be given at least three weeks before the final oral examination.

Course 200 is required of all majors throughout the period of resident studies.

An additional copy of the thesis is required for deposit in the departmental library.

** The student, in registering for these courses, must use the form: Comp. 101-102-103, Comp. 117, Comp. 200-201-202.

Doctor's Degree—Candidates for the Ph.D. degree should earn the Master's degree under Plan A.

Course 200 is required of all majors throughout the period of resident studies.

The written examination for this degree will be given at least one month prior to the oral preliminary examination.

An additional copy of the thesis is required for deposit in the departmental library.

Courses

ENTOMOLOGY

114s. Apiculture. Problems of bee management, disease control, wintering, bee breeding, processing and marketing bee products. (3 cred.; prereq. 9 cred.; lect., lab., field practice) Haydak

117f. Animal Ecology. General ecology stressing ecological principles and land communities. (3 cred.; prereq. 15 cred. in zoology or entomology) Eddy

118w.* Animal Ecology. Experimental approach to the study of environmental factors affecting animal populations. (3 cred.; prereq. 15 cred. in zoology or entomology, ♯) Hodson

120s.* General Ecology of Insects. Ecology with special reference to insects, their dispersal, distribution, abundance, natural control, and related problems. (3 cred.; prereq. 118; lect., field trips, and reading; offered 1954-55 and alternate years) Hodson

124su. Biology of Immature Insects. Habits, habitat, life history, and identification of immature insects with emphasis on aquatic forms. (4 cred.; prereq. 15 cred. in zoology, 52 or equiv., or ♯; offered at Itasca Park Biological Station) Peterson

125f-126w-127s. Advanced General Entomology. Morphology, biology, and classification of insects. Frequent field trips in 127. (3 cred. per qtr.; prereq. 52 or equiv. or ♯; lect., lab.) Mickel

128f-129w.* Insect Physiology. General and comparative physiology, survey of the organ systems and their functioning. Emphasis on research methods and evaluation of data. (4 cred. per qtr.; prereq. 15 cred. in zoology or entomology, and ♯, Zool. 50 or equiv. recommended; lect., lab., reading) Richards

140s. Biological Microscopy. Necessary elements of optics, use and limitations of the various types of microscopes, interpretation of microscopical data. Laboratory: demonstration plus project in field of student's interest. (4 cred.; prereq. 15 cred. in zoology, entomology, or botany and ♯; offered 1955-56 and alternate years)

141f-142w. Insects in Relation to Plant Diseases. Principal insect vectors and their habits, types of insect injuries affecting the health of plants, modes of insect transmission and dissemination of plant diseases, methods of rearing and handling insect vectors. (3 cred. per qtr.; prereq. 8 cred. in entomology or plant pathology) J. J. Christensen, Granovsky

144f. Medical Entomology. Principal arthropods noxious to man and animals. Emphasis on those that serve as vectors of pathogenic organisms of man and animals. (3 cred.; prereq. 15 cred. in zoology or entomology including 52 or equiv. and ♯; lect., lab.) Barr

145w. Parasitic Protozoa. The structure, life histories, and economic relations of protozoal parasites of man and animals. (3 cred.; prereq. 15 cred. in zoology, and ♯; lect., lab. diagnosis) Wallace

146s. Helminthology. Worm parasites of man and animals, their structure, life histories, and biological relationships. (3 cred.; prereq. 15 cred. in zoology, and ♯; lect., lab.) Wallace

150s. Introduction to Aphidology. The biology and taxonomy of the Aphididae. (3 cred.; prereq. 52 or equiv. or ♯) Granovsky

175w. Principles of Economic Entomology. Methods and principles of insect control. (4 cred.; prereq. 15 cred. including Ent. 5 or equiv., or ♯; lect., demonstration labs.; offered 1954-55 and alternate years) Cutkomp

176w. Legal and Regulatory Aspects of Pest Control. Principles of quarantine and administration of control campaigns. (3 cred.; prereq. 15 cred. including Ent. 5 or equiv., or ♯; lect., discussions, demonstrations) Aamodt

177s. Insecticides and Their Action. Chemistry, physiological action, toxicology, and laboratory testing of insecticides. (5 cred.; prereq. 15 cred. including Ent. 5 or equiv. or ♯, inorganic and organic chemistry; lect., lab.; offered 1955-56 and alternate years) Cutkomp

179s. Recent Advances in Entomology. Lectures in special fields of entomological research given by a visiting professor. (Cred. ar.; offered when staff permits)

197f,w,s,su. Introduction to Research. Special problems involving library and laboratory research in various lines of entomology and economic zoology. (1 or more cred. per qtr.; prereq. consent of department) Staff

200f,w. Seminar. Assigned topics dealing with some special fields of work of the division. (1 cred. per qtr.) Staff

201-204. Research in Systematic Entomology. (Cred. ar.) Mickel, Cook

205-208. Research in Insect Transmission of Plant Diseases. (Cred. ar.) Granovsky

209-212. Research in Soil Insect Ecology. (Cred. ar.) Granovsky

213-216. Research in Insect Ecology. (Cred. ar.) Hodson

217-220. Research in Forest Entomology. (Cred. ar.) Hodson

221-224. Research in Economic Entomology. (Cred. ar.) Granovsky, Hodson, Holdaway

225-228. Research in Insect Physiology. (Cred. ar.) Richards

229-232. Research in Insect Histology. (Cred. ar.) Richards

261-264. Research in Medical Entomology. (Cred. ar.) Barr

265-268. Research in Insecticides. (Cred. ar.) Cutkomp

269-272. Research in Apiculture. (Cred. ar.) Haydak

FISHERY AND WILDLIFE MANAGEMENT

119su. Limnology. Conditions for life in the water and distribution of aquatic animals. (3 cred.; prereq. 15 cred. in zoology or entomology; offered at Itasca Park Biological Station) Eddy

121f. Ichthyology. Taxonomy and habits of North American fishes, especially those of upper Mississippi drainage. (3 cred.; prereq. 15 cred. in zoology; lect., lab.) Eddy

162su. Ecology of Terrestrial Vertebrates. Ecological relationships of northern Minnesota terrestrial vertebrates. (4 cred.; prereq. Ent. 68 or Zool. 57-58, Ent. 63 or equiv., Bot. 20) Marshall

164f-165w-166s. Wildlife Management. Life histories, ecology, and management of North American game animals including field studies of research and management techniques at appropriate times during the year. (3 cred. per qtr.; prereq. 63, 64, 118, Zool. 58, Bot. 131, Pl.Pa. 53; lect., library, lab., field work) Marshall

167s. Techniques in Forest Wildlife Management. Largely field work; use of censuses applicable to the major local forms of forest wildlife; preparation of a wildlife management plan for a small forested area. (3 cred.; prereq. 64; given at Cloquet) Marshall

168f-169w. Fishery Biology and Management. Methods and theory of fishery biology; age and rate of growth, populations, mortality and harvest, indices of productivity, lake and stream survey methods and planning: stream improvement and fish pond management. (5 cred. per qtr.; prereq. 64, Zool. 53, 117, 118, 119, 121, Bot. 131 or equiv., P.H. 110-111 or equiv., or ♯; lect., lab.) Smith

170s. Fisheries Resources. Fisheries resources of the United States: fisheries products; methods and description of commercial fisheries; state, federal, and international administration and regulation of fisheries; significant laws and current legislation controlling United States fisheries. Organization of fishery programs. (3 cred.; prereq. 168, 169 or ♯) Smith

197f,w,s,su. Introduction to Research. For description see 197 under Entomology.

233-236. Research in Economic Vertebrate Zoology. (Cred. ar.) Marshall, Beer

237-240. Research in Fishery Biology. (Cred. ar.) Smith

FARM MANAGEMENT AND AGRICULTURAL ECONOMICS

For courses and staff, see Agricultural Economics.

FOOD TECHNOLOGY

Courses

101f-102w. Food Technology. Application of biochemistry and biology to food manufacturing, including effect of processing on chemical composition and nutritive value, methods of food preservation, food bacteriology, molds and fungi, insect and rodent control, food acceptance, chemical engineering operations in the food industries, food packaging. Lectures supplemented by visits to local food processing industries. (3 cred. per qtr.; prereq. Ag.Bi. 3, 5 and 6 or ♯, 52, Bact. 53, and a course in physics; offered when demand warrants) Jezeski, others (101); Geddes, Jezeski, Liener, others (102)

104w. Frozen Food Processing and Storage. A comprehensive study of all types of frozen foods. History and development of the industry, standards, laws, and regulations; quality in relation to temperature, rate, and method of freezing; control of quality from time of harvest to packaging; packaging and wrapping; processing methods; storage, transportation, and handling. (3 cred.; prereq. Ag.Bi. 5 or 6, Bact. 53 or ♯) Winters

105f,w,s. Frozen Food Problems. Special problems based upon work given in 104. (2 to 4 cred. per qtr. with 6 to 12 cred. total; prereq. 104) Winters

FORESTRY

Professor
Frank H. Kaufert
Randolph M. Brown
Louis W. Rees
Thorvald Schantz-Hansen
Arthur E. Schneider

Associate Professor
Donald P. Duncan
Henry L. Hansen
Ralph L. Hossfeld

Assistant Professor
Ronald I. Beazley
Otis F. Hall

Prerequisites—Students normally are expected to have an undergraduate degree in forestry, or its equivalent. The facilities of the Cloquet Experimental Forest and the Forestry and Biological Station at Lake Itasca are available to students taking this work.

Language Requirement—For the M.S. degree, one foreign language selected in consultation with the student's adviser. For the M.F. degree, none. For the Ph.D. degree, either (a) two foreign languages selected in consultation with the student's adviser and the director of the School or (b) one foreign language and the option of a special research technique or a collateral field of knowledge—selection to be made in consultation with the student's adviser and the director of the School.

Master of Science Degree—Offered only under Plan A. This program is intended for graduates preparing for research or teaching in such branches of forestry as silviculture, management, measurements, and wood technology.

Master of Forestry Degree—Students registered for the master of forestry degree will fulfill the requirements for the master of science degree under Plan B. This program is designed to meet the needs for added professional study by qualified forestry graduates primarily interested in administrative and technical work in forest management.

Doctor's Degree—The School of Forestry offers work in all fields of forestry leading to the Ph.D. degree under the general requirements for that degree.

Courses

101w. Advanced Dendrology. Classification and distribution of important timber species of the world. (3 cred.; prereq. 4) Rees

104w. Forest Influences. Influence of woody vegetation upon microclimate, soil water, runoff, stream flow, and erosion. (3 cred.; prereq. 126 or ♯; offered 1955 and alternate years) Duncan

111f-112w. Advanced Forest Measurements. Special mensurational techniques. Statistical methods in forest measurements. (3 cred.; prereq. 9 or ♯) Brown

113w. Wood Pulp and Paper. Production of wood pulp and paper products. (3 cred.; prereq. 53-54, organic chemistry) Hossfeld

114f-115w. Mechanical and Physical Properties of Wood. Formulae used in determining stresses of wood. Laboratory methods in timber mechanics. (3 cred. per qtr.; prereq. 53-54, Math. 7) Rees

116s. Fabrication and Properties of Wood Products. Timber connectors, plywood, fiber boards, and glued-wood construction. (3 cred.; prereq. 114) Rees

119s. Advanced Wood Structure. Microtechnique of woody tissues and identification of tropical woods. (4 cred.; prereq. 53-54) Rees, Hossfeld

120s. Building Cost Estimating. A general course in building cost estimating. (3 cred.)

121f. Wood Finishing. Materials and methods for finishing of wood products. (3 cred.; prereq. organic chemistry) Hossfeld

123f. Introduction to Forest Economics and Valuation. The economic approach to forestry, including the appraisal of forest values. (3 cred.; prereq. Ag.Ec. 2) Beazley

124w. Introduction to Forest Management. Organization and administration of forest lands. Determination of cut. (3 cred.; prereq. 123) Hall

125s. Wood Preservation. History, development, and methods. Systems and preservatives now in use. (3 cred.; prereq. 53-54) Kaufert

126f. Forest Ecology. Fundamental characteristics and environmental relationships of trees in forest stands as the basis of silviculture. (3 cred.; prereq. 4 or equiv.) Hansen

127w. Introduction to Silviculture. Basic silvicultural systems. The forest regions of the U.S. and the silvicultural management of the major forest types. (3 cred.; prereq. 126) Hansen

128s-129s. Field Silviculture I and II. Laboratory and field work on Cloquet Experimental Forest. Courses taken concurrently. (3 cred. per qtr.; prereq. 126, 127) Schantz-Hansen, Schneider

130f. Forest Valuation. Financial aspects of forest management. (3 cred.; prereq. 123) Beazley

131w. Forest Policy. Present-day problems in forestry and their historical background. (3 cred.) Hall

133s. Forest Management and Utilization. Field work at and in the vicinity of Cloquet Experimental Forest. (4 cred.) Schneider, Schantz-Hansen

134s. Forest Inventory and Photographic Interpretation. Laboratory and field work at Cloquet Experimental Forest. (4 cred.; prereq. 9)

136s. Forest Economics. Economic principles of forest resource management from the viewpoint of the firm, the market, and the nation. (3 cred.; prereq. 123) Beazley

137f. Seeding and Planting. Principles of seeding, planting, and nursery practices. Special planting problems. (3 cred.) Hansen, Duncan

140w. Forest Management. Advanced forest organization, regulation of cut, and administration. (3 cred.; prereq. 124) Hall

141w. Principles of Silvics. Silvical characteristics of trees and their reactions to environment. Significant research and literature. (3 cred.; prereq. 126, 127 or #) Hansen

142s. Wood Chemistry. Chemistry of wood components, analysis and chemical technology of wood and wood products. (3 cred.; prereq. 54, organic chemistry) Hossfeld

143w. Forest Recreation. Surveys, planning, development, and maintenance of forest recreational resource. Administrative and technical problems arising from recreational use. (3 cred.; offered 1954 and alternate years) Duncan

145f. Advanced Silviculture. Recent research and published information on American silvicultural problems. (3 cred.; prereq. 127, 129) Hansen

146f. Forest Aerial Photogrammetry. Aerial photographs, aerial surveying, photo interpretation and forestry applications. (3 cred.; prereq. 9, 134 or #)

147w. Forest Inventory. Volume, growth, sampling, and inventory design. (3 cred.; prereq. 9, 134 or #)

156f. Research Methods. Scientific method, bibliography, instrumentation, reduction of data, report writing, publication procedure. (3 cred.) Hossfeld, Duncan, Hall

200-201-202. Research Problems in Silviculture. (Cred. ar.) Hansen, Schantz-Hansen, Schneider, Duncan

203-204. Research Problems in Forest Management. (Cred. ar.) Schantz-Hansen, Schneider, Hall

205-206. Research Problems in Forest Economics. (Cred. ar.) Beazley, Hall, Kaufert

207-208-209. Research Problems in Wood Technology. (Cred. ar.) Kaufert, Hossfeld, Rees

213-214-215. Research Problems in Forest Utilization. (Cred. ar.) Kaufert, Hossfeld, Rees

218-219. Research Problems in Forest Measurements and Photogrammetry. (Cred. ar.) Brown

223f-224w-225s. Seminar. Assigned topics with special reference to current forestry problems and current forestry literature. (1 cred. each qtr.) Staff

GENERAL STUDIES

Courses Carrying Graduate Credit

161. Seminar for Foreign Study I. A directed field study in selected foreign countries, investigating the current economic, political, educational, cultural, and religious patterns of life. Each student in the seminar will study the country carefully before embarking and write a comprehensive report of his findings upon returning. (6 cred.: students pay for 6 cred. but receive 3 cred. when transferred to graduate records; prereq. approval before December by a faculty selection committee; graduate students must also have approval of their faculty adviser) Magner

162. Seminar for Foreign Study II. (Continuation of 161) (6 cred.: students pay for 6 cred. but receive 3 cred. when transferred to graduate records) Magner

Hum. 131f-132w-133s. Humanities Proseminar. Topic for course: The Place of the Humanities in an Age of Science. (2 cred. per qtr.)

Nat.Sci.171f-172w-173s. The Development of the Sciences. (3 cred. per qtr.; prereq. 1 year of biology and of physical science or ‡) Graubard

GEOGRAPHY

Professor	Associate Professor	Visiting Professor
Jan O. M. Broek	John R. Borchert	William William-Olsson
John C. Weaver		

Prerequisites—Geography majors are expected to have taken introductory courses in physical, social, and economic geography, similar to courses 1, 4, and 41, and at least seven Senior College courses in systematic and regional geography and also to have a substantial minor in some related biological, physical, or social science. For *minor work*, 12 credits in geography.

Language Requirement—For the Master's degree, German, French, or Spanish. Exemptions may be made in individual cases by petition. For the Doctor's degree, good reading knowledge of German and French is generally indispensable. In special cases another language may be substituted for French. Adequate reading knowledge of one of the two languages must be demonstrated not later than the close of the second quarter in which the student is registered for an advanced degree.

Master's Degree—Offered under both Plan A and Plan B.

Doctor's Degree—Consult the chairman of the department for suggested program of work leading to the Ph.D. degree.

Courses

101w.* Geography of Western and Central Europe. An introduction to the major physical and cultural regions of Europe as a whole, followed by a discussion of the population patterns, resources, and industries in the individual countries of western and central Europe. (3 cred.; prereq. 5 cred. or ‡) William-Olsson (1954-55)

105. Geography of the Mediterranean Region. A regional survey of the lands adjacent to the Mediterranean Sea, in southern Europe, western Asia, and northern Africa. (3 cred.; prereq. 5 cred. or ‡; not offered 1954-55)

106s. Geography of Scandinavia. Physical and human geography of Denmark, Finland, Iceland, Norway, and Sweden considered both by individual countries and as a region. (3 cred.; prereq. 5 cred. or ‡) William-Olsson (1954-55)

107w. Geography of the Soviet Union. The character of and bases for the regional diversity of physical resources, population, agriculture, manufacturing, and transportation in the U.S.S.R. (3 cred.; prereq. 5 cred. or ‡) Borchert

109f. Geography of Middle America. Physical and human geography of the West Indies and the mainland from Mexico to Panama. (3 cred.; prereq. 5 cred. or ‡) Eidt

110w. Geography of South America. A regional survey of the physical resources, population, agriculture, manufacturing, and transportation in the countries of South America. (3 cred.; prereq. 5 cred. or ‡) Eidt

112f.* Geography of Western Anglo-America. A regional examination of the physical and human geographic patterns of the United States and Canada west of the eastern margins of the Great Plains. (3 cred., §71; prereq. 5 cred. or ‡) Weaver

113w.* Geography of Eastern Anglo-America. A regional examination of the physical and human geographic patterns of the United States and Canada

east of the eastern margins of the Great Plains. (3 cred., §71; prereq. 5 cred. or #) Weaver

114. Historical Geography of North America. (3 cred.; prereq. 1 and 10 additional cred. in geography or history; not offered 1954-55)

117s. The Middle East. Environment and human occupation in their relationship to present regional differentiation within Southwestern Asia. Natural resources of the area and their development. Problems of international relations. (3 cred.; prereq. 5 cred. or #; not offered 1954-55)

118. Geography of Africa. The physical resources of Africa and their use, in the light of the competing cultures and economic forces that have helped to shape the human geography of the continent. (3 cred.; prereq. 5 cred.; not offered 1954-55)

121w.* Geography of India and Southeast Asia. India and Pakistan, Farther India, Indonesia, and the Philippine Islands. Areal differentiation of social-economic structure within the framework of physiographic regions. Geographic aspects of the problems of population pressure, development of resources, and international relations. (3 cred.; prereq. 5 cred. or #; not offered 1954-55) Broek

122f. Geography of East Asia. China, Korea, and Japan. Physiographic features of the area; forms of resource utilization in their regional diversity. Geographic aspects of the problems of population pressure, development of resources, and international trade. (3 cred., §120; prereq. 5 cred.; not offered 1954-55)

126s. Geography of Australia and New Zealand. A geographic survey of the physical and human resources of Australia and New Zealand. (2 cred.; prereq. 5 cred. or #; not offered 1954-55) Weaver

128s.* Geography of the Polar Regions. A systematic and regional examination of the physical environment and of man and his way of life in the Arctic, Subarctic, and Antarctic realms. A survey of the principal eras of geographic discovery in those regions. (3 cred., §125; prereq. 1 or #; not offered 1954-55) Weaver

133f. Introduction to Climatology. The content and uses of our climatic record; world patterns of temperature, atmospheric circulation, moisture, and related elements; the world regional pattern of climate and its basis; uses and limitations of climatic classifications. (3 cred.; prereq. 1 or #) Borchert

134w.* Advanced Climatology. The major climatic regions of the United States, Canada, and Central America; regional types of weather, their synthesis into climatic patterns; problems of long-term changes in the climatic pattern; introduction to the literature on regional climatic problems; analogous regions on the other continents. (3 cred.; prereq. 133, Aero. 173, or #; not offered 1954-55) Borchert

138w-139s. Advanced Cartography. Exercises in use and construction of map projections. Compilation of maps from surveys, statistical and descriptive sources, and aerial photographs. Preparation of maps for display and reproduction. (3 cred. per qtr.; prereq. 70 or #) Eidt

143w-144s.*‡ Political Geography. Scope and content of political geography as exemplified by various writers, followed by an analysis of politically important areas. (3 cred. per qtr., §43; prereq. 12 cred. in geography, history, or political science, or #; not offered 1954-55) Broek

150w.* Agricultural Geography. Analysis of the geographic patterns of the world's principal commercial and subsistence crops and the more broadly inclusive agricultural systems of which they are a part. Emphasis on the ecologic, economic, and human factors that have operated in creating the defined distributions. (3 cred.; prereq. 1 or 41 and 10 additional cred. in geography or economics or #; not offered 1954-55)

152w. Industrial Geography. A geographic analysis of the various factors influencing the location of manufacturing, as illustrated by major industrial regions. Consideration will be given to changes in the geographic patterns of industry and their social-economic implications. (3 cred.; prereq. 5 cred. or #) William-Olsson (1954-55)

153s. Urban Geography. An analysis and classification of cities in selected regions, with emphasis on their distribution, specific location, regional functions, and growth, as well as their forms and internal patterns of land use. Special attention will be given to the geographic aspects of problems in city and regional planning. (3 cred.; open to students majoring in one of the social sciences or architecture; for others ‡) William-Olsson (1954-55)

160w.* Development of Geographic Thought. Objectives, subdivisions, concepts, and methods of geography, with special reference to different schools of geographic thought as expressed in the literature of the last century. (3 cred., §155; prereq. 15 cred.; not offered 1954-55) Broek

165s. Source Materials for Geographic Research. A survey of bibliographic aids and archival sources of geographic material at the international, national, and local levels. Particular attention to methods of handling data and the preparation of written reports. (3 cred.; prereq. 15 cred.) Weaver

170s.* Field Course. Field trips in the vicinity of the Twin Cities. Reports on selected topics. (3 cred.; prereq. 15 cred.) Borchert, Eidt

251f-252w-253s-254f-255w.* Seminars in Geography. Topic for each seminar to be announced later. (Cred. ar.; prereq. ‡) Staff

301f,w,s.* Research Problems in Geography. (Cred. ar.) Staff

GEOLOGY AND MINERALOGY

Professor	Associate Professor	Assistant Professor
George A. Thiel	Frederick M. Swain	Clarence R. Allen
John W. Gruner	Herbert E. Wright, Jr.	Robert E. Sloan
George M. Schwartz		
Samuel S. Goldich		

Prerequisites—For major work in geology, elementary courses in geology, such as 1-2 and A-B; 23-24, Mineralogy; 25, Rock Study; general chemistry, such as In.Ch. 6-7 and 11 and elementary physics, such as Phys. 7-8-9 or equivalent. Students who have not had the necessary undergraduate prerequisites may take them without credit.

Major and Minor—A student selecting some branch of geology as a major may not select general geology as a minor; it is preferable that the minor be taken outside of the major department.

Language Requirement—For the Master's degree, one language acceptable to the department. For the Doctor's degree, German is required, plus an additional language acceptable to the department or the option of a special research technique.

Master's Degree—Offered under both Plan A and Plan B. A field course or geologic field experience is required.

Doctor's Degree—Whatever field of special interest is pursued, it is expected that the student registering for the doctorate will take some courses in each of the major divisions of geology. Some geologic field experience is required.

Courses

100su.*†† Field Work, Northern Minnesota—July 15 to 30, approximately. Students interested should consult the department. (3 cred.; prereq. 25; offered 1954 and alternate years) Gruner, Thiel, Wright

101f.* Sedimentation. Origin of sedimentary rocks and their lithologic associations. (3 cred.; prereq. 24; lect., assigned readings) Thiel

†† A comprehensive report will be required for Graduate School credit.

102w. Methods of Study of Sediments. Textural and mineralogical analyses of clastic and nonclastic sediments. (3 cred.; prereq. 101, 106) Thiel

103w-104s. Micropaleontology. Biological and stratigraphic aspects of microfossils, especially Foraminifera and Ostracoda. (3 cred. per qtr.; prereq. 107) Swain

106f. Petrography. Optical methods; introduction to microscopic work on rocks. (3 cred.; prereq. 25) Goldich

107f. Invertebrate Paleontology. Morphology and classification of important fossil groups. (3 cred.; prereq. B or elementary zoology or ‡) Sloan

108w. Stratigraphic Paleontology. Principles of stratigraphic paleontology; environmental analysis. (3 cred.; prereq. 107) Sloan

109s. Advanced Invertebrate Paleontology. Procedures in taxonomy, preparation of a paleontologic report. (3 cred.; prereq. 108) Sloan

110w-111s. Economic Geology. Principles of economic geology in 110; nature, genesis, and distribution of the metals and nonmetallic minerals in 111. (3 cred. per qtr.; prereq. 25) Schwartz

112s. Petroleum Geology. Petroleum origin; structure and stratigraphy of major oil fields. (3 cred.; prereq. 125, 151) Swain

114s. Geology of Minnesota and Adjoining Areas. Structure and lithology of the rocks and their associated mineral resources. (3 cred.; prereq. 25; offered 1955-56 and alternate years) Thiel

115su.†† Field Work, Southeastern Minnesota—July 15 to 30, approximately. Stratigraphic field methods and principles. (3 cred.; prereq. 25; offered 1955 and alternate years) Sloan

118f.* Geomorphology. Origin and evolution of landforms in different climatic and geologic environments. (3 cred.; prereq. 2 and A; field trips, term paper or field project) Wright

119Aw.* Geomorphology of Eastern United States. General geology, with emphasis on the landforms and the Cenozoic history. Map study. (3 cred.; prereq. 118 or 125; offered 1955-56 and alternate years) Wright

119Bw.* Geomorphology of Western United States. Complementary to 119A. Map study. (3 cred.; prereq. 118 or 125; offered 1954-55 and alternate years) Wright

120s. Glacial Geology. Glaciers, glacial deposits, and Pleistocene history. (3 cred.; prereq. A and 2; field trips) Wright

121f. Crystallography. Symmetry relations in crystal classes. Crystal drawings and measurements. (3 cred.; prereq. Math. 7, general inorganic chemistry) Gruner

125f.* Structural Geology. Primary and secondary structures of rocks; mechanics of rock deformation; field use. (3 cred.; prereq. 2, 25) Allen

131w-132s. Petrology. Petrographic description, classification, and origin of rocks. Emphasis on sedimentary rocks in 131, on igneous and metamorphic rocks in 132. (4 cred. per qtr.; prereq. 106) Goldich

137s.* Principles of Chemical Geology. Geochemical literature. Methods in research and application of physical chemical principles to geologic problems. (3 cred.; prereq. one year of college chemistry and 25) Gruner

140w-141s. Applied Petrography. Application of petrographic techniques to problems in mining and petroleum geology. (3 cred. per qtr.; prereq. 131) Gruner

144w. Geologic Maps. Construction and interpretation of geologic maps, cross sections and structure contour maps. Fault problems. (3 cred.; prereq. 125) Wright

145s. Aerial Photographs. Elements of photogrammetry, stereovision, geologic and geomorphic interpretation, field use. (3 cred.; prereq. A and 2) Wright

146f-147w. Soil Mineralogy. The crystal systems; morphological, physical, and chemical characters of minerals. Blowpipe analysis, sight identification.

†† A comprehensive report will be required for Graduate School credit.

For students in soil science and civil engineering. (3 cred. per qtr.; prereq. a year of college chemistry) Gruner

150su.* Field Geology—June 15 to July 15. Detailed systematic field work. Preparation of geologic maps, structure sections, reports; genesis of ores and their relations to geologic structures. Field: Black Hills, South Dakota. (Cred. ar., a maximum of 6 cred. will be granted after field report is completed; prereq. 125) Swain

151w. Stratigraphy I. Principles of stratigraphic classification and correlation; biostratigraphic zones, sedimentary facies and cycles. Study of typical pre-Mesozoic sequences. (3 cred.; prereq. 107) Swain

152s.* Stratigraphy II. Study of typical Mesozoic and Cenozoic sequences; methods of presentation of stratigraphic data. (3 cred.; prereq. 151) Swain

153f. Subsurface Stratigraphy. The application of sample logs, electrical logs, and other methods to the detailed stratigraphy of the subsurface in selected areas. (3 cred.; prereq. 151) Swain

155w. Vertebrate Paleontology. Evolution and stratigraphic occurrence of important groups of vertebrate fossils. (3 cred.; prereq. 107, comparative anatomy or #) Sloan

161s. Advanced Mineralogy. Systematic study of mineral groups including some of the less common ones. Laboratory study of selected specimens. Special physical and chemical tests including blowpipe analysis. (3 cred.; prereq. 24) Gruner

166w-167s.* Mineralography. Methods of studying opaque minerals and applications to problems in ore genesis and history. (3 cred. per qtr.; prereq. 111, 131) Schwartz

170f,w,s.* Geologic Problems. Individual research in laboratory or field problems. (Cred. ar.; prereq. consent of major adviser) Staff

171f. Preparation of Geologic Report. Preparation, under close supervision, of a geologic report, with maps and other illustrations, on an acceptable area or subject. Preliminary draft due at mid-quarter. (1 cred.; prereq. 144, 150, or #) Staff

175s. Field Work in Glacial Geology and Geomorphology. Mapping surficial deposits and landforms. One day in field each week. (3 cred.; prereq. 118, 120) Wright

211f-212w-213s.* Research in Invertebrate Paleontology. Analyses of selected fossil populations. (3 cred. per qtr.; prereq. 104 or 108, 151) Sloan, Swain

214.* Seminar in Economic Geology. (Cred. ar.; prereq. 111) Goldich, Gruner, Schwartz

215s.* Advanced Course in Principles of Economic Geology. Detailed study of fundamental principles involved in the origin of ore deposits. (3 cred.; prereq. 111; offered 1954-55 and alternate years) Schwartz

216s.* Mining Geology. Fundamental principles of economic geology applied to problems in mining. (3 cred.; prereq. 111; offered 1955-56 and alternate years) Schwartz

217.* Research Course in Petroleum Geology. (Cred. ar.; prereq. 112, 153 or #) Swain

218f.* Advanced Structural Geology. Fundamental problems of primary and secondary structures. (3 cred.; prereq. 125, 132) Allen

241.* Field Course in Geology. To be arranged with individual students upon application to the department. (Cred. ar.) Staff

243-244.* Research Course in Geology. Advanced work in geology; chiefly individual work on selected subjects. (Cred. ar.) Staff

245-246.* Research in Sedimentation. (3 cred. per qtr.; prereq. 102) Thiel

247.* Research in Geomorphology and Pleistocene Geology. (Cred. ar.; prereq. 118, 120) Wright

248.* Seminar in Geomorphology and Pleistocene Geology. (Cred. ar.; prereq. 118, 120) Wright

251-252.* Mineralogical Problems. Morphology and physical measurements of minerals. (Cred. ar.; prereq. 121, 161) Gruner

253-254.* Research Course in Economic Geology. (Cred. ar.; prereq. 111) Goldich, Gruner, Schwartz

260f,w,s. Rock Analysis. Laboratory course covering the technique of rock analysis. (3 cred.; prereq. #) Goldich

261s. Theoretical Mineralogy. Crystalline state. Isomorphism and polymorphism. Structures of silicates. Synthesis of minerals. Identification of minerals by X rays. Mineralogical phase rule. (3 cred.; prereq. 121, 161, or #) Gruner

262f. Advanced Optical Mineralogy. Theory of crystal optics. Determination of optical constants, universal stage and other techniques. (3 cred.; prereq. 106) Goldich

263w. Seminar in Igneous Petrology. (3 cred.; prereq. 132; offered 1955-56 and alternate years) Goldich

264w. Seminar in Metamorphic Petrology. (3 cred.; prereq. 131; offered 1954-55 and alternate years) Goldich

265. Seminar in Special Research Fields.

268s. Seminar in Mineralogy. (Cred. ar.; prereq. 161 or #; offered 1955-56 and alternate years) Gruner

GEOPHYSICS

Advisers:

Assistant Professor
Harold M. Mooney (Geophysics)

Professor
J. William Buchta (Physics)

Associate Professor
Frederick M. Swain (Geology)

Assistant Professor
William D. Munro (Mathematics)

Prerequisites—Basic preparation in physics, mathematics, and geology with an undergraduate major in one of these subjects or geophysics is required.

Major and Minor—With the approval of the adviser, courses in physics or geology may be accepted as part of the major work in geophysics. Physics, mathematics, electrical engineering, and geology are acceptable minor fields.

Language Requirement—One foreign language, preferably German.

Master's Degree—Offered under Plan A or Plan B.

Courses

108f. Introduction to General Geophysics. Physics of the earth; evidence and data on age and shape of the earth, internal constitution, gravity and magnetic fields. (3 cred.; prereq. Phys. 9, Geol. 2; Geol. 125 recommended) Mooney

109w. Elementary Seismology. Physics and geology of earthquakes; causes, effects, and distribution. Theory of seismic waves. (3 cred.; prereq. Phys. 9, Geol. 125) Mooney

110s. Introduction to Exploration Geophysics. Principles of exploration by gravitational, magnetic, seismic, and electrical measurements. (3 cred.; prereq. Phys. 9, Geol. 2; Geol. 125 recommended) Mooney

125f. Principles of Gravity and Magnetic Exploration. Techniques of interpretation; use in geologic and mining problems. (2 cred.; prereq. Phys. 9, Geol. 125, I.T.M. 25) Mooney

126w. Principles of Seismic Exploration. Reflection and refraction shooting, interpretation of data. (2 cred.; prereq. Phys. 9, Geol. 125, I.T.M. 25) Mooney

127s. Principles of Electrical Exploration. Resistivity method and others; theory, interpretation, and instruments. (2 cred.; prereq. Phys. 9, Geol. 125, I.T.M. 25) Mooney

130f,w,s.* Special Problems. (Cred. ar.; prereq. ‡) Mooney
Geol.110f-111w. Economic Geology.
Geol. 112s. Petroleum Geology.
Geol.125f.* Structural Geology.
I.T.M.132f-133w-134s. Industrial Statistics.
I.T.M.150f or 105f,w,s. Intermediate Calculus.
I.T.M.151w,s* or 106f,w. Differential Equations.
I.T.M.152w-153s or 107s. Advanced Calculus.
I.T.M.154f.* Vector Analysis.
Phys.101f-103w-105s. Theoretical Physics.
Phys.131f-133w. Geometrical and Physical Optics.

GERMAN

Associate Professor
Lynwood G. Downs
Hermann Ramras
Frank H. Wood

Assistant Professor
Frederick L. Pfeiffer

Prerequisites—For major work, 27 Senior College quarter credits or equivalent. For minor work, 18 Senior College quarter credits or equivalent. All candidates for advanced degrees shall understand spoken German and speak and write the language with some facility.

Language Requirement—A candidate for the Master's degree must have a reading knowledge of at least one foreign language other than German.

Master's Degree—Offered under both Plan A and Plan B.

Doctor's Degree—In German, major work may be done in either of two historical subdivisions of the general field. The first, German Literature, embraces New High German literature and extends from the end of the Middle Ages to the present. The second, Linguistics and Philology, embraces the dialects, culture, and literature of the Germanic peoples and of Germany from early times through the Middle Ages.

Doctor's Degree in German Literature

Normally candidates are expected to offer 18 credits in linguistics and philology.

A minor in linguistics and philology will require at least 27 credits. Majors in German literature may, however, offer a combined minor by offering 18 credits in linguistics and philology and 12 or more in one of the following fields: classics, English literature, fine arts, foreign literature, history, philosophy. In any case, it is strongly recommended that candidates in German literature supplement their major by courses chosen from one or more of these fields.

Doctor's Degree in Linguistics and Philology

Normally candidates are expected to offer 18 credits in German literature.

A substantial knowledge of Latin is expected of all candidates.

An elementary knowledge of Greek is strongly recommended.

Note—For information on work in comparative literature, see page 23.

Courses

GERMAN LITERATURE

103f-104w-105s.‡ German Syntax and Composition. (1 cred. per qtr.; prereq. 57 or equiv.; required of all graduate majors; offered 1954-55) Staff

130f-131w-132s.*‡ The Age of Luther. (3 cred. per qtr.; prereq. 70 and 11 cred. above 59 or equiv.; not offered) Downs

143f-144w-145s.*‡ The Classical Period: Goethe. (a) Lessing, Wieland, Herder; (b) Goethe; (c) Schiller; (d) Goethe and his literary relations to France, England, and the United States. (3 cred. per qtr.; prereq. 71 and 11 cred. above 59 or equiv.; (a) offered 1955-56, (c) offered 1954-55) Ramras

150f-151w-152s.*‡ Studies in German Literature of the Nineteenth Century. (a) Die Novelle; (b) Austrian Drama; (c) Romanticism. (3 cred. per qtr.; prereq. 72 and 11 cred. above 59 or equiv.; not offered) Pfeiffer

153f-154w-155s.*‡ Studies in the Literature of the Twentieth Century. (a) Literary Movements; (b) The Drama; (c) Die Novelle; (d) Essays and Criticism. (3 cred. per qtr.; prereq. 72 and 11 cred. above 59 or equiv.; (a) offered 1954-55) Wood

156f-157w-158s.*‡ Problems in German Literary Criticism. History, methods, bibliography. (3 cred. per qtr.; prereq. 70-71-72 and 6 cred. above 59 or equiv.; not offered) Wood

160f-161w-162s.*‡ Lyric Poetry. 160: From the Renaissance through Sturm und Drang. 161: From Goethe through Romanticism. 162: From Heine to Rilke. (3 cred. per qtr.; prereq. 70-71-72 or equiv. and 11 cred. above 59; offered 1955-56) Wood

163f-164w-165s.*‡ The German Novel. (a) Development of the Novel; (b) The Nineteenth-Century Novel; (c) The Twentieth Century. (3 cred. per qtr.; prereq. 70-71-72 and 6 cred. above 59 or equiv.; (b) offered 1954-55, (c) offered 1955-56) Pfeiffer

166f-167w-168s.‡ History of German Literature. (1 cred. per qtr.; prereq. 70 or equiv. or 11 cred. above 59; required of all graduate majors and minors; offered 1955-56) Staff

173f-174w-175s.*‡ European Literary Relations. (a) English-German Literary Relations; (b) French-German Literary Relations. (3 cred. per qtr.; prereq. 70-71-72 and 6 cred. above 59 or equiv.; not offered) Pfeiffer, Wood

180f-181w-182s.*‡ Drama in Translation. (3 cred. per qtr.; prereq. 9 cred. in theater arts or literature above 50; no knowledge of German required; offered 1954-55) Menze

253f-254w-255s.*‡ Seminar: Literary Problems. (a) Goethe and Schiller; (b) Romanticism; (c) Nineteenth- and Twentieth-Century Drama: Kleist, Grillparzer, Hebbel, and Hauptmann. (3 cred. per qtr.; prereq. 70-71-72; (a) offered 1955-56) Wood, Pfeiffer, Ramras

GERMAN LINGUISTICS AND PHILOLOGY

110f-111w-112s.*† Middle High German. Linguistic introduction and readings in Middle High German literature. (3 cred. per qtr.; prereq. 70 and 11 cred. above 59 or equiv.; not offered) Downs

113f-114w.‡ Gothic. (Same as Scan. 113-114) The course is an introduction to Germanic linguistics and to a comparative study of Indo-European languages. (3 cred. per qtr.; prereq. 80 and 11 cred. above 59 or equiv.; not offered) Downs

118f-119w-120s.‡ Old High German. Linguistic discussion and readings in Old High German literature. (3 cred. per qtr.; prereq. 70 and 11 cred. above 59 or equiv.; not offered) Downs

125s. History of the German Language. (3 cred.; prereq. 80 and 11 cred. above 59; not offered) Downs

126s. Historical German Grammar. (3 cred.; prereq. 110-111-112 or 113-114-115; not offered) Downs

176f-177w-178s.‡ Problems and Research Trends in Germanic Philology. 176: The Germanic Languages. 177: The Germanic Literary Tradition. A comparative discussion of the native and foreign records of the Old Germanic Period. 178: Linguistic Geography. (3 cred. per qtr.; prereq. two Germanic dialects; not offered)

194s. Old Saxon. The Heliand. (3 cred.; not offered) Downs

195f-196w-197s.‡ Old Norse, Language and Literature. (Same as Scan. 195-196-197) (3 cred. per qtr.; knowledge of one Germanic dialect recommended; offered 1955-56) Downs

GREEK

For courses and staff, see Classics.

HISTORY

Professor
Herbert Heaton
Alfred L. Burt
Harold C. Deutsch
Tom B. Jones
Philip D. Jordan
August C. Krey
Ernest S. Osgood
Lawrence D. Steefel
Faith Thompson
Alice F. Tyler
David H. Willson
John B. Wolf

Associate Professor
George W. Anderson
W. Donald Beatty
John Bowditch
Rodney C. Loehr

Assistant Professor
Clarke A. Chambers

Instructor
David W. Noble

Note—For information on work in international relations, see page 26; for work in American Studies, see pages 22 and 52.

Prerequisites—Students entering upon graduate work in history will usually be expected to have taken (1) general survey courses in two or three of the following areas or periods: Ancient, European, English, and American; (2) advanced or Senior College courses in two of them, including (3) at least one course in which intensive work has been done.

A student who makes history a minor must have completed approximately the same amount of prerequisite work as that indicated in the preceding paragraph with the possible exception of the course involving intensive work.

Language Requirement—The department attaches much importance to adequate preparation in the foreign languages, which may be used by the student in the course of advanced and research work.

Adviser—A candidate for the M.A. or Ph.D. degree is free to choose his adviser from the members of the graduate faculty of the department. A candidate unfamiliar with the department or uncertain of his interests should consult one of the members of the History Department Graduate Studies Advisory Committee for assignment to an adviser.

Master of Arts Degree

PLAN A—The candidate's program of study shall be made through consultation with his adviser. In general it will be expected that the candidate will prepare himself by taking courses or by personal study in two subfields comparable to those required for the Ph.D. He will also present a thesis. A minimum of 21 credits in the major, including Hist. 200 or its equivalent, and 9 credits in the minor will be required. There shall

be a final written examination covering the major subfields and an oral examination covering the thesis, the major, and the minor.

PLAN B—The candidate's program of study shall be made through consultation with his adviser. It is expected that the candidate will register for courses that will give a balanced training in the general field of history, together with attention to supporting fields. One of the courses in history carrying at least 9 credits shall be a seminar or readings course.

Doctor's Degree in History

The candidate for the Ph.D. in history must be prepared for examination in three of the following fields in history (with the exception of the candidate specializing in ancient history, to be noted below):

1. Ancient history
2. Medieval and early modern history to 1600
3. Modern European history 1500 to the present
4. English history
5. History of the Americas

In the field of his specialization (i.e., of his thesis), the student shall demonstrate particular competence in two subfields, the one, a period (for example: the XIII century, the XVII century, U.S. colonial period, etc.), the other, a region or topic (for example: economic history, diplomatic history, the westward movement, Canada, France, Russia, etc.). In each of the other two fields the candidate shall demonstrate particular competence in one subfield. (A list of subfields may be obtained from the History Department, Ford Hall.)

All candidates shall take Hist. 168, 169, and 200, or equivalents.

A candidate specializing in ancient history shall present ancient history with three subfields (the Old Orient, Greece, Rome) and medieval history with one subfield, in place of the three fields previously described.

The candidate's program of study and the definition of his fields and subfields shall be arranged by consultation with his adviser. In cases where there is to be an unusual definition of a subfield, the departmental Graduate Studies Advisory Committee should be consulted.

Preliminary Examination—The preliminary examination shall cover all the fields of history chosen by the candidate and also the minor. The written examinations may be taken the first week in November, the first week in February, and the first week in May. The oral examination must follow immediately after. In the preliminary examination the candidate will be required to demonstrate a general knowledge of the fields and a specific knowledge of the subfields for which he is responsible.

Final Examination—The final oral examination shall cover the thesis and its relationship to the field of history in which it falls.

Minor in History—The candidate for the M.A. degree with a minor in history (Plan A) must take a minimum of 9 credits and be examined in one subfield of history.

The candidate for the Ph.D. degree with a minor in history must be prepared for oral examination, and may also be required to take a writ-

ten examination in one of the fields previously listed, and demonstrate particular competence in two subfields within it. Normally this work in the minor will be equivalent to at least 21 credits.

All minor programs must be approved by a member of the History Department Graduate Studies Advisory Committee.

Lecture Courses

100f-101w-102s. The Ancient Near East. (3 cred per qtr.) Jones

100af-101aw-102as. History of Greece. (3 cred. per qtr.) Jones

100bf-101bw-102bs. History of Rome. (3 cred. per qtr.) Jones

103f-104w-105s. Medieval History. Students attend classes in 65f-66w-67s. (3 cred. per qtr.) Krey

103af-104aw-105as. Renaissance and Reformation. Students attend classes in 65af-66aw-67as. (3 cred. per qtr.) Krey

106f-107w-108s. Continental Europe (1559 to 1815). (3 cred. per qtr.) Wolf

106af-107aw-108as. Continental Europe (Nineteenth Century). (3 cred. per qtr.) Steefel

109f-110w-111s. Europe in the Twentieth Century. (3 cred. per qtr.) Deutsch

112f-113w-114s. Economic History of Europe. (3 cred. per qtr.) Heaton

115f-116w-117s. European Expansion. (3 cred. per qtr.) Willson

120f-121w. Modern France. (3 cred. per qtr.) Bowditch

122f-123w-124s. Scandinavian History. (3 cred. per qtr.)

125f-126w-127s. Russian History. (3 cred. per qtr.) Anderson

125af-126aw-127as. History of Eastern Europe and the Middle East. (3 cred. per qtr.) Anderson

128f-129w-130s. Modern England (1485-1714). (3 cred. per qtr.) Willson

128af-129aw-130as. Modern England (1714 to the Present). (3 cred. per qtr.) Willson

131f. Economic Development of the Scandinavian Countries. (3 cred.)

134f-135w-136s. World War II. (3 cred. per qtr.) Deutsch

137f-138w-139s. Early National United States History. (3 cred. per qtr.) Jordan

137af-138aw-139as. American History (1850-1900). (3 cred. per qtr.) Loehr

140f-141w-142s. History of Germany. (3 cred. per qtr.) Steefel

143f-144w-145s. American Folklore. (3 cred. per qtr.) Jordan

146f-147w-148s. American Economic History. (3 cred. per qtr.) Loehr

146af-147aw-148as. History of the South. (3 cred. per qtr.) Noble

149f-150w-151s. Social and Intellectual History of the United States. (3 cred. per qtr.) Tyler

152f-153w. The Immigrant in American History. (3 cred. per qtr.; not offered)

154f-155w-156s. Canadian History and Canadian-American Relations. Students attend classes in 76f-77w-78s. (3 cred. per qtr.) Burt

157f-158w-159s. Latin-American History. (3 cred. per qtr.) Beatty

168w-169s. Readings in the Works of Great Historians. (3 cred. per qtr.; this course required of all candidates for Ph.D. degree) Steefel

Readings Courses

170f-171w-172s.*† Ancient History. (3 cred. per qtr.) Jones

173f-174w-175s.*† Medieval and Renaissance History. (3 cred. per qtr.) Krey

173af-174aw-175as.*† Medieval English History. (3 cred. per qtr.) Thompson

176f-177w-178s.*† Seventeenth-Century France. (3 cred. per qtr.; reading knowledge of French required) Wolf

176af-177aw-178as.*† Russian History. (3 cred. per qtr.) Anderson

176bf-177bw-178bs.*† Scandinavian History. (3 cred. per qtr.)

176cf-177cw-178cs.*† Recent European History. (3 cred. per qtr.) Deutsch

176df-177dw-178ds.*† Nineteenth-Century European History. (3 cred. per qtr.) Steefel

179f-180w-181s.*† European Economic History Since 1700. (3 cred. per qtr.) Heaton

182f-183w-184s.*† English History, Tudor and Stuart Periods. (3 cred. per qtr.) Willson

185f-186w-187s.*† Problems of Slavery in American History. (3 cred. per qtr.) Tyler

185af-186aw-187as.*† The West in American History. (3 cred. per qtr.) Osgood

185bf-186bw-187bs.*† American Diplomatic History. (3 cred. per qtr.) Beatty

185cf-186cw-187cs.*† Twentieth-Century American History. (3 cred. per qtr.) Chambers

185df-186dw-187ds.*† Nineteenth-Century American History. (3 cred. per qtr.) Jordan

185ef-186ew-187es.*† Problems of the Eighteenth Century; Some Phases of Early American Social and Intellectual History. (3 cred. per qtr.) Tyler

188f-189w-190s.*† American Economic History. (3 cred. per qtr.) Loehr

191f-192w-193s.*† Canadian History and Canadian-American Relations. (3 cred. per qtr.) Burt

194f-195w-196s.*† Latin-American History. (3 cred. per qtr.) Beatty

200f. Historical Bibliography and Criticism. (3 cred.; required of candidates for advanced degrees in history who do not present evidence of similar training elsewhere) Steefel, others

Seminars

204f-205w-206s.† Medieval History. (3 cred. per qtr.) Krey

208f-209w-210s.*† American Economic History. (3 cred. per qtr.) Loehr

208af-209aw-210as.*† The American West. (3 cred. per qtr.) Osgood

208bf-209bw-210bs.*† The Slavery Controversy. (3 cred. per qtr.)

221f-222w-223s.*† European Economic History. (3 cred. per qtr.) Heaton

224f-225w-226s.*† Modern European History. (3 cred. per qtr.) Steefel

230f-231w-232s.*† Ancient History. (3 cred. per qtr.) Jones

240f-241w-242s.*† Latin-American History. (3 cred. per qtr.) Beatty

HOME ECONOMICS

Professor
Louise A. Stedman
Alice Biester
Roxana Ford
Jane M. Leichsenring
Isabel Noble
Ethel L. Phelps
Ella J. Rose

Associate Professor
Gertrude Esteros

Prerequisites—Students desiring to major in home economics must present undergraduate credits in such of the following—social sciences, physical sciences, biological sciences, art, and education—as shall be satisfactory to the adviser under whose direction the major work is to be done. In addition the student must have adequate undergraduate training in that field of home economics in which she wishes to specialize.

Major and Minor—Students majoring in home economics for a Master's or a Doctor's degree and those minoring in this school for the Doctor's degree must include either 209, 249, 279, or 299 in the study program.

Language Requirement—Candidates for the Master's degree under Plan B are exempted from the foreign language requirement. Candidates for the Ph.D. degree may submit (a) two foreign languages or (b) one foreign language and the option of a special research technique or a collateral field of knowledge.

Master's Degree—Offered under both Plan A and Plan B.

Doctor's Degree—Work for the Ph.D. degree is offered in certain fields of home economics.

Courses

102f. Advanced Textiles. The nature of textile raw materials; economic, chemical, and physical problems involved in their manufacture and use; measurement and significance of physical characteristics of yarns and fabrics. (3 cred.; prereq. 50, Ag.Bi. 1, Ag.Ec. 3 or ¶) Phelps

107w. Textile Analysis. Application of quantitative methods in the analysis of textile materials, with special reference to fiber composition and finishes. (3 cred.; prereq. 50, Ag.Bi. 1, 2) Phelps

115w. Economic and Social Aspects of Clothing. Trends in clothing consumption, clothing expenditure patterns, clothing budgets for low-income and dependent groups, motivation in dress, sociological and economic aspects of fashion in dress, ready-to-wear industry. (3 cred.; prereq. 50, Ag.Ec. 3)

116f,w, or s. Family Clothing Problems. Buying, simplification, labeling, and standardization of clothing; sizing of garments and patterns; recent developments in choice of clothing for specific uses. (3 cred.; prereq. 50)

120f,w,s. Art History. A general view of the history of art from the Egyptian period to the present. Architecture, furniture, painting, sculpture, and costume of the past studied for their present influences and contributions and their significance to contemporary houses and furnishings and to dress. (3 cred.; field trips) Esteros

121f. Textile Design. Historic and modern textile designs and designers studied. Original designs applied to textiles by means of silk screen, batik, and block print techniques. (3 cred.; prereq. 27, 50, 23 advised, or #) Esteros

122s. Advanced Interior Design. Small-house interiors designed and elevation drawings rendered in color. Studies and reports on modern trends, designers and their work, and other topics of practical and historic interest. Actual materials used as far as possible. Field trips to shops and homes. (3 cred.; prereq. 27, 120 or #) Esteros, Ludwig

125w. Advanced Costume Design. Modern and historic costume. Studies and reports on selected topics. Problems in draping and sketching designs for various figure types. Pencil, crayon, and watercolor techniques. (3 cred.; prereq. 3, 22, 25 recommended, or #) Esteros

140f. New Developments in Food Preparation. Survey of recent trends in food preparation. (3 cred.; prereq. 40 or equiv.) Noble

141su. Current Literature in Foods. Lecture and discussion of recent literature dealing with food products and preparation. (3 cred.; prereq. 40 or equiv.) Trammell

142f,s. Experimental Cookery. An intensive study of food problems. (3 cred.; prereq. 40, Ag.Bi. 1) Noble

146s. Special Food Problems. Class problems in foods and food preparation. (3 cred.; prereq. 142) Noble

150su. Textile Problems. Recent developments and findings in the field of textiles. Emphasis on needs of home economics teachers in secondary schools, colleges, and adult classes. (3 cred.; prereq. 3 cred. in textiles or equiv.)

170f,w. Nutrition of the Family. Fundamental principles of human nutrition and their application in promotion and maintenance of optimal health of the family. (3 cred.; prereq. 31, 40, Ag.Bi. 1, Phsl. 4) Biester, Leichsenring

171w,s. Child Nutrition. Lectures and discussions dealing with the principles of child nutrition and with the formation of desirable food habits. Observation of children at mealtime is included. (3 cred.; prereq. 170, H.E.Ed. 90) Leichsenring

172. Current Developments in Nutrition. Provides fundamental facts and techniques for solving current nutrition problems. (3 cred.; prereq. 31, 40, Ag.Bi. 1, Phsl. 4 or ♯; not offered 1954-55) Biester, Leichsenring

173s. Nutrition in Disease. Fundamental principles involved in using diet in treatment of certain diseases. (4 cred.; prereq. 170, 35 advised)

175w. Nutrition. Tissues and tissue metabolism as well as work on blood, milk, and urine. (4 cred.; prereq. 33)

176w. Advanced Nutrition. Selected quantitative methods applicable to investigations relating to digestion and metabolism. (4 cred.; prereq. 35 or ¶, Ag.Bi. 2) Biester

177s. Digestion and Metabolism. Selected problems relating to digestion and metabolism. (3 cred.; prereq. 35; lect., readings, lab.) Leichsenring

178f,w,s. Clinical Problems in Nutrition. Application of nutrition information to problems in health and disease, involving assigned readings, discussions, and experience in a clinic. (2 cred.; prereq. 170, 35 or ¶35)

179f,w. Readings in Nutrition. Experience in use of nutrition books and periodicals. Readings, oral and written reports. (2 cred.; prereq. 170) Biester, Leichsenring

180f,w,s. Home Planning and Furnishing. Problems in planning and furnishing a home to meet family needs. Aesthetic, economic, social, and managerial aspects considered. Each student develops a plan for a house and its furnishings based on family living. Field trips. (5 cred.; prereq. 27, 49, 120 advised) Myren, Ludwig, Esteros

181s. Housing Problems of the Family. Plans for both urban and rural homes will be considered, and the economic, art, and social aspects will be evaluated. Discussion, field trips, and classroom analyses will be a part of the work. (3 cred.; prereq. 24 or 27)

184s. Home-Management Principles. Discussion of the management aspects of homemaking with emphasis on problems involved in use of time, energy, and money. (3 cred.; prereq. 40, 41 advised)

185w. Family Relationships. Factors that promote satisfaction in family living, and inter-relationships of the family and the community. (3 cred.; prereq. 17, 86, H.E.Ed. 90 or ♯)

186s. Problems in Income Management. Specific aspects of financial management for the individual and for the family. (3 cred.; prereq. 86, 34 or equiv., or ♯; readings, discussions, field work)

195s. Development of Home Economics. A discussion of the development of home economics with emphasis upon current problems. (2 cred.) Stedman

202f,w, or s. Animal Fibers. Advanced study of structure, composition, properties, and special problems of manufacture of wool, silk, and other protein and protein-like fibers in relation to use. (2 cred.; prereq. advanced textiles, ♯) Phelps

204f,w, or s. Plant and Other Cellulosic Fibers. Advanced study of structure, composition, properties, and special problems of manufacture of cotton, flax, rayon, and certain minor and chemically manufactured fibers in relation to use. (2 cred.; prereq. botany, advanced textiles, ♯) Phelps

208f,w, or s. Microanalysis of Textile Fibers. Laboratory applications of histological and microchemical methods in the study of textile materials. (Cred. ar.; prereq. botany, zoology, advanced textiles, ♯) Phelps

209f,w,s.* Seminar in Textiles and Clothing. Reviews and interpretations of the literature of this field, emphasizing recent advances. Individual oral and written reports. (1 cred.; prereq. ♯) Phelps

247w. Special Food Problems. Review of recent research in experimental foods. (3 cred.; prereq. 142, Ag.Bi. 1, ♯) Noble

249f,w,s.* Seminar in Foods. Review and interpretation of the literature in the field of foods and experimental food preparation. (1 or 2 cred.; prereq. ♯) Noble

270f-271f. Principles of Human Nutrition. An advanced course dealing with certain aspects of digestion, metabolism, excretion, and food requirements under various conditions. (3 cred. per qtr.; prereq. 170, ♯) Leichsenring

279w,s.* Seminar in Nutrition. Reviews and interpretations of the literature of this field, emphasizing recent advances. Individual oral and written reports. (1 cred.; prereq. ♯) Biester, Leichsenring

295f,w,s-296f,w,s.* Home Economics Problems. Investigation of selected problems in home economics in fields such as foods, nutrition, textiles and clothing, home management, and related art. Independent study and written reports. (1 to 5 cred. per qtr.; prereq. ♯) Staff

299f,w,s.* Home Economics Problems. Recent advances in the field of home economics, involving independent study, reading, and oral or written reports. (Cred. ar.; prereq. ♯) Staff

HORTICULTURE

Professor	Associate Professor
Leon C. Snyder	Arthur E. Hutchins
Troy M. Currence	Robert E. Nylund
Fred A. Krantz	Arthur N. Wilcox
	James D. Winter

Prerequisites—For a major in horticulture a student must have completed a sufficient amount of work in plant sciences to satisfy the adviser that graduate study in this field may be satisfactorily undertaken. In certain cases further foundation courses may be required without credit.

Major—With the approval of the adviser, courses in closely related fields may be accepted as part of the major work.

Language Requirement—For the Master's degree under Plan A the graduate committee may, in individual cases, waive the requirement by petition. Under Plan B a foreign language is not generally required. For the Doctor's degree this requirement may be fulfilled, with the approval of the adviser, by (a) two foreign languages (German, French, Swedish, Russian, and Spanish are acceptable) or (b) one acceptable language and either a special research technique or a collateral field of knowledge.

Master's Degree—Offered under either Plan A or Plan B.

Doctor's Degree—Work for the Ph.D. degree is offered by the Department of Horticulture.

Courses

107f. Orchard Management. Orchard operations and costs. (3 cred.; lect., lab.; offered 1954-55 and alternate years)

110w. Horticultural Crop Breeding. Applied genetics. Principles and methods of breeding fruits, vegetables, ornamentals. (3 cred.; prereq. Agro. 31 or 131) Wilcox

111f. Systematic Pomology. Description, classification and identification of fruit varieties. (3 cred.; lect., lab.; offered 1955-56 and alternate years)

121w. Small Fruit Culture. Cultural practices; botanic relationships. (3 cred.; lect., problems)

135f. Potatoes. Production, improvement, and use. (3 cred.) Krantz

136f. Adaptation and Maintenance of Vegetable Varieties. Origin and history, adaptation, and seed production. Organizations working toward variety im-

provement. (3 cred.; prereq. 32 or equiv.; offered 1955-56 and alternate years) Currence

138w,139w. Vegetable Crops I and II. Relation of environmental factors to the growth and culture of vegetable crops. (3 cred. per qtr.; prereq. 32 or equiv.; 138 offered 1954-55, 139 offered 1955-56) Nylund

150s. Principles of Quality Control. Factors influencing the quality of fruits and vegetables after harvest; methods of quality evaluation and control; prepacking materials and methods. (2 cred.; prereq. ♯; offered 1955-56 and alternate years) Winter

190f-191w-192s. Special Problems. Supervised reading or experimentation. Written report required. (2 to 4 cred. per qtr.; prereq. ♯) Staff

193f-194w. Horticultural Seminar. Reports and discussions of current problems and investigations. (1 cred. per qtr.; required of graduate students) Staff

241w. Organization of Horticultural Research. Organization and administration in agricultural experiment stations with emphasis on project development and research outlines. (2 cred.) Snyder, Krantz

243f*-244w.* Advanced Topics in Horticulture. A review of recent advances in horticultural research. (2 cred. per qtr.) Staff

247f,w,s,su.◆ Report on Special Horticultural Topics. Written report of the literature dealing with a selected topic or problem. (Not to exceed 9 cred.; final approval by graduate committee in horticulture) Staff

248w. Truck Crop Breeding. Variety improvement, selection methods, pollination control, inheritance of characters, and suitable improvement programs for different crop species. (3 cred.; prereq. 110 or Agro. 132; offered 1954-55 and alternate years) Currence

249f,w,s,su.* Research in Horticultural Crop Breeding. (Cred. ar.) Currence, Krantz, Hutchins, Wilcox

Agro.242f,s.* Plant Breeding Seminar. (1 cred. per qtr.) Horticulture and Agronomy staffs

Agro.246w.* Genetics Seminar. (2 cred.) Horticulture, Agronomy, and Animal Husbandry staffs

Food 104w. Frozen Food Processing and Storage. History and development of the frozen food industry; factors influencing quality; processing and packaging; storage and transportation. (3 cred.; prereq. Ag.Bi. 5 or 6 and Bact. 53 or ♯) Winter

Food 105f,w,s. Frozen Food Problems. Special problems based upon work given in Food 104. (2 to 4 cred.; prereq. Food 104) Winter

HYDROMECHANICS

Courses

101. Fluid Mechanics. Basic principles of the mechanics of fluids. (3 cred.; prereq. M.&M. 26 or 84; 3 rec. hours per week) Straub, staff

102. Fluid Mechanics. Basic principles of the mechanics of fluids and applications. (4 cred.; prereq. M.&M. 26; 4 rec. hours per week) Straub, staff

103. Fluid Mechanics. Physical fluid properties, fluid statics, energy principle for compressible and incompressible fluids, pressure-momentum principle, elementary principles of turbines and pumps, introduction to advanced principles of flow phenomena. (5 cred.; prereq. M.&M. 26 or 84; 5 rec. hours per week) Straub, staff

104. Hydraulics Laboratory. Introduction to laboratory techniques, calibration principles, and fluid measurements. Open channel, pipe line, and hydraulic machinery experiments. (1 cred.; prereq. 101, 102, 103 or ¶ or Ch.En. 101) Straub, L. A. Johnson, staff

183f.* Open Channel Flow. Theory of uniform and varied flow in open channels, with practical applications to the design of hydraulic structures, computations of drawdown curves, backwater curves, hydraulic jump, measur-

ing flumes, submerged weirs, etc. (3 cred.; prereq. 101 or 102 or 103 and 104) Anderson or Straub

184f-185w-186s.* Advanced Hydraulic Problems. Problems in hydraulic design. (2 cred. per qtr.; prereq. 183 or ¶, ♯; offered when demand warrants) Straub, staff

187f. Intermediate Fluid Mechanics. One- and two-dimensional flow of an ideal fluid, energy and momentum relations, fluid forces, boundary layer theory, separation and cavitation, hydrofoils. (3 cred.; prereq. 101 or 102 or 103 and 104)

190w.* Mechanics of Similitude and Dimensional Analysis. Theory of the use of models in design; conditions for similarity in the case of hydraulic structures, elastic structures, aircraft, ships, waves, etc. (3 cred.; prereq. 101 or 102 or 103 and M.&M. 127, 128, or ♯) Anderson or Straub

191w. Hydraulic Motors and Pumps. Introductory theory of hydraulic pumps, turbines, motors, transmissions. (3 cred.; prereq. 187 or ♯) Ripken

192s.* Natural and Artificial Waterways. Wave motion, tides, ship resistance, transportation of sediment. Control and regulation of rivers, design of ship canals, locks, dry docks, movable dams, harbors. (3 cred.; prereq. 183 or ♯) Anderson or Straub

193s. Hydraulic Measurements. Study of laboratory and field methods and instruments for measurement of hydraulic pressure, velocity, and discharge. (3 cred.; prereq. 187 or ♯) Ripken

194f-195w-196s.* Advanced Hydraulic Laboratory. Experimental studies concerning characteristics of turbines, pumps, etc. Hydraulic models. (2 cred. per qtr.; prereq. 101 or 102 or 103 and 104; offered when demand warrants)

287. Fluid Turbulence. Quantitative description of turbulence; momentum and vorticity transfer theories; statistical theory of turbulence. Phenomena of turbulence diffusion and energy dissipation. Turbulence in wind-tunnels, rivers, and the atmosphere. (3 cred.; prereq. 187 or ♯; offered when demand warrants)

290f-291w-292s. Advanced Fluid Mechanics. (3 cred. per qtr.; prereq. 190; offered when staff permits) Straub

293f-294w-295s. Hydrodynamics. Theory of fluid motion. (3 cred. per qtr.; prereq. 187 and differential equations or advanced calculus, or ♯; offered when demand warrants) Silberman

296f-297w-298s. Advanced Hydrodynamics. (3 cred. per qtr.; prereq. 295; offered when demand warrants) Silberman

INTERNATIONAL RELATIONS AND AREA STUDIES

For general statement, see page 26.

JOURNALISM

Professor
Ralph D. Casey
Thomas F. Barnhart
Mitchell V. Charnley
J. Edward Gerald
Raymond B. Nixon

Associate Professor
W. Edwin Emery

Edwin H. Ford
Robert L. Jones

Assistant Professor
Alexander G. Park

Prerequisites—Courses in journalism are open to regularly enrolled graduate students who can meet the prerequisites prescribed for particular courses. Before acceptance as a candidate for a graduate degree with a major or minor in journalism, a student shall satisfy his adviser that he is sufficiently prepared to carry on graduate work in this discipline.

For major work, a total of 27 credits in journalism and the social sciences or English distributed as follows: in journalism, a minimum of

15 credits in basic courses; in one of the social sciences, or in advanced courses in English, 12 credits.

For minor work, not fewer than 12 credits in journalism courses which satisfy the journalism adviser of the student's journalistic background and proficiency.

Degree of Master of Arts

Work for the Master's degree is offered under Plan A and Plan B.

A five-year program in journalism offers qualified students the opportunity to correlate the work of their senior year with a Graduate School program for the M.A. in the fifth year (such a program must be worked out at the beginning of the senior year with the major adviser).

Master's candidates preparing for professional work in communications research should consult the adviser for the listing of special courses in this area.

Minor—A candidate who meets the prerequisites may satisfy the minor requirement by electing courses from among the following: 101, 103, 106, 109-110, 111, 113, 115, 118B, 120, 121, 125, 126, 130-131, 177, 200, 205, 208.

Language Requirement—One foreign language unless special exception is made upon petition. Foreign students who have gained proficiency in English as an acquired language may be permitted to offer English on recommendation of the major adviser and with the approval of the graduate group committee.

Degree of Doctor of Philosophy in Journalism

The program leading to the Ph.D. degree in journalism is intended for students whose academic and professional experience qualifies them to seek the degree, and who plan careers in professional journalism, mass communications research, or journalism teaching following their doctoral work. Candidates for the degree must give clear evidence of their ability to carry on independent original research.

In planning the three-year program for doctoral candidates, individual differences in the needs and purposes of students will be taken into account. The candidate shall, with the approval of his adviser, select four from among seven fields of concentration.** One field shall be designated as the thesis field. The seven fields are (1) theory of mass communications, (2) history of communications, (3) communications and public affairs, (4) international communications, (5) propaganda and public opinion, (6) economics of communications, and (7) quantitative communications research.

Each field is supported by course offerings from other disciplines within the University. The concept of a journalism field for the Ph.D. is that journalism is a specialized extension of the social sciences (supported, where necessary, by English, law, and education). Supporting courses will include offerings from such disciplines as history, political science, sociology, social psychology, economics, and geography. Decision as to what constitutes adequate preparation in any of the journalism

** A detailed statement of the offerings that may support each of the seven fields may be obtained from advisers or the office of the School of Journalism.

fields will be made in terms both of the communications specialty and of the social science to which it relates.

Minor in Journalism—Candidates for the Ph.D. degree in other departments may elect a minor in journalism by obtaining the approval of the dean of the Graduate School, the candidate's adviser, and the director of the School of Journalism.

Language Requirement—Either (a) two foreign languages or (b) one foreign language and the option of a special research technique or a collateral field of knowledge.

Courses

101w,s. Reporting of Public Affairs. Training in reporting court trials, city, county, state, federal, administrative, and legislative agencies; politics, business, and labor. (3 cred.; prereq. 51) Hage

103s.* Literary Aspects of Journalism. The literary, creative aspects of journalism as exemplified in the works of English and American fiction writers, poets, critics, essayists, and humorists. (3 cred.; prereq. ♯) Ford

106f,s.* Critical Writing. Theory and practice of writing book, theater, and motion picture reviews. Analysis of leading critics and critical periodicals. Weekly critical writing assignments. (3 cred.; prereq. a Senior College writing course, ♯) Ford, Gray

109w-110s.*‡ History of Journalism. 109: Development of newspapers and periodicals from early beginnings in Europe through the 1860's in the United States. 110: Emergence of modern journalism in the post-Civil War period. (3 cred. per qtr.) Ford, Emery

111f.* International Communications and Foreign Affairs. The channels of international communication and the news-gathering agencies. Factors affecting flow of news throughout the world. The role of the foreign correspondent. The relation of communications to foreign affairs and international understanding. (3 cred.; prereq. 15 cred. in social science including a history or political science course in international affairs) Park

113s.* Mass Communications. Analysis of channels and barriers between the writer and the mass audience. Emphasis upon problems of communicating information and ideas to group and mass audiences by newspaper, radio, film, television, books, and other media. Comparative studies of content and influence. (3 cred.; prereq. majors in journalism; others, ♯) Nixon

115w,s.* Communication Media Analysis. Scientific techniques in analyzing the content and audiences of mass communications. Social stratification and attitude studies as they relate to the utilization of the media by the public. (3 cred.; prereq. 51 or Econ. 5 or Psy. 70 or equiv., 113 and ♯) Jones

118.* Selected Topics in Journalism. A(s): Advanced reporting of public affairs. (3 cred.; prereq. 101, ♯) Staff. B(s): Projects in media analysis. (3 cred.; prereq. 115, ♯) Staff. C(f,w,s): Selected readings in journalism. (3 cred.; prereq. ♯) Casey, Nixon

120f.* Development of Radio and Television Communications. Historical and economic development of aural and visual broadcasting, television, and facsimile; government regulation of the media; the audience; broadcasting in other countries. (3 cred.; prereq. 51 for journalism majors, 13 or ♯ for speech-radio majors) Charnley

121w.* The Press in a Dynamic Society. Economic, political, and social determinants of the character and content of mass communications. Patterns of operation, their effect on content, and their relative social utility. Government and mass communications. (3 cred.; prereq. for journalism majors, 15 or 18; others, consent of adviser) Gerald

125w.* Communication Systems of the Free World. Communications in foreign democracies as compared with the United States and with totalitarian systems. Special emphasis upon Great Britain, the Netherlands, the Scan-

dinavian countries, France, and Latin America, with some attention to the problems of constructing a free press in Germany, Italy, Japan, and less developed areas. (3 cred.; prereq. 15 cred. in the social sciences with a Senior College course in international relations or comparative government recommended) Nixon

126s.* Communications in Authoritarian Society. Traditional relationships between government and communications media in authoritarian nations. Rise of the totalitarian regimes; their impact upon the structure and operations of mass communication media. Case studies of communications in selected Communist, Fascist, and neo-Fascist states. (3 cred.; prereq. 15 cred. in the social sciences with a Senior College course in international relations or comparative government recommended) Park

130f-131w.* Communication Agencies, Propaganda, and Public Opinion. Press, radio, and motion pictures and their role in the opinion-forming process. Theories of public opinion and propaganda. Propaganda and informational techniques of governments, political parties, pressure groups, and other organized bodies. Propaganda in war and crisis. (3 cred. per qtr.; prereq. for 130, 15 cred. in social science; for 131, 130) Casey

140f-141w. Interpretation of Contemporary Affairs. Analysis of major political, economic, and social problems and their interpretation in the editorial, interpretive article, and commentary. Source materials in the backgrounding of the news. (3 cred. per qtr.; prereq. 51, 10 cred. in the social sciences or consent of major adviser in journalism) Gerald, Nixon, Emery, Park

142s. Current Communications Problems. The individual project method is used for analyses of journalistic problems of contemporary importance. (3 cred.; prereq. 51) Nixon, Hage

150s. Public Relations in Community Services. Principles and practices of public relations and educational campaigns in public health, social work, and other community service fields. (2 or 3 cred.; prereq. consent of major adviser and instructor; not open to those who have completed work in 78 nor ordinarily to journalism majors) Emery

151w,s. Newspaper Advertising. The role of newspaper advertising; the newspaper's relations with the retail advertiser, national representative, and advertising agency; organization of newspaper advertising departments; rate structures; services. Retail advertising copy approaches. (3 cred.; prereq. 51, 55 and 86 or ‡) Barnhart

152f,s.* Advanced Newspaper Advertising. Policy problems of advertising departments; sales programs and newspaper sales promotion; review of advertising research. (3 cred.; prereq. 51, 151 and ‡) Barnhart

177s.* Freedom of the Press and Communications Law. The Anglo-American concept of freedom of speech and press, its development under the Constitution of the United States, and the present areas of tension. Statutes and administrative regulations affecting freedom of information, publishing, and broadcasting. (3 cred.; prereq. 51 or ‡) Gerald

200f.* Research in Mass Communications Problems. Individual research in either historical or contemporary phases of newspaper, magazine, or advertising fields. (3 cred.; prereq. 113 or ¶ and consent of director of the school) Jones

205s.* Topics in International News Communications. Discussion and reports on the rise and development of international news communication and the news-gathering agencies. (3 cred.; prereq. ‡) Casey, Park

208s.* Communication Agencies as Social Institutions. Influence of political, social, and economic forces upon the national character and performance of press, radio, and motion picture. (3 cred.; prereq. ‡) Gerald

212f.* Topics in the History of Communications. Research in the history and development of the mass media. (3 cred.; prereq. 109-110 and ‡) Emery

218s.* Seminar in Media Analysis. Consideration of research designs and of procedures for quantitative studies of media control, content, audiences, and effects; relationships between research and decision-making. (3 cred.; prereq. 113 or 115, 200, and a course in statistics, or ‡) Jones

230w.* Seminar in Public Opinion and Propaganda. The theoretical bases of public opinion and propaganda. Studies of the developing literature in this field of specialization. Topics in the opinion-making processes of governments, political parties, pressure groups, and other organized groups. (3 cred.; prereq. 130-131 and consent of adviser) Casey, Nixon

277f,w.* Government and Mass Communications. Reconciliation of the social and individual interest through government actions affecting the mass media. (3 cred.; prereq. 12 cred. in journalism, including 177, and ‡) Gerald

LATIN

For courses and staff, see Classics.

LIBRARY SCIENCE

Associate Professor
David K. Berninghausen

Professor
Errett W. McDiarmid
Edward B. Stanford

Associate Professor
C. Irene Hayner
Harold G. Russell
Raymond H. Shove

Assistant Professor
Wesley Simonton

Students may plan their study programs for work in college, university, public, special, children's, or school libraries.

Prerequisites—Admission to the Graduate School for major work in library science requires a Bachelor's degree from an approved college or university and satisfactory undergraduate training or the equivalent in the basic elements of library science, including bibliography, administration, and reading guidance.

Language Requirement—Reading knowledge of one foreign language.

Master's Degree—Offered under both Plan A and Plan B.

Courses

131s.* Public Library Extension and Development. Larger units of service, laws, finance, promotion; the state library agency. (3 cred.; prereq. 55) Fulmer

153f.* History of Books and Printing. The alphabet; manuscript books; the printed book from earliest times to the present. (3 cred.) Shove

154w.* The Public Library. Theories and principles of administration. (3 cred.; prereq. 55) Fulmer

155w.* The College and University Library. Educational functions of the college and university library and the administrative organization to perform these functions. (3 cred.; prereq. 55) Shove

156w.* Special Libraries. Procedures of newspaper, insurance, technical, medical, and other special libraries. (3 cred.; prereq. 55) Hopp

157w.* School Library Problems. Service in large units, relationships with public libraries, planning library quarters, budgets, training for school librarianship. (3 cred.; prereq. ‡) Hayner

163w. Reference II. Reference material in subject fields, subject bibliography. (3 cred.; prereq. 62) Fulmer

164s.* Reference III. Specialized reference tools; government publications; administration of the reference department; special problems in large libraries. (3 cred.; prereq. 62, 163) Russell

165w.* Advanced Bibliography. Specialized trade and national bibliographies, domestic and foreign. (3 cred.) Shove

171w.* Reading Guidance for Children. (3 cred.) Hayner

172s.* Reading Guidance for Adolescents. (3 cred.) Hayner

173f,s.* Reading Guidance for Adults. (3 cred.; prereq. 70) Fulmer

175f,s.* Publishers and Publishing. A study of the book trade including methods of distribution. (3 cred.) Fulmer, Shove

176s.* Communication Media and the Library. (3 cred.) Berninghausen

184w.* Cataloguing and Classification II. Special problems of cataloguing and classification, including study of the Library of Congress Classification. (3 cred.; prereq. 83) Simonton

185f,w,s.* Special Problems. Individual study on library problems for advanced students in library science. (1 to 3 cred.; prereq. approval of director of Library School) Shove, Hayner, Fulmer

259s.* Problems in Library Administration—Personnel, financial, and other problems. (3 cred.; prereq. 55 and one of the following: 154, 155, 156, 157) Stanford, McDiarmid

260w.* Literature of the Social Sciences. Bibliographies and landmark books in the social sciences. (3 cred.) Shove, Berninghausen

261f,w.* Literature of the Humanities. (3 cred.) Russell, Kingsley

262s.* Literature of the Natural Sciences. (3 cred.) Shove, Kingsley

272f.* Library Work with Children and Young People. (3 cred.) Hayner

277f.* History of Children's Literature. A history of this area of literature for librarians, teachers, and students of our cultural history. (3 cred.) Hayner

281s.* Theories of Bibliographical Organization. (3 cred.; prereq. 83 and 184) Simonton

LINGUISTICS AND COMPARATIVE PHILOLOGY

Assistant Professor
Donald C. Swanson

Professor
John W. Clark
Raymond L. Grismer

Associate Professor
Harold B. Allen
Emmert M. Brackney
Lynwood G. Downs
Thomas B. Irving
Robert F. Spencer

Assistant Professor
Thomas M. Magner

Instructor
Robert H. Brower

Prerequisites—For major work, not less than 6 quarter credits above 50 in each of two foreign languages, one of which must be German or Latin. For minor work, not less than 6 quarter credits above 50 in a foreign language.

Master's Degree—Offered under Plan B; Plan A may be followed by petition. Reading knowledge of Latin and German and a fair knowledge of Greek are required of all candidates.

Doctor's Degree—For a major, candidates are expected to have a substantial knowledge of German, French, and Latin, and an elementary knowledge of Greek. Their preparation should lead to a comprehensive knowledge of the descriptive and comparative-historical techniques of linguistic science. The comparative technique will be actualized by special attention to comparative Indo-European grammar.

Programs for candidates who wish to minor in linguistics will be planned in accordance with their background or needs.

Program—Candidates will work toward competence in the following fields (items 1 to 3 for majors for the M.A. degree; items 1 to 5 for majors for the doctorate):

1. General linguistics
2. A modern language (such as French or Russian)

3. Ancient languages; Sanskrit is required of all candidates.

4. A non-Indo-European language, such as Arabic, Chinese, Hebrew, Japanese; one year minimum of serious study.

5. English linguistics: both the modern and earlier stages of English.

Note—For information on work in comparative literature, see page 23.

Courses

GENERAL

Anth.105f. Phonetics
Anth.109f. Descriptive Linguistics

For details, see Anthropology

Clas.106f,107w. Introduction to the Study of Language
Clas.108s. Cultural Aspects of Language

For details, see Classics

Ling.151f-152w-153s. Honors Course. (1 to 3 cred. per qtr.) Staff
Ling.201f-202w-203s. Directed Readings. (1 to 3 cred. per qtr.) Staff

CLASSICS

Clas.133s. Vulgar Latin

For details, see Classics

ENGLISH

Engl.100f. Old English
Engl.102w. Readings in Old English Prose and Verse
Engl.103s. Beowulf
Engl.147f-148w-149s. Middle English Literature Exclusive of Chaucer
Engl.165f. Introduction to Modern English
Engl.166s. Historical Backgrounds of Modern English
Engl.174s. American English
Engl.204f-205w-206s. The Development of Standard English
Engl.297f-298w-299s. Independent Reading

For details, see English

GERMAN

Ger.110f-111w-112s. Middle High German
Ger.113f-114w. Gothic
Ger.118f-119w-120s. Old High German
Ger.125s. History of the German Language
Ger.126s. Historical German Grammar
Ger.194s. Old Saxon
Ger.195f-196w-197s. Old Norse Language and Literature

For details, see German

ROMANCE LANGUAGES

Fren.171f-172w-173s. History of French Language
Fren.201f-202w-203s. Old French Phonology and Morphology
Fren.204f-205w-206s. Reading in Old French Literature
Span.161f-162w-163s. Hispano-Arabic Culture

Span.241f-242w-243s. Old Spanish Philology
Span.244f-245w-246s. Readings in Old Spanish Literature
For details, see Romance Languages

SLAVIC AND ORIENTAL LANGUAGES

Sanskrit

Skt.128f-129w-130s. Readings in Sanskrit
Skt.131f-132w. Introduction to Sanskrit

Semitic

Sem.121f-122w-123s. Introduction to Arabic Grammar and Reading

Slavic

Slav.113f-114w-115s. Old Church Slavic (Old Bulgarian)
Russ.125f-126w-127s. History of the Russian Language

Chinese

Chin.101f-102w-103s. Advanced Chinese
Chin.110s. Chinese Literature in Translation

Japanese

Jap.101f-102w-103s. Advanced Japanese
Jap.110f-111w. Japanese Literature in Translation

Russian

Russ.101f-102w-103s. Russian Literature in Translation
Russ.131f-132w-133s. Russian Poetry—Nineteenth Century
For details, see Slavic and Oriental Languages

MATHEMATICS

Professor
Raymond W. Brink
Robert H. Cameron
Henry C. T. Eggers
William L. Hart
Hugh L. Turrittin
Stefan E. Warschawski
Hugh B. Wilcox

Associate Professor
Elizabeth Carlson
Monroe D. Donsker
Bernard R. Gelbaum
Gladys E. C. Gibbens
Gerhard K. Kalisch
Fulton Koehler
Edward S. Loye
Arthur N. Milgram
John M. H. Olmsted
Paul C. Rosenbloom

Assistant Professor
Henry D. Block
Watson B. Fulks
Charles Hatfield, Jr.
Warren S. Loud
Gayle W. McElrath
William D. Munro
Evar D. Nering
James B. Serrin

Instructor
Leon W. Green
John M. Slye

Students majoring in mathematics should consult either Mr. Olmsted, chairman, or Mr. Koehler, secretary of the group, or should confer with Mr. Brink, chairman of the Department of Mathematics of the College of Science, Literature, and the Arts (119 Folwell Hall), or Mr. Warschawski, head of the Department of Mathematics of the Institute of Technology (114 Engineering Building).

Prerequisites—For students majoring in mathematics, 10 credits in calculus and 14 other credits in non-Junior College courses. Exceptions

may be made in unusual circumstances. For students minoring in mathematics, 10 credits in calculus.

Language Requirement—For the Master's degree, one foreign language. In exceptional cases the department may waive this requirement. For the Ph.D. degree, two foreign languages.

Master's Degree—Offered under both Plan A and Plan B. Both written and oral examinations required.

Doctor's Degree—A student's program of work for the Ph.D. degree is to be made in consultation with an adviser, and will include the fundamentals in at least three of the four following major fields: (1) algebra, (2) analysis, (3) applied mathematics and/or statistics, (4) geometry and/or topology. Preliminary written and oral, and final oral examinations required of majors. Preliminary written examination in mathematics required of minors.

For more detailed information about the following courses and for the courses offered in 1955-56, students should consult the program of the Department of Mathematics in the *Bulletin of the College of Science, Literature, and the Arts* and the program of the Department of Mathematics in the *Bulletin of the Institute of Technology.*

Note—For information on work in statistics, see pages 31-33.

Courses

106f,s.¶¶ Differential Equations. (3 cred.; prereq. differential and integral calculus) Gibbens, Slye

107w-108s.*¶¶ Advanced Calculus. (3 cred. per qtr.; prereq. Math. 52) Hatfield

109.*¶¶ Theory of Numbers. (3 cred.; prereq. differential and integral calculus; not offered 1954-55)

118s.*¶¶ Vector Analysis. (3 cred.; prereq. differential and integral calculus) Nering

120w.*¶¶ Group Representations. Elementary theory of finite groups and of infinite abelian groups with some application to permutation and crystallographic groups; representation by matrices, characters. (3 cred.; prereq. 119 or 131) Nering

121f-122w-123s.*¶¶ Mathematical Theory of Statistics. (3 cred. per qtr.; prereq. differential and integral calculus) Hart

126.*¶¶ Calculus of Finite Differences. (3 cred.; prereq. differential and integral calculus; not offered 1954-55)

127f-128w-129s.¶¶ Applied Mathematics for the Social and Biological Sciences. (3 cred. per qtr.; prereq. differential and integral calculus or Math. 15-16) Donsker

131f.*¶¶ Advanced Algebraic Theory. Linear dependence and independence of vectors of n-tuples with real or complex entries; dimension; matrices and linear transformations; determinants; ranks of matrices; systems of linear equations; special (orthogonal, symmetric, unitary, hermitean, normal) matrices; bilinear, quadratic, hermitean forms; characteristic values and vectors; diagonalization of symmetric, hermitean, normal matrices and

* This course may be taken to meet a certain requirement for the Master's degree under Plan B. (See the requirements for that degree in another part of this bulletin.) Other courses may be so marked with an asterisk for individual students with the consent of their advisers and the instructors who give the courses.

¶¶ This course is given by the Department of Mathematics in the College of Science, Literature, and the Arts.

quadratic and hermitean forms. (3 cred.; prereq. differential and integral calculus) Nering

132f-133w-134s.§§ Industrial Statistics. (3 cred. per qtr.; prereq. differential and integral calculus)

136w.*¶¶ Solid Analytic Geometry. (3 cred.; prereq. differential calculus) Gibbens

140.*¶¶ Projective Geometry. (3 cred.; prereq. differential and integral calculus; not offered 1954-55)

142f-143w.§§ Vector and Matrix Theory with Applications. (3 cred. per qtr.; prereq. differential and integral calculus) Milgram

144-145-146.*¶¶ Fourier Series and Orthogonal Functions. (3 cred. per qtr.; prereq. differential and integral calculus; not offered 1954-55)

150f.w.§§ Calculus III: Intermediate Calculus. (3 cred.; prereq. differential and integral calculus) Loye

151w,s.*§§ Differential Equations. (3 cred.; prereq. I.T.M. 80 or equiv.) Polansky

152w,s-153f,s.§§ Advanced Calculus with Applications. (3 cred. per qtr.; prereq. 150) Koehler

154f,w.*§§ Vector Analysis. (3 cred.; prereq. differential and integral calculus) Wilcox

155w,s.*§§ Vector Analysis and Dyadics with Applications. (3 cred.; prereq. 154) Wilcox

156s.*§§ Elements of Tensor Analysis. (3 cred.; prereq. 154) Milgram

157f-158w-159s.*¶¶ Methods of Applied Mathematics. Integrated study of analytic tools commonly used in applications of mathematics with many problems and emphasis on developing technique. Material will include topics from complex variables, matrices, ordinary and partial differential equations, asymptotic expansions, etc. (3 cred. per qtr.; prereq. intermediate calculus or ♯) Loud

161f-162w-163s.*§§ Analytical Dynamics. (3 cred. per qtr.; prereq. M.&M. 127 or ♯) Koehler

168w.§§ Elementary Theory of Complex Variables. (3 cred.; prereq. 153) Fulks

169s.§§ Mathematical Theory of Flow. (3 cred.; prereq. 168) Serrin

170w-171s.*¶¶ Introduction to Modern Algebra. (3 cred. per qtr.; prereq. 119 or 131; offered 1954-55) Kalisch

170f-171w-172s.*¶¶ Introduction to Modern Algebra. Definitions and elementary theory of groups, rings, fields, and vector spaces; properties of linear transformations and matrices in vector spaces over arbitrary fields; factorization in integral domains; polynomial domains; finite and infinite field extensions; real fields. (3 cred. per qtr.; prereq. 131; offered 1955-56)

173f-174w-175s.*§§ Elementary Partial Differential Equations with Applications. (3 cred. per qtr.; prereq. I.T.M. 80, 153) Polansky

176-177.*¶¶ Intermediate Differential Equations. (3 cred. per qtr.; prereq. 106 or 151; not offered 1954-55)

179.*¶¶ Special Functions. (3 cred.; prereq. differential and integral calculus; not offered 1954-55)

184f.§§ Elementary Numerical Analysis in Engineering. (3 cred.; prereq. I.T.M. 80) Munro

185w-186s.*§§ Advanced Numerical Analysis in Engineering. (3 cred. per qtr.; prereq. 151, 153, 184) Munro

* This course may be taken to meet a certain requirement for the Master's degree under Plan B. (See the requirements for that degree in another part of this bulletin.) Other courses may be so marked with an asterisk for individual students with the consent of their advisers and the instructors who give the courses.

§§ This course is given by the Department of Mathematics in the Institute of Technology.

¶¶ This course is given by the Department of Mathematics in the College of Science, Literature, and the Arts.

187.*¶¶ Non-Euclidean Geometry. (3 cred.; prereq. differential and integral calculus; not offered 1954-55)

190f-191w-192s.*§§ Advanced Topics in Industrial Statistics. (3 cred. per qtr.; prereq. 134 or ♯) McElrath

193f-194w-195s.*§§ The Absolute Differential Calculus. (3 cred. per qtr.; prereq. 153 or ♯; offered 1954-55) Milgram

196f-197w-198s.*§§ Special Functions in Mathematical Analysis. (3 cred. per qtr.; prereq. 168; offered 1955-56) Fulks

199af-199bw-199cs.‡¶¶§§ Problem Course. (3 cred. per qtr.; prereq. ♯) Rosenbloom, Olmstead

203f-204w-205s.*¶¶ Advanced Mathematical Statistics. (3 cred. per qtr.; prereq. 121-122-123 and either 108 or ♯) Gelbaum

206f-207w-208s.*¶¶ Theory of Functions of Real and Complex Variables. (3 cred. per qtr.; prereq. 108 or ♯) Cameron

212f-213w.*¶¶ Point Set Topology. (3 cred. per qtr.; prereq. 206; offered 1954-55) Olmsted

214.*¶¶ Topological Algebra. (3 cred.; prereq. 213 and either 120 or 170; not offered 1954-55)

220s.*¶¶ Algebraic Topology. Homology groups of abstract complexes; topological invariance of homology groups of topological spaces. (3 cred.; prereq. 120 or 170 or equiv., and 213; offered 1954-55) Kalisch

227f-228w-229s.*§§ Mathematics of Computers and Control Devices. (3 cred. per qtr.; prereq. 186; offered 1955-56) Munro

232f-233w-234s.*§§ Mathematical Theory of Continuous Media. (3 cred. per qtr.; prereq. I.T.M. 80, 153, 154, M.&M. 127; offered 1954-55) Serrin

239-240.*¶¶ Fourier Transforms. (3 cred. per qtr.; prereq. 245; not offered 1954-55)

245s.*¶¶ Introduction to Lebesgue Integrals. (4 cred.; prereq. 207) Cameron

246f-247w.*¶¶ Integration in Function Space. (3 cred. per qtr.; prereq. 245) Cameron

248f-249w-250s.*¶¶§§ Reading and Research. Competent students will be assisted in independent reading and reports by members of the department. (1 to 3 cred. per qtr.)

258f-259w-260s.*¶¶ Theory of Probability. An integrated development of selected topics in modern probability theory, including recent advances in limit theorems and an introduction to stochastic processes. (3 cred. per qtr.; prereq. 245 or ♯; offered 1954-55) Donsker

261f-262w-263s.*§§ Functions of a Complex Variable. (3 cred. per qtr.; prereq. 153) Warschawski

264f-265w-266s.*§§ Conformal Mapping. (3 cred. per qtr.; prereq. 261 or ♯; offered 1954-55) Warschawski

267f-268w-269s.*§§ Selected Topics in the Theory of Analytic Functions. (3 cred. per qtr.; prereq. 263 or equiv.; offered 1955-56) Warschawski

274f-275w-276s.*§§ Partial Differential and Integral Equations of Applied Mathematics. (3 cred. per qtr.; prereq. 151, 153 or ♯; offered 1955-56) Turrittin

284f-285w-286s.*¶¶ Stochastic Processes. (3 cred. per qtr.; prereq. 245; not offered 1954-55)

290f-291w-292s.*¶¶ Banach Spaces. (3 cred. per qtr.; prereq. 245; not offered 1954-55)

* This course may be taken to meet a certain requirement for the Master's degree under Plan B. (See the requirements for that degree in another part of this bulletin.) Other courses may be so marked with an asterisk for individual students with the consent of their advisers and the instructors who give the courses.

§§ This course is given by the Department of Mathematics in the Institute of Technology.

¶¶ This course is given by the Department of Mathematics in the College of Science, Literature, and the Arts.

301f-302w-303s.*§§ Topics in Advanced Differential Geometry. (3 cred. per qtr.; prereq. ♯; offered 1954-55) Milgram

304f-305w-306s.*§§ Advanced Topics in Differential and Difference Equations. Topic for 1954-55: Ordinary linear differential and difference equations. (3 cred. per qtr.; prereq. ♯) Turrittin

307f-308w-309s.*§§ Mathematical Problems of Theoretical Physics. Topic for 1954-55: Electromagnetic theory. (3 cred. per qtr.; prereq. 263 or 208, or ♯) Rosenbloom

The following courses have been offered recently, and these or other courses of equivalent level will be given from time to time.

100.¶¶ Foundations of Geometry
111.¶¶ Development of the Number System
112.¶¶ Mathematical Reasoning and Theory of Sets
114.¶¶ Mathematics of Small Vibrations
124.¶¶ Foundations of Calculus
125.¶¶ Theory of Geometrical Constructions
130.¶¶ Elementary Theory of Summability
135.¶¶ Integral Equations
137.¶¶ Advanced Theory of Equations
141.¶¶ Mathematics of Transient Analysis
181-182-183.§§ Selected Topics in the Theory of Numbers
199.¶¶ Calculus of Variations
217-218-219.§§ Riemannian Geometry
230.§§ Advanced Tensor Analysis
271-272-273.¶¶ Theory of Linear Differential and Integral Equations
277-278-279.§§ Partial Differential Equations of the First Order
281-282-283.§§ Potential Theory
284-285-286.§§ Nonlinear Ordinary Differential Equations
287-288-289.§§ Banach Spaces and Functional Analysis
294-295-296.§§ Mathematical Theory of Elasticity
297-298-299.§§ Mathematical Foundations of Statistical Mechanics

DRAWING AND DESCRIPTIVE GEOMETRY

111f-112w-113s.§§ Advanced Descriptive Geometry. (3 cred. per qtr.; prereq. Draw. 6, I.T.M. 25)

115f-116w-117s.§§ Curve Fitting. (3 cred. per qtr.; prereq. Draw. 6, I.T.M. 25) Eggers

118f,w,s.§§ Short Course in Curve Fitting. (3 cred.; prereq. Draw. 6, I.T.M. 25) Eggers

152f,w,s-153w-154s.§§ Nomography. (3 cred. per qtr.; prereq. Draw. 52, I.T.M. 25) Eggers

157f-158w-159s.§§ Graphical Mathematics. (2 cred. per qtr.; prereq. Draw. 6, M.&M. 26) Eggers

MECHANICAL ENGINEERING

Professor
Richard C. Jordan
Axel B. Algren
Ernst R. G. Eckert
Newman A. Hall
Emory N. Kemler
James J. Ryan
Robert E. Summers

Associate Professor
Fulton Holtby
Millard H. LaJoy

John M. MacKenzie
Thomas E. Murphy

Assistant Professor
Adolph O. Lee
Gayle W. McElrath

* This course may be taken to meet a certain requirement for the Master's degree under Plan B. (See the requirements for that degree in another part of this bulletin.) Other courses may be so marked with an asterisk for individual students with the consent of their advisers and the instructors who give the courses.

§§ This course is given by the Department of Mathematics in the Institute of Technology.

¶¶ This course is given by the Department of Mathematics in the College of Science, Literature, and the Arts.

Prerequisites—For major work, adequate preparation in the sciences fundamental to mechanical engineering (chemistry, physics, mathematics and mechanics, technical subjects) and the general admission requirements. For minor work, the prerequisites to the courses to be pursued and approval of minor department or division.

Language Requirement—For the M.S. degree, none. For the Ph.D. degree, reading knowledge of French and German. (Substitution of other languages such as Russian or in special cases of a research technique may be permitted.)

Master's Degree—The M.S. degree is offered either under Plan A or Plan B. The major and the minor work may be taken in two separate divisions of the Mechanical Engineering Department under Plan A.

Doctor's Degree—The department offers work leading to the Ph.D. degree.

[Professional degrees in engineering—These degrees are administered by the Institute of Technology.]

Courses

INDUSTRIAL LABORATORIES

110. Control of Metal Working Processes. Inspection by X-ray, gamma-ray, magnetic particle, metallographic, and chemical methods. (3 cred.; prereq. 118; 1 lect., 6 lab. hours per week) Holtby, Hughes

111. Advanced Casting Processes. Advanced techniques and new developments in molding and casting; foundry control procedures. (3 cred.; prereq. 110, Met. 156; 2 lect., 3 lab. hours per week) Holtby

112. Properties and Fabrication of Plastics. Materials, equipment, and processes for fabrication of plastics. Plastic product and mold design. (3 cred.; prereq. 12, 13, 14, or ♯; 2 lect., 3 lab. hours per week) Holtby

113. Advanced Metal Cutting. Advanced machine tool operations. Selection, tooling, and set-up of machine tools for production. (3 cred.; prereq. 118; 1 lect., 6 lab. hours per week) Crowder

114. Advanced Welding. Theory and applications of welding processes; factors affecting weldability; considerations in the design of weldments. (3 cred.; prereq. 118, Met. 156; 2 lect., 3 lab. hours per week) Hughes

115. Control of Manufacturing Standards. Precision measuring instruments and gauges for dimensional control in interchangeable manufacture. (3 cred.; prereq. 118; 1 lect., 6 lab. hours per week) Crowder

118. Design for Casting, Forming, and Welding. Basic factors in the design of parts and structures for most efficient processing and fabrication and maximum performance. (3 cred.; prereq. 118; 1 lect., 6 lab. hours per week) Holtby, Hughes

170. Tool Design. Design of jigs, fixtures, and dies for machining, forming, welding, and assembly operations. (3 cred.; prereq. 118; 1 lect., 6 lab. hours per week) Crowder

INSTRUMENTATION

198. Industrial Instrumentation and Automatic Control. Theory and operation of instruments and automatic controls. Domestic and industrial control mechanisms. On-off, proportional, floating, and rate response in control instruments. (3 cred.; 2 lect., 3 lab. hours per week) LaJoy

199. Servomechanism. Study of basic servomechanisms. Mechanical and electrical error indicators. Analysis of various types of damping. (3 cred.; prereq. I.T.M. 80, E.E. 37; 2 lect., 3 lab. hours per week) LaJoy

298.* Advanced Instrumentation and Automatic Control. Controller characteristics under simulated process conditions; effect of process time constants; methods of controller calibration. (3 cred.; prereq. 198) LaJoy

MACHINE DESIGN

122. Mechanical Engineering Design I. Advanced statics, dynamics, and stress analysis applied to machines. Special design problems. (3 cred.; prereq. 121; 1 lect., 6 lab. hours per week) Ryan

123. Mechanical Engineering Design II. Application of fundamentals of engineering design with emphasis on creative aspects. (3 cred.; prereq. 121; 1 lect., 6 lab. hours per week) Ryan

124. Experimental Stress Analysis. Experimental application and theoretical evaluation of the methods of stress analysis. Strain gauges, surface coatings, photoelasticity, dynamic stress measurements, penetration methods, and fracture methods. (3 cred.; prereq. M.&M. 128; 2 lect., 3 lab. hours per week) Ryan

125. Machine Design Laboratory. Use of vibration instruments, stroboscopes, sound meters and analyzers, photoelastic, polariscope, electronic measuring devices and testing machines. (2 cred.; prereq. 24; 1 lect., 3 lab. hours per week) Ryan

127. Lubrication. Hydrodynamic theory of lubrication. Bearing design and construction, laboratory tests on 8-inch journal bearings. (3 cred.; prereq. 121; 3 lect. hours per week) Ryan

128. Photoelastic Stress Analysis. Fundamentals of advanced stress analysis. Theory of photoelasticity and operation of polariscopes. Applications to solutions of special design problems. (3 cred.; prereq. M.&M. 128; 2 lect., 3 lab. hours per week) Ryan

129. Vibration Engineering. Elementary vibration theory with application to vibration absorption and isolation. (3 cred.; prereq. M.&M. 127; 3 lect. hours per week) Kemler, Ryan

221-222-223.* Advanced Mechanical Engineering Design. Applications of elasticity to the solution of mechanical design problems. (3 cred. per qtr.; prereq. 121; 3 rec. hours per week) Kemler

224-225-226.* Advanced Applied Dynamics. Application of principles of dynamics to selected mechanical engineering problems. (3 cred. per qtr.; prereq. 129; 3 rec. hours per week) Kemler

228. Photoelasticity. Advanced studies in stress analysis by photoelasticity. Studies of stress patterns. Frozen stresses. Solution of individual problems. (3 cred.; prereq. 128; 2 lect., 3 lab. hours per week) Ryan

229.* Advanced Vibration Engineering. Advanced dynamics of vibration, vibration in mechanical, electrical, and equivalent systems. (3 cred.; prereq. 129; 3 lect. hours per week) Kemler, Ryan

THERMODYNAMICS

133. Heat Transmission. Introduction to conduction, convection, and radiation of heat and their utilization in engineering applications. Discussion of heat exchangers. (3 cred.; prereq. 132; 3 lect. or rec. hours per week) Eckert

134. Thermodynamics of Fluid Flow. The energy analysis of the flow of viscous and compressible fluids. Applications to flow processes and components in engineering systems. (3 cred.; prereq. 132; 3 rec. hours per week) Hall

135. Turbomachinery. Principles of turbomachinery. Application to turbines, compressors, pumps, and fluid power transmissions. (3 cred.; prereq. 131, 132; 3 rec. hours per week) Lee

231. Advanced Thermodynamics. Thermodynamic equation of state for gases, liquids, and mixtures. Applications and interpretations of thermodynamic functions or processes, reactions, and equilibrium states. (3 cred.; prereq. 132; 3 rec. hours per week) Hall

232. Advanced Fluid Thermodynamics. The mechanism of thermodynamic actions in fluids, irreversible processes related to viscosity, heat transfer, diffusion, and chemical reaction. (3 cred.; prereq. 134, 231, or ♯; 3 hours per week) Hall

233. Conduction. Steady and unsteady heat conduction with and without heat sources or change of state, relaxation method, analogs, the regenerator. (3 cred.; prereq. 133; 3 lect. or rec. hours per week) Eckert

234. Convection. Heat transfer in laminar and turbulent boundary layer and channel flow, dimensional analysis. Free convection. Condensation and evaporation. Convective mass transfer. (3 cred.; prereq. 233; 3 lect. or rec. hours per week) Eckert

235. Radiation. Heat radiation of black bodies, or electrical conductors and non-conductors, of gases and flames. Heat exchange by radiation. Configuration and interchange factors. (3 cred.; prereq. 234; 3 lect. or rec. hours per week) Eckert

STEAM POWER

142. Advanced Heat Power Engineering. Practice and economics relating to power plant cycles, steam generators, prime movers, plant controls, and plant auxiliaries. Trends in power development. (3 cred.; prereq. 141; 3 rec. hours per week) Lee

146. Fuels and Combustion. Fuel classification and analysis, stoichiometry, rates, combustion processes, combustion equipment, and controls. (3 cred.; prereq. 141; 3 rec. hours per week) Lee

147. Design of Steam Machinery. Steam generating station layout. General design of all component parts. (3 cred.; prereq. 141; 1 lect., 6 lab. hours per week) Lee

148. Design of Power Plant Units. Steam generating station heat balance. Detail design of some component part-boiler, economizer, superheater, condenser, etc. (3 cred.; prereq. 147; 1 lect., 6 lab. hours per week) Lee

149. Advanced Steam Laboratory. Tests of steam engines, steam turbines, evaporators, air compressors, and multiple turbogenerator units simulating actual power plant conditions. (2 cred.; prereq. 141, 35; 4 lab. hours per week) Lee

242.* Power Plant Specification. Estimating of initial installation, maintenance, and depreciation costs of power plant components, and their effect on selection of units. Specification of units and components. (2 cred.; prereq. 148) Lee

243.* Power Plant Layout. Power plant layout and selection of most economical fuel components for location and type of service. (2 cred.; prereq. 242) Lee

244.* Power Plant Management. Maintenance and operating schedules. Records on performance. Operating problems. Load curves and efficient operation of plants. (3 cred.; prereq. 142) Lee

INTERNAL COMBUSTION ENGINES

151. Advanced Internal Combustion Engines. Comprehensive study of fuels, lubrication, supercharging, carburetion, and cooling. (3 cred.; prereq. 150; 3 rec. hours per week) Murphy

152. Diesel Engines. Advanced course in the theory, design, operation, and economics of the Diesel engine with emphasis on high speed combustion and injection systems. (3 cred.; prereq. 150; 3 rec. hours per week) Murphy

153. Engine Service Management. Methods used in servicing or reconditioning engines. Causes of mechanical failure and wear. Lubrication and ignition service. (3 cred.; prereq. 150; 3 rec. hours per week) Murphy

154-155. Design of Internal Combustion Engines. Detailed study of design, calculation of bearing loads, stresses in moving parts, and valve mechanisms. (3 cred. per qtr.; prereq. 121, 150; 1 lect., 6 lab. hours per week) Murphy

156. High Speed Engine Testing. Advanced laboratory procedure. Effects of fuel, mixture distribution, etc., upon general engine performance. (2 cred.; prereq. 158 or 159 and minimum honor point average of 1.5; 6 lab. hours per week) Murphy

157. Gas Turbine and Jet Propulsion Power Plants. Gas turbine cycles and principles; characteristics of compressors and turbines; power and efficiency calculations. (3 cred.; prereq. 150 or 150A; 3 lect. hours per week) Murphy

158. Aero Engine Testing. Use of modern instruments for testing aircraft engines. Use of dynamometers and thrust stands in determining engine performance. (2 cred.; prereq. 150 or 150A or ¶150A; 6 lab. hours per week) Murphy, others

159. Internal Combustion Engine Laboratory. Tests of gasoline, aircraft, and Diesel engines. Problems on application of engine to vehicles or machines. (2 cred.; prereq. 150 or ¶150; 4 lab. hours per week) Murphy, others

250.* Dynamics of High Speed Engines. Study of inertia forces; balancing high speed engines; engine torque analysis; torsional vibration, etc. Conferences, assigned readings, and problems. (3 cred.; prereq. 121, 150) Murphy

252. Advanced Reciprocating Engines. Performance as affected by airflow, fuel-air ratio, mixture temperature, manifold pressure, and spark timing; cooling and lubrication requirements. (3 cred.; prereq. 151 or 151A) Murphy

253. Advanced Gas Turbines. Study of gas turbines for aircraft performance, control, nozzles, axial and centrifugal compressors, and turbines; cooling, lubrication, and construction. (3 cred.; prereq. 157) Hall, Murphy

255. Thermal Jets and Rockets. Study of thermal jets and rockets with particular regard to the problems of design and calculations of the performance of ram jets and liquid fuel rockets. (3 cred.; prereq. 134, 157) Eckert

256.* Engine Testing and Research. Problems involving volumetric efficiency, manifolding, friction losses, cylinder pressures, and other engine performance factors of current interest. (Cred. ar.; prereq. 158 or 159) Murphy

257.* Combustion and Fuels for Gas Turbines and Engines. Heating value, heat of formation, energy of reaction, flame temperatures, equilibrium in combustion. (3 cred.; prereq. 150, 157) Hall

HEATING, VENTILATING, AND AIR CONDITIONING

161-162. Heating, Ventilation, and Air Conditioning Design. Heating and cooling loads; selection of equipment; design of complete systems. (3 cred. per qtr.; prereq. 160; 1 lect., 6 lab. hours per week) Algren, others

165. Advanced Heating, Ventilation, and Air Conditioning. Basic requirements for comfort, health, and industrial processes. Methods of control and application. (3 cred.; prereq. 160; 3 lect. hours per week) Algren

166. Industrial Air Conditioning and Exhaust Systems. Requirements for manufacturing, processing, and preservation of materials. Classification of systems and design principles. (3 cred.; prereq. 160; 3 lect. hours per week) Algren, others

169. Heating and Ventilation Laboratory. Tests and studies of heating, ventilation, and air conditioning equipment. (2 cred.; prereq. 35, 160 or ¶160; 4 lab. hours per week) Algren, others

265.* Advanced Air Conditioning. Advanced study of basic principles of heating, ventilation, and air conditioning. (3 cred.; prereq. 160) Algren

266.* Advanced Ventilation and Air Distribution. Design principles and methods of air distribution; study of component parts of complete systems. (3 cred.; prereq. 160, 265, or #) Algren

267.* Applied Heating, Ventilation, and Air Conditioning. Field studies and practical problems related to heating, ventilating, and air conditioning. (3 cred.; prereq. 160, 266, or #) Algren

REFRIGERATION

181. Advanced Refrigeration. Advanced refrigeration theory covering multistage and multiple evaporator systems; low temperature refrigeration; special topics. (3 cred.; prereq. 180; 3 lect. hours per week) Threlkeld

182. Refrigeration Design. Refrigeration loads; selection of equipment; design and layout of complete systems. (3 cred.; prereq. 180; 1 lect., 6 lab. hours per week) Threlkeld

189. Refrigeration Laboratory. Tests and studies of refrigeration systems and component parts. (2 cred.; prereq. 180 or ¶180; 4 lab. hours per week) Threlkeld

280.* Theoretical Refrigeration. Advanced study dealing with problems involving the theory and design of refrigeration systems. Lectures, assigned reading, and reports. (3 cred.; prereq. 180) Jordan

281.* Applied Refrigeration. Advanced study involving the applications of refrigeration systems to commercial and industrial equipment and processing. Lectures, assigned reading, and reports. (3 cred.; prereq. 180) Jordan

282.* Reverse Applications of Refrigeration—the Heat Pump. Industrial, commercial, and residential applications of refrigeration systems as heat pumps. Lectures, assigned reading, and reports. (3 cred.; prereq. 180) Jordan

GENERAL

196. Inventions and Patents. Study of problems associated with inventions, their patenting, development, evaluation, and exploitation. (3 cred.; prereq. 24 or ‡; 3 rec. hours per week) Kemler

290-291-292.* Mechanical Engineering Research. Investigations in connection with special problems. (Cred. ar.; registration with consent of division chief in charge of work) Staff

293. Graduate Seminar. Colloquium for graduate students and staff. Reports and discussion by members on research or specific problems to be assigned. Recommended for graduate students and junior staff members. (No cred.) Staff

INDUSTRIAL ENGINEERING

Advanced degrees with a specialization in industrial engineering are available to students with the Bachelor's degree in this field and to graduates of other engineering curricula who meet specific requirements. Industrial engineering may also be used as a minor subject by students in other departments who satisfy the prerequisites for specific courses.

Related courses in mechanical engineering, business administration, psychology, and public health are recommended in conjunction with a specialization in industrial engineering.

Students contemplating graduate study in this field should consult the division chief regarding their individual programs and requirements.

Courses

154. Advanced Methods Engineering and Work Measurement. Multiple operation analysis, advanced work measurement techniques and incentives. (3 cred.; prereq. 153; 2 rec., 3 lab. hours per week) Block

163. Process Planning and Development. Planning of manufacturing operations to meet quantity, quality, and cost requirements of the product. (3 cred.; prereq. 150; 2 rec., 3 lab. hours per week) MacKenzie

165. Industrial Plants. Analysis of materials flow; layout of production and service departments; plant buildings, service facilities, and handling equipment. (3 cred.; prereq. 153; 2 rec., 3 lab. hours per week)

170. Production Planning and Control. Planning of production requirements; routing, scheduling, and coordination of production; inventory policies and control. (3 cred.; prereq. 153; 3 rec. hours per week) Block

171. Quality Control. Quality standards, application of statistical methods and sampling theory; interpretation of results and corrective action. (3 cred.; prereq. 150, I.T.M. 90 or ‡; 3 rec. hours per week) McElrath

173. Engineering Economic Analysis. Analysis of capital expenditures and annual operating costs as the basis for management policies and decisions. (3 cred.; prereq. 165, B.A. 66; 3 rec. hours per week) MacKenzie

180. Elements of Supervision. Supervisory functions and relations with employees, other supervisors, staff departments, and management. (3 cred.; prereq. 150; 3 rec. hours per week) Block

182. Industrial Safety and Hygiene. Safety requirements for production processes, equipment, and plants; organization and administration of safety and hygiene programs. (3 cred.; prereq. 150; 3 rec. hours per week) Block

190-191-192.* Industrial Engineering Seminar. Current developments in industrial engineering and management; assigned articles and classroom discussions. (1 cred. per qtr.; 1 rec. hour per week) Staff

193. Inspection Trip. Visits to selected industrial plants during spring vacation period. Studies of production methods and processes, equipment, and plants. (1 cred.; prereq. required in 5th year) Staff

194-195-196. Applied Industrial Engineering. Industrial engineering surveys and programs; case problems; studies in local plants. (3 cred. per qtr.; prereq. 15 cred. in industrial engineering; 2 rec., 3 lab. hours per week) Staff

251-252-253.* Advanced Industrial Engineering. Advanced studies in manufacturing policy, production engineering, plant operation, engineering economy, and industrial development. (3 cred. per qtr.; prereq. ‡) Staff

261-262-263.* Production Engineering Problems. Application of industrial engineering principles to the solution of manufacturing problems in local plants. (3 to 5 cred. per qtr.; prereq. ‡) Staff

271-272-273.* Industrial Engineering Research. Research studies in selected areas of industrial engineering, production, and management; work of thesis quality but lesser scope. (3 to 5 cred. per qtr.; prereq. ‡) Staff

MECHANICS AND MATERIALS

Professor
Benjamin J. Lazan
Harry A. Doeringsfeld
Forrest E. Miller
Lawrence E. Goodman

Assistant Professor
Franz H. Vitovec

Students who wish to major in mechanics and materials should consult Mr. Lazan, head of the Department.

Prerequisites—For major work, adequate preparation in fundamental engineering sciences (mathematics, physics, mechanics, and chemistry) and the general admission requirements. For minor work, course prerequisites govern.

Language Requirement—For Master's degree, none. For the Ph.D. degree, two foreign languages or one foreign language with the option of a special research technique.

Master's Degree—Offered under both Plan A and Plan B.

Doctor's Degree—Program to be developed in consultation with adviser.

Courses

127. Engineering Dynamics. Kinematics of the particle and rigid body, theorem of Coriolis, particle dynamics, dynamics of a rigid body in plane motion, the energy equation, impulse and momentum, applications to technical problems. (5 cred.; prereq. 26; 5 rec. hours per week) Staff

128. Mechanics of Materials. Mechanical and elastic properties of materials of construction; stresses and deformations in beams, shafts, and columns;

stresses in statically indeterminate structures; combined stress. (5 cred.; prereq. 26; 5 rec. hours per week) Staff

129. Fundamentals of Materials Engineering. Analysis of fundamental engineering properties of materials, their evaluation in the laboratory and relationship to service behavior. Introduction to engineering physical metallurgy, including metallographic structure, phase diagrams, heat treatment, mechanical metallurgy, etc., and its relationship to engineering properties. Systematic study of important engineering materials including ferrous and nonferrous metals, plastics, concrete, and timber. (5 cred.; prereq. 85 or 93 or 128; 4 rec., 3 lab. hours per week) Lazan, Vitovec

141. Materials Testing Laboratory. Investigation of the physical properties of various metals and engineering materials (steel, cast iron, wood, brick, etc.). Standard methods of testing. (1 cred.; prereq. ¶128; 2 lab. hours per week) Staff

164-165-166.*‡ Special Problems in Mechanics and Materials. Short duration research problems on dynamic properties of materials, theories of mechanical failure, and experimental mechanics. Literature studies, conferences, seminars, and reports on special problems. (3 cred. per qtr.; prereq. ♯) Lazan, Goodman, Vitovec

180. Advanced Mechanics of Materials. Stress analysis in statically indeterminate structures. Theory of superposition. Energy of strain. Elastic stability. (3 cred.; prereq. 128; 3 lect. hours per week; offered when demand warrants) Goodman, Miller, Lazan

181-182-183.† Applied Elasticity. Special problems in stress analysis. (3 cred. per qtr.; prereq. 128; 3 lect. hours per week) Goodman, Miller, Lazan

193-194-195.† Theory of Vibrations. Mathematical treatment of one, two, and many degrees of freedom, forced and damped vibrations. Critical speeds, torsional vibrations, criterion of stability, nonlinear characteristics, vibrations of plates and shells. (3 cred. per qtr.; prereq. 127, I.T.M. 80 and ¶152; offered 1954-55 and alternate years) Goodman

235-236-237.† Advanced Materials Engineering. Physics of metal. Theories of failure of materials under static, impact, fatigue, creep, and other types of stresses. Theory of plasticity. Classification and study of conditions which cause service failure. Laboratory techniques for evaluating fundamental properties of engineering materials and relationship to service behavior. Experimental mechanics. (3 cred. per qtr.; prereq. ♯; offered every two years if demand warrants) Lazan, Vitovec

290-291-292.† Theory of Plates and Shells. (3 cred. per qtr.; prereq. 294 and I.T.M. 153; 3 rec. hours per week; offered every two years if demand warrants) Goodman

294-295-296.† Theory of Elasticity. (3 cred. per qtr.; prereq. 128 and I.T.M. 153; 3 rec. hours per week; offered 1955-56 and alternate years) Goodman

MEDICAL SOCIAL WORK

For statement of prerequisites and of graduate courses and staff, see Social Work and Sociology, pages 209 and 214.

MEDICINE

Including Divisions of Internal Medicine, Dermatology and Syphilology, and Clinical Laboratory Medicine

The graduate work in the Department of Medicine is designed to offer opportunities for gifted men and women to prepare themselves for the practice of internal medicine or any of its subdivisions as a specialty, and aims to guide its fellows in research in these fields and to give them a start in university teaching. Prospective fellows who have had no

special orientation in addition to that of the ordinary undergraduate courses will profit greatly from some special work. While any of the preclinical subjects might be of value, physiology, biochemistry, pharmacology, bacteriology, and pathology at the present are of the greatest importance. Work in any of these subjects might be further continued during the major studies in medicine to meet the requirements for a minor subject. In dermatology, first-year fellows are residents at the Minneapolis General Hospital; the last two years are outlined by arrangement.

For staff and courses of study offered, see the *Graduate Medical Bulletin.*

METALLURGICAL ENGINEERING

Professor	Associate Professor	Assistant Professor
Ralph L. Dowdell	Henry S. Jerabek	Gust Bitsianes
Strathmore R. B. Cooke	Allan Martin	William B. F. Mackay
Edward W. Davis		
Thomas L. Joseph		

Prerequisites—For major work, adequate preparation in the physical sciences and general engineering subjects fundamental to metallurgy.

Language Requirement—For the Master's degree, none. For the Ph.D. degree, either (a) two foreign languages (German, French, or Russian) or (b) one of these languages and the option of a special research technique.

Master's Degree—Offered under both Plan A and Plan B.

Doctor's Degree—The department offers work leading to the Ph.D. degree.

Courses

106f. Principles of Process Metallurgy. Stoichiometry, heat balances, metallurgical fuels, combustion of fuels and heat utilization. (3 cred.; prereq. general inorganic chemistry) Bitsianes

107w. Principles of Process Metallurgy. Flow of heat. Flow of fluids. Pyrometry, phases in pyrometallurgical systems. (3 cred.; prereq. 106) Bitsianes

108s. Principles of Process Metallurgy. Chemical equilibria, rates of reactions, instrumentation, refractories. (3 cred.; prereq. 107) Martin

110f. Mineral Dressing. Theory, attributes, and practice of comminution. Volumetric and gravimetric sizing. Principles of the movement of solids in fluids. Laboratory investigation of crushing, grinding, size analysis, and size of liberation of ores. (4 cred.; prereq. Geol. 24) Cooke

111w. Mineral Dressing. Principles of ore beneficiation by gravity, magnetic, and electrostatic processes. Material balances. Laboratory examination and pilot plant concentration of ores. (4 cred.; prereq. 110) Cooke

112s. Mineral Dressing. Principles of flotation in ore beneficiation. Theory of frothing, collecting, depression, activation, conditioning. Integration of processes into flowsheets. (4 cred.; prereq. 111) Cooke

118f,119w,120s. Metallurgical Engineering Practice. Report writing on current problems in ferrous and nonferrous metallurgical practice. (Cred. ar.; prereq. ‡) Joseph, Martin, Bitsianes

122w. Advanced Mineral Dressing. Determination of methods for economic metallurgical extraction of minerals from ores. (3 cred.; prereq. 112) Cooke

123s. Advanced Mineral Dressing. Consideration of factors affecting extraction. Study of distribution of values in mill and metallurgical products. Special research techniques. (3 cred.; prereq. 122) Cooke

134f.* Metallurgical Unit Processes. Slag-metal equilibria, refining of liquid metals, solidification and segregation of metals, slag constitution. (3 cred.; prereq. 108) Martin

135w.* Metallurgical Unit Processes. Gas-solid processes. Blast furnace smelting. (3 cred.; prereq. 108) Joseph

136s.* Metallurgical Unit Processes. Electrolytic extraction and refining of metals, sintering and pyroagglomeration, retorting and liquation. (3 cred.; prereq. 108) Bitsianes

137f. Research Techniques in Process Metallurgy. A study of specialized research techniques and their application to metallurgical problems. (2 cred.; prereq. 108) Bitsianes, Martin

138w. Advanced Physical Chemistry of Process Metallurgy. The application of physical chemistry, especially thermodynamics to some advanced problems in metallurgy. (2 cred.; prereq. 134) Martin

153f-154w*-155s.* Physical Metallurgy. Theory of alloys; relation of structure to properties and response to heat treatment; steel and other commercial alloys. (3 or 4 cred. per qtr. depending on lab.; prereq. ♯) Jerabek

157w.* Industrial Physical Metallurgy. (Mech.E.) Metallography, heat treatment, properties and applications of alloy steels. Metallurgical aspects of machining, welding, and other fabrication processes. (2 or 3 cred. depending on lab.; prereq. 156 or 160) Mackay

158s.* Industrial Physical Metallurgy. (Mech.E.) Metallography, heat treatment, properties and application of common nonferrous metals and alloys including brasses, bronzes, aluminum, magnesium, titanium, etc. Precipitation hardening, corrosion, and bearings. (2 or 3 cred. depending on lab.; prereq. 156 or 160) Mackay

163f.* Advanced Physical Metallurgy. Theory of metals and alloys. Relation of structure to physical and mechanical properties. (3 cred.; prereq. 6 cred. in physical metallurgy) Dowdell

164w.* Advanced Physical Metallurgy. Theory of metals and alloys. Relation of structure to physical and mechanical properties. (3 cred.; prereq. 6 cred. in physical metallurgy) Dowdell

165s.* Advanced Physical Metallurgy. Technical physical metallurgy, specifications, heat treatments as affecting structures and properties of industrial and special alloys. (3 cred.; prereq. 6 cred. in physical metallurgy) Dowdell

172s. X-ray Research in Physical Metallurgy. (Cred. ar.; prereq. ♯) Jerabek

201f-202w-203s.*‡ Research in Process Metallurgy. (Cred. ar.) Bitsianes, Joseph, Martin

204f-205w-206s.‡ Research in Mineral Dressing. (Cred. ar.) Cooke

207f-208w-209s.*‡ Research in Physical Metallurgy. (Cred. ar.) Dowdell, Jerabek, Mackay

210f-211w-212s.*‡ Seminar in Metallurgical Engineering. (Cred. ar.) Staff

MINING AND PETROLEUM ENGINEERING

Associate Professor	Assistant Professor	Instructor
Eugene P. Pfleider	Washington D. Lacabanne	Howard C. Hartman
	Donald H. Yardley	

Prerequisites—For major work, the Bachelor's degree in mining or petroleum engineering, or its equivalent. If the student cannot meet this requirement, he may become eligible by taking courses prescribed by his adviser.

Language Requirement—None.

Master's Degree—Offered under both Plan A and Plan B.

Courses

MINING ENGINEERING

111f-112w-113s. Mining Engineering Principles. Fundamentals of mining, embracing, exploration, development, and exploitation of mineral deposits. The principles and technology of prospecting, drilling, blasting, hoisting, and transporting of ores, mine drainage. Support of excavations, tunneling, and underground mining methods. (3 cred. per qtr.; prereq. Geol. 25 or ‡; 4 lect. hours per week) Pfleider, Yardley

121w. Mine Plant Engineering. Application of basic engineering principles to the design and selection of mine plant equipment. Calculations involving power transmission and the drilling, transporting, and hoisting of materials. (2 cred.; prereq. M.&M. 84, M.E. 131; 2 lect. hours, 4 lab. hours per week) Hartman

122s. Mine and Petroleum Plant Engineering. Application of basic engineering principles to the design and selection of mine and petroleum plant equipment. Calculations involving compressed air, pumping, transmission of gases and fluids, electrical equipment and power systems. (3 cred.; prereq. Hydr. 102, M.E. 131, and E.E. 41; 3 lect., 3 lab. hours per week) Hartman

123f. Mine Air Conditioning. Study of mine gases, dust control, and physical properties of air; measurement of air properties, selection and application of mechanical ventilation equipment, design of ventilation, heating, and refrigeration systems. (3 cred.; prereq. 113, Hydr. 102; 3 lect., 3 lab. hours per week) Hartman

139. Mining Field Trip. Study of mining operations, mine plant, and metallurgical plants in several mining camps. (6 cred.; prereq. ‡; three weeks beginning about September 1)

141f. Mineral Economics. Mine and oil field examinations and reports; mineral conservation, economics and taxation; capitalization, amortization, and depletion. Organization and administration. (3 cred.; prereq. 113 or Pet. 112; 4 lect. hours per week) Pfleider

142w. Surface Mining Engineering. The development, engineering planning and operation of open cut properties. Excavation by shovels and draglines; handling materials by railroad, trucks, and conveyors. Quarries: methods, equipment, field for product. Placers: dredging, hydraulicking. (3 cred.; prereq. 112; 4 lect. hours per week) Pfleider

143s. Coal Mining Engineering. The economics and technology of coal. Production and preparation including mining methods and mechanization. Time study applications. Mine gases; safety work and organization. (3 cred.; prereq. 113; 4 lect. hours per week) Yardley

144w-145s. Advanced Mining Engineering. Preparation of a report on a mining property or some phase of the mineral industry. (2 cred. for 144, 4 cred. for 145; prereq. 141; 6 lab. hours per week for 144, 10 lab. hours per week for 145) Pfleider, staff

151f-152w-153s.* Special Problems in Mining. Literature survey or research work on mining problems. (Cred. and hours ar.; prereq. 113) Staff

160. Mining and Processing Industrial Minerals. Survey of minerals and rocks industrially important but primarily not mined for recovery of metals. Origin, geographic distribution, mining methods, processing, uses, etc. (2 cred.; prereq. 112 or ‡; 2 lect. hours per week) Pfleider

180.* Geochemical Exploration. Application of geochemical techniques and principles to the search for orebodies. Laboratory work on geochemical methods for the determination of total and specific heavy metal content of rocks, soil, water, and plants. (3 cred.; prereq. ‡) Yardley

201-202-203.* Special Problems in Mining. Seminar work on mining problems. (Cred. ar.) Pfleider, staff

210.* Field Course in Mining. Detailed study and report of the actual operations of a mine. (Term and cred. ar.) Pfleider

212-213-214.* Special Problems in Mining. Intended primarily for research. (Cred. ar.) Pfleider and staff

The following courses are offered when demand warrants:

220. Advanced Mine Air Conditioning. Theory of dust control and exhaust ventilation systems, calculation of pressure drops and leakage in complicated mine ventilation circuits, theory of heat flow from wall rock into mine openings, and design of refrigeration and air conditioning systems. (3 cred.; prereq. 123, M.E. 131, 160, 180) Hartman

230.* Advanced Geochemical Exploration. Special studies in the development of geochemical techniques, both field and laboratory phases. Specific project assignment. (Cred. ar.; prereq. #) Yardley

240.* Advanced Concepts in Drilling of Rocks. Disintegration and comminution by sound waves and gases at ultra high velocities and temperatures. Cutting action of percussion and rotary bits by shear, tensile, and compressive forces. (3 cred.; prereq. #) Pfleider

PETROLEUM ENGINEERING

111f. Oil Field Development. Drilling and completion of oil wells, methods and equipment involved. Problems and protection of completed well; directional drilling, well surveying; electrical and mechanical logging and other methods of securing underground information; well records. (3 cred.; prereq. Geol. 25 or #; 4 lect. hours per week) Lacabanne

112w. Oil Field Production. Principles and methods of producing oil. Characteristics of oil reservoirs; of oil and gas, phase relations under reservoir conditions; condensate fields; sand drainage; oil reservoir performance; lifting oil; secondary methods of recovery; gas wells. (3 cred.; prereq. 111; 4 lect. hours per week) Lacabanne

131s. Petroleum Refining. Distillation and fractionation processes used in making commercial products from crude petroleum. General physical and chemical properties of petroleum; oil refinery methods, principles of cracking; polymerization; alkylation. (2 cred.; prereq. In.Ch. 12, Phys. 7; 2 lect. hours per week) Lacabanne

134w. Natural Gas Engineering. Properties of natural gas, gravities, etc. Critical condition of gases, deviations, compressibility factor, reduced and pseudo states; retrograde condensation. Estimation of gas reserves. Orifice meters, measuring of gas flow. Gas well capacities by back-pressure. Gas hydrates. (2 cred.; prereq. 152 or #; 2 lect. hours per week) Lacabanne

135s. Study of Oil Well Drilling and Production Methods and Refining Practice in One or More Oil Fields. (3 cred.; prereq. #; two-week field trip to be arranged) Lacabanne

138s. Oil Field Mapping. A study of the methods and practices of graphically displaying, studying, and interpreting oil field data. Oil and gas well logs; property, contour, cross-section, and correlation maps; methods of displaying data and records, etc. (2 cred.; prereq. 112; 6 lab. hours per week) Lacabanne

144w-145s. Advanced Petroleum Engineering. Preparation of report on the exploration and development of an oil property or some phase of the industry. (2 cred. for 144, 4 cred. for 145; prereq. Min. 141; 6 lab. hours per week for 144, 10 lab. hours per week for 145) Pfleider

152f-153w-154s. Petroleum Production Technology. Problems in oil and gas production. Mud fluids, core analysis, permeability and porosity, electrical and mechanical coring and other logging methods, oil well cements, oil flow and drainage through porous formations, water analysis, problems.

(3 cred. per qtr.; prereq. 112; 1 lect., 6 lab. hours per week) Lacabanne, Yardley

155-156-157.* Special Problems in Petroleum Engineering. Seminar in petroleum problems. (Cred. and hours ar.; prereq. ¶144-145 or ♯) Lacabanne

201-202-203. Seminar on Petroleum Problems. (Cred. ar.) Lacabanne

206.* Field Course in Petroleum Engineering. A detailed study and report of the actual operations of an oil field. (Term and cred. ar.) Lacabanne, Pfleider

207-208-209.* Problems in Petroleum Engineering. Intended primarily for research. (Cred. ar.) Lacabanne, Pfleider

MUSIC

Professor
Paul M. Oberg
James Aliferis

Associate Professor
Paul S. Ivory

Assistant Professor
Arnold F. Caswell
Edward O. Downes
Johannes Riedel

Instructor
Edward Berryman
Paul Fetler
Earl George

Prerequisites—Candidates for graduate work must have a working knowledge of piano and performing ability in some phase of instrumental or vocal music, plus 30 undergraduate quarter credits in one of the following branches of music: (1) history and literature, (2) theory and composition, (3) normal piano, or (4) music education. Placement tests in music theory and applied music are required of all entering students.

Language Requirement—For the Master's degree, a reading knowledge of French or German. Substitution may be made by petition when a different language is needed for an individual research problem. For the Ph.D. degree, either (a) two foreign languages, or (b) the option of a special research technique or a collateral field of knowledge.

Master's Degree—Offered under both Plan A and Plan B. The thesis subject and major work may be chosen from either the historical, theoretical, or music education fields. An original composition may be offered in place of the usual research thesis under Plan A. Under Plan B, courses from the fields of music not used for the concentration may be taken as related work, except that all Plan B students must present at least one field of 9 credits outside the various music fields.

Doctor's Degree—The department offers work leading to the Ph.D. degree with thesis, with emphasis on music history and literature, theory and composition, or music education. Students with marked creative ability may substitute an original composition for full orchestra for the usual research thesis.

Courses

104f-105w-106s.* American Music. Study of music in America from early colonial times to the present through reading and record listening. American Indian music, European folk music transplanted to this continent, the origin and development of jazz and contemporary American music, all receive special consideration. (2 cred. per qtr.; prereq. 36 or 9 cred. in American history or American studies) Riedel

121f-122w-123s. Advanced Harmony. Study of chromatic harmony through analysis of representative nineteenth- and twentieth-century works, with emphasis on the theories of Hindemith, Schenker, and Schönberg. (2 cred. per qtr.; prereq. 6T) George

124f-125w-126s.* History of Opera. Survey of opera as music and drama, including production, styles, and cultural background, from the late sixteenth century to the present day with emphasis on modern repertoire which is to be broadcast during the year by the Metropolitan Opera Company. (3 cred. per qtr.; prereq. 9 cred. in either history of music, history of art, history of the theater, European history from 1600, or #)

127f-128w-129s. Composition. Original work in various forms. (2 cred. per qtr.; prereq. 97-98-99, 121-122-123) Fetler

134f-135w-136s.* History of Church Music. Trends in church music from the beginning to the present including the relationships of music to various theologies and liturgies. (2 cred. per qtr.; prereq. 34-35-36 or #) Berryman

137f-138w-139s. Keyboard Harmony. Practical ear training as applied to the piano. Chorales are transposed into all keys in four parts and expanded chords by melodic and harmonic analysis. Modulation is also studied. (1 cred. per qtr.; prereq. 3T-6T) Jennings

141f-142w-143s. Orchestration. A detailed study of the instruments of the orchestra together with a practical study of art of symphonic scoring. (2 cred. per qtr.; prereq. 6T) Aliferis

144f-145w-146s. Bach Through Beethoven. Study of the forms, techniques, and styles of the late Baroque and Classical periods with particular attention to the following masters: Bach, Handel, Gluck, Mozart, Haydn, and Beethoven. (3 cred. per qtr.; prereq. 36) Downes

154f-155w-156s.* Music in the Middle Ages and Renaissance. An intensive study of monophonic music from the period of Gregorian Chant to that of the English Madrigal School. (2 cred. per qtr.; prereq. 34-35-36; offered 1955-56 and alternate years) Riedel

164f-165w-166s.* Music in the Baroque Era. An intensive study of the music of the early, middle, and late Baroque periods in Italy, The Netherlands, Germany, Austria, France, and Spain. (2 cred. per qtr.; prereq. 34-35-36; offered 1954-55 and alternate years) Riedel

197f-198w-199s. Advanced Counterpoint. Study of Bach's *Art of the Fugue;* practice in the technique of writing three- and four-voice fugues, with emphasis on special contrapuntal devices and problems; analysis of polyphonic examples of various periods. (2 cred. per qtr.; prereq. 97-98-99) Fetler

200f-201w-202s.* Basis of Musical Expression. (3 cred. per qtr.; prereq. 144-145-146; offered 1955-56 and alternate years)

204f,w,s. Graduate Applied Music. (3 cred. per qtr., maximum 9 cred.; prereq. placement test by Music Dept. staff; minimum of 12 hours practice per week) Staff

209f-210w-211s.* Advanced Topics in Music. (3 cred. per qtr.; prereq. 76; offered 1954-55 and alternate years) Oberg

212f,w,s.* Special Problems. (3 to 9 cred. per qtr.; prereq. 202 or 211) Oberg

227f-228w-229s. Seminar in Composition and Orchestration. Open only to graduates who have completed an undergraduate major sequence in music theory and composition, including the following: 97-98-99, 121-122-123, 127-128-129, 141-142-143, 197-198-199. (3 cred. per qtr.) Aliferis

For music Education courses, see page 114.

OBSTETRICS AND GYNECOLOGY

For staff and courses of study offered, see the *Graduate Medical Bulletin.*

OPHTHALMOLOGY AND OTOLARYNGOLOGY

For staff and courses of study offered, see the *Graduate Medical Bulletin.*

PATHOLOGY

Professor
James R. Dawson, Jr., M.D., *head*
A. B. Baker, M.D., Ph.D.
Robert Hebbel, M.D., Ph.D.
James McCartney, M.D.

Professor Emeritus
E. T. Bell, M.D.
Benjamin J. Clawson, M.D., Ph.D.

Associate Professor
Kano Ikeda, M.D.
Nathaniel H. Lufkin, M.D.
John F. Noble, M.D.

Prerequisites—Graduate students who desire to take their major work in pathology must present credits for the equivalent of the first two years' work of the Medical School of this University. A degree with designation, such as M.S. in pathology, is awarded only to those who have an M.D. degree.

Language Requirement—For the Master's degree, one foreign language. For the Ph.D. degree, either (a) two foreign languages or (b) one foreign language and the option of a collateral field of knowledge.

Master's Degree—Offered only under Plan A.

Master's Degree with Designation in Pathology—Given only after three years of work.

Doctor's Degree—The Ph.D. degree with designation in pathology may be awarded after completion of three or more years in graduate work and presentation of a thesis of high quality.

Courses

101. Pathology. General Pathology. (8 cred.; prereq. completion of first year in Medical School or equiv; 143 hours) Dawson, Hebbel, McCartney, staff

102. Pathology. Special Pathology. (8 cred.; prereq. 101; 143 hours) Dawson, Hebbel, McCartney, staff

104. Autopsies. (Cred. ar.; prereq. 102) Staff

105. Diseases of the Kidney. (3 cred.; prereq. 102) Hebbel

106. Diseases of the Heart. (3 cred.; prereq. 102) McCartney

110. Seminar in Pathology. (1 cred. per qtr.; prereq. 102) Staff

111. Conference on Autopsies. (1 cred. per qtr.; prereq. 102) Staff

112. Diagnosis of Tumors. (2 to 5 cred. per qtr.; prereq. 102) Hebbel, McCartney

113. Surgical Pathology. (2 to 5 cred. per qtr.; prereq. 102) Hebbel, McCartney

114. Diseases of the Liver. (1 cred.; prereq. 102) McCartney

115. Advanced Neuropathology. (See N.Psy. 150, 210) (Hours and cred. ar.) Baker

116. Problems in Neuropathology. (See N.Psy. 146) (Hours and cred. ar.) Baker

117. Neuropathology. (See N.Psy. 143) (Hours and cred. ar.) Baker

118. Intracranial Neoplasms. (See N.Psy. 211) (Hours and cred. ar.) Baker

119. Survey of Neuropathology. (See N.Psy. 151) Examination of specimens from current autopsies. Baker

201. Research. Graduate students with necessary preliminary training may elect research, either as majors or minors in pathology. (Hours and cred. ar.) Staff

PEDIATRICS

For staff and courses of study offered, see the *Graduate Medical Bulletin.*

PHARMACEUTICAL CHEMISTRY

Professor
Charles H. Rogers, Sc.D., *dean*
Ole Gisvold, Ph.D.
Willard J. Hadley, Ph.D.
Charles V. Netz, Ph.D.
Taito O. Soine, Ph.D.

Associate Professor
Frank E. DiGangi, Ph.D.

Assistant Professor
Robert H. Miller, Ph.D.

Prerequisites—Graduate work leading to the M.S. and Ph.D. degrees with a major in pharmaceutical chemistry or pharmacognosy is open to students who have shown exceptional scholarship and ability in undergraduate courses of this or some other college of pharmacy of equal standing. Consideration will be given to applications of students who are not graduates in pharmacy but whose pattern of undergraduate work includes training in such allied or related subjects as would implement them to do graduate work successfully with a major in pharmaceutical chemistry.

Language Requirement—For the Master's degree, one foreign language. For the Ph.D. degree, either (a) two foreign languages or (b) one foreign language and the option of a special research technique.

Master's Degree—In general, offered under Plan A. Plan B may be followed by petition.

Doctor's Degree—Graduate work leading to the Ph.D. degree is offered to students prepared for advanced work in pharmaceutical chemistry.

Courses

161f-162w-163s. Organic Pharmaceutical Products. Sources, methods of production, properties, reactions, relationships of structures to activity, and uses of natural and synthetic organic compounds used as therapeutic agents. 161: Hydrocarbons, halogenated hydrocarbons, alcohols, aldehydes, ketones, acids, phenols, ethers, and esters. 162: Analgesics, organometallics—mercurials, silver compounds, arsenicals, and bismuth compounds—dyes, surface active agents, miscellaneous antiseptic agents, sulfonamides, and antibiotics. 163: Pressor principles, myotics, mydriatrics, antispasmodics, local anesthetics, barbiturates and related compounds, alkaloids, tannins, cardiac glycosides, sex hormones, and structurally related compounds and vitamins. (161, 3 cred.; 162, 3 cred.; 163, 4 cred.; prereq. Or.Ch. 2) Gisvold

164w-165s. Special Analytical Methods. The Food, Drug, and Cosmetic Act and official analytical methods of the United States Pharmacopoeia, National Formulary, and Association of Official Agricultural Chemists. Laboratory work: special analytical methods. physical and chemical, used in analyses of some drugs and foods. Student uses the viscosimeter, Abbé and Zeiss refractometers, polariscope, Duboscq colorimeter, photoelectric colorimeter, cryoscope, spectrophotometer, and other instruments for quantitative measurements. Professional elective. (Students planning to do graduate work with a major in pharmaceutical chemistry and a minor in organic chemistry should elect 164 for their winter professional elective and Or.Ch. 63 and 64 for their spring professional electives.) (3 cred. per qtr.; prereq. 3, 54, Or.Ch. 62) Soine or DiGangi, staff

201f,w,s.* Pharmaceutical Chemistry Seminar. Required of majors in pharmaceutical chemistry and pharmacognosy. (1 cred. per qtr.) Gisvold

202f-203w-204s.* Advanced Analytical Methods. Analyses of complex food, drug, and cosmetic products. Identification of colors, perfumes, flavoring agents, digestants, adulterants, etc. Precision instruments. (3 to 5 cred. per qtr.; prereq. 165; offered when demand warrants) Rogers, Netz

205f-206w-207s.* Chemistry of Medicinal Products. Chemistry and relationships between constitution and physiologic action of organic compounds. Isolation of active principles and syntheses of medicinal compounds. 205: Proteins, enzymes, co-enzymes, respiratory enzymes, biological oxidations and reductions, vitamins, some hormones, and the cardiac glycosides. Gisvold. 206: Organometallics (i.e., mercurials, arsenicals, and bismuth compounds), certain dyes, acridines, sulfones, sulfonamides, amidines, and the complex ureas. Gisvold. 207: Central nervous system depressants, central nervous system stimulants, local anesthetics, parasympathomimetics, sympathomimetics, and spasmolytics. Soine. (3 to 6 cred. per qtr.; prereq. Or.Ch. 2 and 163 or ♯; offered 1955-56 and alternate years)

208f. Carbohydrates and Glycosides. Origin, isolation, characterization, and chemistry of the carbohydrates and glycosides. (3 to 5 cred.; prereq. 163 or ♯; offered 1954-55 and alternate years) Gisvold

209s.* Alkaloids. Chemistry and experiments on methods used to isolate, purify, and characterize alkaloids. (3 to 5 cred.; prereq. 163 or ♯; offered 1954-55 and alternate years) Soine

210f.* History of Pharmaceutical Chemistry. (3 cred.) Netz

211s.* Terpenes, Carotinoids, Tannins, and Anthocyanins. Discussion of their chemistry and experimental investigation of methods of isolation and characterization of the volatile oils and their constituents. (3 to 5 cred.; prereq. 163 or ♯; offered 1954-55 and alternate years) DiGangi

212w.* Fats, Waxes, Sterols, and Related Compounds. Origin, isolation, characterization, and chemistry of the fats, waxes, sterols, and related compounds. (3 to 5 cred.; prereq. 163 or ♯; offered 1954-55 and alternate years) Gisvold

213f,w,s,su. Research Problems. Study and experimental investigation of one or more topics, e.g., complex drug and cosmetic products, carotinoids, enzymes, fats, oleoresins, pigments, proteins, resins, vitamins, waxes, etc. (Cred. ar.; prereq. 163 or ♯) Staff

214f,w,s,su. Research in Pharmaceutical Chemistry. (Cred. ar.) Staff

215f-216w. Pharmaceutical Development. Theoretical and practical problems involved in the development, stabilization, and manufacturing of a wide variety of pharmaceuticals, e.g., tablets, ointments, liquids, and suspensions on a pilot plant scale. (5 cred. per qtr.; prereq. 163 or ♯; offered 1954-55 and alternate years) Miller

218f. Extraction, Distribution, and Partition Coefficients. The theory and practice of extraction of liquids and solids, countercurrent distribution, solvent and solute effects and chromatography. (3 or 5 cred.; prereq. 163 or ♯; offered 1955-56 and alternate years) Miller

PHARMACOGNOSY

Professor
Earl B. Fischer, Ph.D.

Associate Professor
Wallace F. White, Ph.D.

For prerequisites and statements on Master's and Doctor's degrees, see Pharmaceutical Chemistry.

Language Requirement—For the Master's degree, one foreign language. For the Ph.D. degree, two foreign languages, one of which must be German.

Courses

162w. Biological Assay of Drugs. Didactic and laboratory considerations of biological assays of vegetable and animal drugs of the United States Pharmacopoeia and National Formulary. Important nonofficial assay methods are also studied. Registration limited to available instructional facilities. (3 cred.; prereq. 57) White

201f,202w,203s.* Advanced Pharmacognosy. Lecture and laboratory courses dealing with a systematic study of the pharmacognosy and pharmacohistology of the official, and a few important nonofficial, vegetable, and animal drugs. Information concerning the microscopic and microchemical properties of cell contents and cell forms such as alkaloids, glycosides, calcium oxalate, carbohydrates, parenchyma cells, stone cells, conducting cells, etc., and their appearance and arrangement in vegetable drug tissue, is applied to the identification, determination of purity, evaluation and detection of adulteration of vegetable and animal drugs. Important microscopical accessories such as the micropolariscope, microphotographic camera, staining reagents, etc. are used. (3 to 5 cred.; prereq. 55, 56, 57; offered when demand warrants) Fischer

204f,w,s,su. Research in Pharmacognosy. (Cred. ar.) Fischer, White

205f. Microscopy of Foods. Identification of food products of vegetable origin, by means of the microscopic structure and microchemical reactions of their tissues and cell contents, together with the determination of purity and the detection of adulteration. (3 to 5 cred.; prereq. 55, 56, 57; offered when demand warrants) Fischer

206w. Technical Microscopy. Study of microscopic characteristics and identification of technical products such as vegetable and animal fibers, woods, barks, cellulose, textiles, seeds, etc. (3 to 5 cred.; prereq. 55, 56, 57; offered when demand warrants) Fischer

207f,208w. Pharmacodynamic Methods. Practical application and evaluation of special techniques used in testing qualitative and especially quantitative drug action on experimental animals. Drug types studied include anthelmintics, diuretics, bactericidal and bacteriostatic agents, analgesics, cardiac drugs, local anesthetics, and antispasmodics. (3 to 5 cred. per qtr.; offered when demand warrants) White

209f,210w,211s. Advanced Experimental Drug Testing Techniques. Projects will be assigned including library and laboratory work to duplicate techniques of selected original investigations reported in the literature in order to prepare the student to carry on original investigations in drug testing. (Cred. ar.; students may enter this course at beginning of any quarter; offered when demand warrants) White

PHARMACOLOGY

Professor
Raymond N. Bieter, M.D., Ph.D., *head*
Harold N. G. Wright, Ph.D.

Assistant Professor
Elizabeth M. Cranston, Ph.D.

The laboratories of the Department of Pharmacology are excellently equipped for study of both the chemical properties of drugs and their actions upon functions of living organs and tissues, for studies on detection, isolation, and estimation of poisons, and for experimental chemotherapy. By cooperation of the clinical departments, special studies may be made of the action of drugs, old and new, upon patients in the University Hospitals and allied hospitals.

Prerequisites—In addition to fulfilling requirements for admission to the Graduate School students should satisfy the requirements for entrance to the Medical School.

Minor—This department offers work for a minor to students in allied sciences.

Language Requirement—For the Master's degree, one foreign language. For the Ph.D., either (a) two foreign languages or (b) one foreign language and the option of a collateral field of knowledge.

Master's Degree—Offered under Plan A.

Doctor's Degree—Work toward the Ph.D. degree is offered in this department.

Courses

101f,w,s. Introduction to Pharmacology. The first course in a sequence in which drugs and related chemical compounds are presented for study from the standpoints of chemical structure, beneficial pharmacological actions or effects upon the living body and on living organisms, toxic or harmful effects, and their applications to the treatment of disease. (2 cred.; prereq. Phsl. 106, 107 or equiv.) Bieter, Wright, Cranston

102s. General and Experimental Pharmacology. Continuation of 101 with laboratory experiments and demonstrations. (9 cred.; prereq. 101; this course runs as a single unit through the spring quarter and the first term of Summer Session) Bieter, Wright, Cranston

105f,w. General and Experimental Pharmacology. Continuation of 101 with laboratory experiments and demonstrations. (6 cred.; prereq. 101; see 108 below) Bieter, Wright, Cranston

106w,s. General Pharmacology. A lecture continuation of 105. (2 cred.; see 108 below) Bieter, Wright, Cranston

108w,s. Prescription Writing. (1 cred.; prereq. 101, 105, 106 [101 and 102 are equiv. to 101, 105, 106 and 108]) Wright

109f,w,s,su. Pharmacological Problems. (Cred. and hours ar.; prereq. 101 and 102 or equiv.) Bieter, Wright, Cranston

110f,su. Toxicology. (Cred. and hours ar.; prereq. 101 and 102 or equiv.; lect. and lab.; lect. only may be taken if desired) Wright

111s. Advanced Toxicology. Laboratory study of quantitative toxicological analysis. (3 cred.; prereq. 110 or #) Wright

112w. Spectrochemical Toxicology. (5 cred.; prereq. 110) Wright

113f. Industrial Toxicology. (2 cred.; prereq. 110) Wright

124f,w,s. Pharmacology of Special Systems. Conferences on the more detailed pharmacology of special organ systems and the clinical applications thereof. (3 cred.) Bieter, Wright, or Cranston

203f,w,s,su. Research in Pharmacology. (Cred. and hours ar.; prereq. 101 and 102 or equiv., #) Bieter, Wright, or Cranston

204f,w,s. Advanced Pharmacology. (1 cred.; prereq. 101 and 102 or equiv., #) Bieter, Wright, Cranston

205f,w,s. General Discussions in Pharmacology. A seminar. (1 cred.; prereq. 101 and 102 or equiv., #) Bieter, Wright, or Cranston

PHILOSOPHY

Professor
Wilfrid Sellars
Herbert Feigl

Associate Professor
May Brodbeck
Paul L. Holmer
John Hospers
Mary Shaw

I. Graduate Major in Philosophy

Prerequisites—To be accepted as a graduate major in philosophy, the applicant must have completed 18 Senior College credit hours in philosophy with a grade average of B or above. In special cases provisional registration may be arranged.

Fields of Specialization—The following broad classification of philosophical studies is adopted for the purpose of these regulations: (a)

history of philosophy; (b) logic and epistemology; (c) metaphysics; (d) philosophy of science; (e) ethics; (f) philosophy of religion; (g) aesthetics; (h) social and political philosophy. In addition to the requirements listed, candidates for advanced degrees in philosophy are expected to be familiar with the basic concepts and problems of each of these fields.

Language Requirement—For the Master's degree, one foreign language. For the Ph.D. degree, two foreign languages, one of which must be German.

Master's Degree—Offered only under Plan A. The candidate shall, with the approval of his adviser, choose three fields of specialization from those listed, including the history of philosophy—one of these three fields shall be designated as his thesis field. The written examination required by the Graduate School shall consist of a written examination in each of the three selected fields of specialization.

Doctor's Degree—The candidate shall, with the approval of his adviser, choose four fields of specialization, including fields (a) and (b). One of the four fields shall be designated as his thesis field. The candidate is responsible for preparing himself in these fields and must pass a written examination in each field prior to the preliminary oral examinations.

II. Graduate Minor in Philosophy

Prerequisites—Registration as a graduate minor in philosophy is permitted only upon consultation with a graduate adviser in the department.

Master's Degree—The general requirements of the Graduate School must be satisfied.

Doctor's Degree—In addition to satisfying the general Graduate School requirements, the candidate offering philosophy as a minor must pass a written examination in two of the fields of specialization listed in section I of these regulations.

Note—Students interested in major work in American Studies will find a description of this work on pages 22 and 52. For credit in Humanities Seminar, see page 132.

Courses

Check with Philosophy Department to ascertain which of the following courses are offered in 1954-55, which in 1955-56, which in both years.

101f-102w. Principles of Philosophy. 101: Knowledge, meaning, truth, reality, mind, and nature. 102: Human values and action. (4 cred. per qtr.; open only to seniors and graduates who have not had 1 [Problems of Philosophy]) Brodbeck

103w. Eighteenth-Century Philosophy. (Formerly Phil. 111A) The philosophy of the enlightenment in France, England, and Germany. The course is designed not only for majors in philosophy but also in history, English literature, French, and German. (3 cred.) Shaw

104s. Nineteenth-Century Thought. (Formerly Phil. 115A) Main currents in British and European philosophy; the ideological background; the interaction between Continental and British thinkers; realism and positivism; German and British idealism; romanticism; philosophical psychology; materialism; evolutionism and its philosophical consequence. (3 cred.; prereq. ♯) Brodbeck

105f. Introduction to American Philosophy: Puritanism to Pragmatism. (Formerly Phil. 114) A study of Puritanism, the Revolutionary period, transcendentalism, and evolutionism. Especially for students of American history and literature. (3 cred.) Brodbeck

106w. American Philosophy from William James. (Formerly Phil. 114A) Continuation of 105. (3 cred.; prereq. 105 or #) Brodbeck

107w. Philosophy in Modern Literature. (Formerly Phil. 135) A survey of basic philosophical ideas in modern civilization as they are expressed in major works of literature. (3 cred.) Terrell

108w. Political and Social Ethics. (Formerly Phil. 165) A discussion of the ethical principles, theoretical and practical, at the basis of the political order. (3 cred.; prereq. one course from 50-51-52 or #) Hospers

109f. History of Ethics. A study of the most significant contributions to the development of ethical theory in western philosophy, with emphasis on British writers of the modern period (17th-18th centuries). (3 cred.; prereq. 3 or at least one course in the history of philosophy or #) Terrell

112f-113w. Plato. (Formerly Phil. 106-107) Study of the philosophy of Plato based on analysis of major dialogues. (3 cred. per qtr.; prereq. 50 or #) Sellars

114s. Aristotle. (Formerly Phil. 108) Study of the philosophy of Aristotle based on analysis of selected passages from his major works. Particular attention given to his relationship to Plato. A survey will be made of Aristotelian tradition in western philosophy. (3 cred.; prereq. one course from 50-51-52 or #) Shaw

115s. Epicureanism and Stoicism. (Formerly Phil. 148) Greek philosophy after Aristotle. Modern elements in stoic logic. (3 cred.; prereq. 50) Shaw

116w. Skepticism. (Formerly Phil. 149) The development of Greek and Roman skepticism; the revival of skepticism in the French Renaissance and its influences in the 17th and 18th centuries. (3 cred.; prereq. 50) Shaw

118f. Readings in Medieval Philosophy. (Formerly Phil. 130) An analysis of selected works of the principal medieval philosophers. (3 cred.; prereq. 50, 51 or #) Shaw

120. Rationalism. (Formerly Phil. 110) The philosophies of Descartes, Spinoza, and Leibnitz. (3 cred.; prereq. one course from 50-51-52 or #)

121f. Descartes. (Formerly Phil. 125) An analysis of the philosophical works of Descartes. (2 cred.; prereq. one course from 50-51-52 or #) Shaw

122w. Spinoza. (Formerly Phil. 126) A study of the philosophy of Spinoza based primarily on the analysis of his *Ethics*. (2 cred.; prereq. 121 or #) Sellars

123s. Leibnitz. (Formerly Phil. 127) A study of the philosophy of Leibnitz based on the analysis of selected philosophical writings. (2 cred.; prereq. 121 or #) Sellars

130f. Locke and Berkeley. (Formerly Phil. 133) An analysis of the principal epistemological works of Locke and Berkeley with emphasis upon their sources and influence. (3 cred.; prereq. 52 or #) Shaw

131w. Hume. (Formerly Phil. 134) A detailed study of Hume's *Treatise* and *Inquiry*. (3 cred.; prereq. 52, 130) Shaw

134s. Kant. (Formerly Phil. 112) A study of the philosophy of Kant based on an analysis of selected passages from his major works. (3 cred.; prereq. 52 or #) Sellars

137w. Kierkegaard and Scandinavian Philosophy. (Formerly Phil. 113) A study of the philosophical tradition in the Scandinavian countries, with special reference to Kierkegaard and his significance. (3 cred.; prereq. one course from 50-51-52 or #) Holmer

140f. Contemporary Philosophy. (Formerly Phil. 115) A study of current systematic and critical philosophies, especially idealism, naturalism, realism, pragmatism, positivism, and existentialism, as represented by their principal exponents. (3 cred.; prereq. 52 or #) Raab

143. Philosophy of John Dewey. (Formerly Phil. 116) A survey of the ethical, social, educational, and logical contributions made to modern thought by

this distinctively American thinker. (3 cred.; prereq. 52 or ‡; offered when demand warrants)

147f-148w-149s. Readings in Recent Philosophy. (Formerly Phil. 117-118-119) An intensive study of works by Russell, Whitehead, and Collingwood; works by other authors. (3 cred. per qtr.; prereq. 52 or ‡) Holmer

150s. Ethical Theory. (Formerly Phil. 164) Distinguishing characteristics of a moral judgment; applications of moral judgments to motives, acts, consequences, and persons; moral freedom and responsibility; moral relativity, skepticism, and unity; ethical monism and pluralism; examination of representative systems. (3 cred.; prereq. one course from 50-51-52 or ‡) Sellars, Hospers

151f-152w. Principles of Aesthetics. (Formerly Phil. 159-160) The nature of the aesthetic experience; standards of aesthetic evaluation; beauty in art and beauty in nature; the status of subject matter in the arts; the relation of form and content; the concepts of representation, expression, style, meaning, and truth in the arts; the use of symbols in art; the relation of the arts to knowledge, and to society; the relation of aesthetics to ethics. (3 cred. per qtr.; prereq. ‡) Hospers

154f. Elements of Symbolic Logic. (Formerly Phil. 147) A systematic introduction to modern logic. The topics include the dimensions of language; calculus of propositions, classes, and relations; applications to foundations of mathematics. (4 cred.; prereq. 2 or ‡) Brodbeck

157s. Metaphysics. (Formerly Phil. 155) A study of some recent attempts to discover general principles characteristic of the universe. (4 cred.; prereq. one course from 50-51-52 or ‡) Terrell

158w. Theory of Knowledge. (Formerly Phil. 143) An analysis of the logical structure and experiential roots of knowledge. The topics include meaning, validity, truth, reason and experience, induction, criteria of objectivity, and reality. (4 cred.; prereq. 2 or ‡) Feigl, Sellars

160s. Philosophy of Science. (Formerly Phil. 153) An attempt to provide a clear understanding of the meaning, methods, and implications of modern science through the examination of basic concepts, presuppositions, and procedures. The topics include description, explanation, prediction, experimentation; space, time, number, matter, energy; causality, probability, statistics; organic life, evolution, mind. (4 cred.; prereq. 2 or ‡) Feigl

164w. The Logic of the Social Sciences I. (Formerly Phil. 140) A philosophical examination of the foundations of the behavior sciences in general; their concepts, laws and theories; concrete illustrations from these sciences; problems of value and objectivity; logical nature of social philosophies and ideologies; role of the social scientist in a democratic society. (3 cred.; prereq. 15 cred. in social science, psychology, education, history, or philosophy, or ‡) Brodbeck

165s. The Logic of the Social Sciences II. (Formerly Phil. 141) A closer and more specific study of the items introduced in the preceding course, with greater attention to the logical methods and problems peculiar to each of the specialized social sciences. (3 cred.; prereq. 164) Brodbeck

167f. Philosophy of History. (Formerly Phil. 170) A study of the idealistic, theological, and economic interpretations of history, with particular reference to the concepts of progress, continuity, pluralism, etc., and to the philosophical aspects of historical methods. (3 cred.; prereq. 6 cred. in philosophy or 10 cred. in history) Holmer

170. Comparative Philosophy. (Formerly Phil. 123) (3 cred.; prereq. one course from 50-51-52 or ‡; offered when staff permits)

180f. History of Religions. (3 cred.; prereq. 6 cred.) Holmer

181w. Psychology of Religion. (3 cred.; prereq. 6 cred.) Holmer

182s. Philosophy of Religion. (3 cred.; prereq. 6 cred.) Holmer

190f-191w-192s. Seminar in Philosophy. (Formerly Phil. 191-192-193) Individual investigation, with topics to be determined after consultation with the department. (3 cred. per qtr.; prereq. 9 cred., ‡) Feigl, Sellars, Shaw, Holmer, others

206-207. Seminar in Comparative Philosophy. 206: Theory of knowledge and methodology. 207: Ethics and philosophy of religion. (3 cred. per qtr.; prereq. 170 or ♯; offered when staff permits)

210f-211w-212s. Seminar in Moral Philosophy. Systematic study of concepts and problems relating to the moral universe of discourse. (3 cred. per qtr.; prereq. 150 or ♯) Sellars

215s. Seminar in Aesthetics. A study of special problems in aesthetics, more intensive and more specialized than the study of aesthetic problems in 151-152. Topics treated in any given year will vary somewhat with the interests of the students. Such topics may include: detailed analysis of the concept of beauty; the relevance of beauty to artistic style, artistic greatness, and artistic perfection; a reading of Kant's *Critique of Judgment;* an analysis of the artistic imagination. (3 cred.; prereq. 151-152) Hospers

216s. Seminar in Philosophy of Criticism. (Alternates with Phil. 215) A survey of various theories of criticism, and of the interrelationship and mutual bearing of different kinds of criticism among the arts. Instructors from various departments will appear from time to time. (3 cred.; prereq. 151-152) Hospers

220f-221w-222s. Seminar in Philosophical Analysis. Systematic study of the basic concepts and problems of epistemology. (3 cred. per qtr.; prereq. 158 or ♯) Sellars

223f-224w-225s. Seminar in Philosophy of Languages. Systematic study of concepts and problems relating to the structure, meaning, and use of language. (3 cred. per qtr.; prereq. 158 or 154, ♯) Sellars

230f-231w-232s. History of Philosophy, Advanced. Primarily for graduate students in other departments who have had no previous courses in philosophy. Philosophy majors who have taken 50-51-52 may enroll with permission. (3 cred. per qtr.) Hospers

233f-234w-235s. Seminar in Philosophy of Religion. Systematic study of the conceptual structure of religion. (3 cred. per qtr.; prereq. 182 or ♯) Holmer

236f-237w-238s. Seminar in the History of the Philosophy of Religion. Historical study seeking to isolate the origins, the nature, the scope of philosophy of religion in Western culture from the Greeks through the 18th century (3 cred. per qtr.; prereq. 182, knowledge of the history of philosophy, ♯) Holmer

241f-242w-243s. Seminar: Philosophy of the Physical Sciences. (3 cred. per qtr.; prereq. ♯) Feigl

244f-245w-246s. Seminar: Philosophy of Psychology. (3 cred. per qtr.; open to advanced graduate students in philosophy or psychology with written consent) Feigl

247f-248w-249s. Seminar: Logic of the Exact Sciences. (3 cred. per qtr.; prereq. ♯) Feigl, Rosenbloom

250f-251w-252s. Seminar: Philosophy of the Social Sciences. (3 cred. per qtr.; prereq. ♯) Feigl, Brodbeck

350f-351w-352s. Research in History of Philosophy. (Cred. ar.; prereq. ♯) Sellars, Shaw, others

360f-361w-362s. Research in Philosophy of Science. (Cred. ar.; prereq. ♯) Feigl, Brodbeck, others

370f-371w-372s. Research in Philosophy of Culture. (Cred. ar.; prereq. ♯)

PHYSICS

Professor
Alfred O. C. Nier, *chairman*
J. William Buchta
Charles L. Critchfield
Edward L. Hill
Otto H. Schmitt
Joseph Valasek
Clifford N. Wall
John H. Williams

Associate Professor
Edward P. Ney
John R. Winckler

Assistant Professor
J. Morris Blair
Warren B. Cheston
George D. Freier
Norton M. Hintz
Lawrence H. Johnston
Lawrence M. Slifkin

Prerequisites—For major work, differential and integral calculus and two years of college physics. For minor work, differential and integral calculus and one year of college physics.

Language Requirement—For the Master's degree, reading knowledge of French or German. It is desirable that the language requirement be fulfilled before graduate work is begun. For the Ph.D. degree, German and either French, Russian, or Italian. Other languages may be considered on petition.

Master's Degree—Offered under either Plan A or Plan B. Courses 181-183-185 and 191-192-193 are required. Alterations of this requirement may be made only after consultation with the chairman of the department.

Doctor's Degree—Candidates for the Ph.D. degree will be expected to pass qualifying examinations as determined by the chairman of the department before admission to the preliminary examination.

Note—For courses in biophysics, see pages 63-65. For courses in geophysics, see page 138.

Courses

101f-103w-105s.‡ Theoretical Physics. Analytical survey of the fundamental principles of classical physics. (5 cred. per qtr.; prereq. 15 cred., Math. 106 or I.T.M. 80 or one of them ¶; 5 lect. hours per week) Nier

107f*-109w*-111s.* Modern Physics. Survey of the newer developments in physics. (3 cred. per qtr.; students may, with permission, enter any quarter; prereq. 15 cred. in physics, Math. 51 or I.T.M. 25)

114f,w,s*-116f,w,s*-118f,w,s.*‡ Physical Investigation. Problems, either experimental or theoretical, in which the student may have special interest. A written report on the work accomplished is required. (3 cred. per qtr.; prereq. consent of department chairman) Staff

120f.* Atomic Physics. A laboratory course to introduce techniques and methods used in physics research laboratories. Vacuum gauges and systems, properties of charged particles, X-ray diffraction, ionization of gases, mass spectroscopy, photoelectricity, secondary electron emission. (3 cred.; prereq. 50 or ♯, Math. 51 or I.T.M. 25) Blair

121w.* Experimental Nuclear Physics I. A laboratory course not requiring extensive knowledge of electronic circuits. Natural radioactivity, cloud chambers, ionization chambers, properties of nuclear radiation, alpha, beta, and gamma rays, neutrons; shielding artificial radioactivity, photographic techniques, health protection. (3 cred.; prereq. 50 or ♯, Math. 51 or I.T.M. 25) Blair

122s.* Experimental Nuclear Physics II. A laboratory course in techniques requiring knowledge of electronic circuits. Geiger, proportional, scintillation, and coincidence counters. Cosmic rays. Nuclear resonance phenomena. Health monitoring instruments. (3 cred.; prereq. 121, 146 or ♯) Blair

131f.* Geometrical Optics. Theory of mirrors, prisms, and lenses. Optical instruments. (3 cred.; prereq. 15 cred., Math. 51 or I.T.M. 25) Valasek

133w.* Physical Optics. Theory of interference and interferometers. Theory of diffraction, resolving power, and diffraction gratings. Polarized light, crystal optics, and applications. (3 cred.; prereq. 15 cred., Math. 51 or I.T.M. 25) Valasek

134f,w.* Experimental Optics. Laboratory work in spectrometry, optics of compound lenses, photometry, absorption, interferometry, polarized light. (3 cred.; prereq. 15 cred.; 2 three-hour lab. periods a week) Valasek

135s.* Spectroscopy. Light sources, instruments and methods used in spectroscopy of the X-ray, ultraviolet, visible, and infrared regions of the spectrum. (3 cred.; prereq. 15 cred., Math. 51 or I.T.M. 25) Valasek

136w,s.* Spectrum Analysis. Laboratory work on measurement of wave lengths, intensities, and absorption coefficients in the infrared, visible, and ultraviolet regions of the spectrum. (3 cred.; prereq. 15 cred.; 2 three-hour lab. periods per week) Valasek

144f. Electrical Measurements. An experimental course covering ballistic and current galvanometers, magnetic flux measurements, potentiometer methods, D.C. bridges, and audiofrequency A.C. bridges. (4 cred.; prereq. 15 cred., Math. 51 or I.T.M. 25) Blair

146w.* Electronics. Physics of vacuum tubes and associated circuits, thermionics. (4 cred.; prereq. 144 or ♯) Blair

148s.* Application of Electronic Circuits. Application of various electronic circuits which are useful in physics research. Lecture and laboratory work involving amplifiers, computing circuits, servomechanisms, regulating circuits, and others especially adapted to work in physics. (4 cred.; prereq. 146 or ♯)

181f*-183w*-185s.* Atomistics and Elementary Quantum Mechanics. An introduction to wave mechanics, atomic structure, and nuclear physics. (3 cred. per qtr.; prereq. 101-103-105 or ♯) Williams

191f*-192w*-193s.* Introduction to Mathematical Physics. Intensive treatment of the equations of mathematical physics using material drawn from the fields of mechanics, small vibrations of continuous media, acoustics, electromagnetic theory, and heat conduction. (3 cred. per qtr.; prereq. 101-103-105, Math. 106-107-108 or 157-158-159 or I.T.M. 150, 152, 153)

Prerequisites for the following courses are Phys. 191-192-193 or consent, and advanced calculus. A reading knowledge of German is highly desirable and will be presumed in certain phases of the work.

204f-205w-206s. Statistical Thermodynamics. (3 cred. per qtr.; offered 1954-55 and alternate years) Wall

207f-208w-209s. Electrodynamics, Theoretical Optics, and the Theory of Relativity. (3 cred. per qtr.; offered 1954-55 and alternate years)

210f-211w-212s. Quantum Mechanics. (3 cred. per qtr.) Hill

213f*-214w*-215s.* Seminar in Contemporary Experimental Physics. (3 cred. per qtr.) Staff

216f*-217w*-218s.* Seminar in Contemporary Theoretical Physics. (3 cred. per qtr.) Staff

225f-226w-227s. Advanced Quantum Theory. (3 cred. per qtr.)

228f-229w-230s. Nuclear Theory. (3 cred. per qtr.; offered 1954-55)

231f-232w-233s. Theory of Atomic and Molecular Structure. (3 cred. per qtr.) Hill

246f-247w-248s. Cosmic Rays. (3 cred. per qtr.)

249f-250w-251s. Theory of the Solid State of Matter. (3 cred. per qtr.)

252f-253w-254s. Seminar in Nuclear Physics. (Cred. ar.) Williams, staff

255f-256w-257s. Seminar in Mass Spectroscopy. (Cred. ar.) Nier, staff

258f-259w-260s. Seminar in Cosmic Rays. (Cred. ar.) Ney, Winckler, staff

264f-265w-266s. Collision Processes of High Energy Particles. (3 cred. per qtr.; prereq. quantum mechanics)

The following courses will be offered when demand warrants:

201f-202w-203s. Dynamics of Fluid Motion. Hill

234f-235w-236s. Advanced Theory of Optics and Optical Instruments. Valasek

261f-262w-263s. Mathematical Foundations of Quantum Mechanics. Hill

PHYSIOLOGICAL CHEMISTRY

Professor
Wallace D. Armstrong, M.D., Ph.D., *head*
David Glick, Ph.D.
Karl Sollner, Ph.D.

Associate Professor
Cyrus P. Barnum, Jr., Ph.D.
Saul L. Cohen, Ph.D.
Ralph Holman, Ph.D.

Assistant Professor
Charles W. Carr, Ph.D.
Helmut R. Gutmann, Ph.D.
Leon Singer, Ph.D.

Prerequisites--A Bachelor's degree with a major in chemistry or physics and a minor in some other science. Prerequisites for admittance as a candidate for the Ph.D. degree with either a major or minor in this department, or for the M.S. degree with a major in this department, are: An.Ch. 1-2 or 101-102 or equivalent; Or.Ch. 63-64 or equivalent; P.Ch. 107-108 or equivalent; and 6 credits of a biological science.

Language Requirement—One foreign language for the Master's degree. For the Ph.D. degree, two foreign languages. In general these languages will be French and German, but at the discretion of the major adviser other foreign languages may be substituted for either or both French and German.

Master's Degree—Offered under Plan A. The following are required of all candidates for the Master's degree with a major in this department: 3 credits of advanced analytical chemistry, 3 credits of advanced organic chemistry, 6 credits of biological sciences, and Ph.Ch. 100-101.

Doctor's Degree—The following are required of all candidates for the Doctor's degree with a major in this department: 6 credits of advanced analytical chemistry, 6 credits of advanced organic chemistry, 6 credits of advanced physical chemistry or physics, 10 credits of Phsl. 106-107, Ph.Ch. 100-101, and 4 of the 5 physiological chemistry courses numbered 206, 207, 208, 209, or 211. These are not intended to be interpreted as minimum requirements, however, and each graduate student is expected to work out his full program in consultation with an adviser, with the understanding that needs may differ in individual cases.

If Ph.Ch. 100-101 or its equivalent has been taken five years or more prior to the time the candidate is to appear for the preliminary oral examination, this course must be retaken.

Courses

100f,su-101w,su. Physiological Chemistry. (7 cred. for 100, 6 cred. for 101; prereq. physics, organic chemistry) Armstrong, Barnum, Glick, Cohen, Carr

153f,w,s,su. Problems in Physiological Chemistry. Special work arranged with qualified students. (Hours and cred. ar.; may be taken one or more quarters; prereq. 100-101) Armstrong, Barnum, Glick, Cohen, Carr

155f,w,s. Seminar and Conference on Dental and Oral Biochemistry. (Hours and cred. ar.; prereq. 100-101 or 56-57) Armstrong

200f,w,s. Seminar in Physiological Chemistry. (1 cred.) Staff

205f,w,s,su. Research in Physiological Chemistry. (Hours and cred. ar.) Armstrong, Barnum, Glick, Sollner, Cohen

206f. Advanced Endocrinology and Steroid Chemistry.** (3 cred.; prereq. 100-101; offered 1955-56 and alternate years) Cohen

207w. Radiotracers and Mineral Metabolism.** (3 cred.; prereq. 100-101; offered 1955-56 and alternate years) Armstrong

208s. Advanced Laboratory Technique. (3 cred.; prereq. 100-101 and ♯; limited to 10 students; offered 1955-56 and alternate years) Staff

209f. Histochemistry.** (3 cred.; prereq. 100-101 and histology or ♯; offered 1954-55 and alternate years) Glick

211s. Intermediary Metabolism.** (3 cred.; prereq. 100-101; offered 1954-55 and alternate years) Barnum

212f,w,s,su. Histochemistry Laboratory. Problems in the field of histochemistry selected to meet individual interests. (Hours and cred. ar.; prereq. 100-101 and ♯) Glick

213f,w,s. Clinical Physiological Chemistry. (Hours and cred. ar.) Staff

236f,w,s. Radio-Isotope Seminar. (1 cred.) Stenstrom, Armstrong, staff

PHYSIOLOGICAL HYGIENE

(A Division of the School of Public Health)

Professor
Ancel Keys, Ph.D., *director*
Associate Professor
Joseph T. Anderson, Ph.D.
Josef M. Brozek, Ph.D.
Francisco Grande, M.D.
Ernst Simonson, M.D.
Henry L. Taylor, Ph.D.

Minor—It is suggested that students who major in physiological hygiene present a minor in one of the following fields: physiology, physiological chemistry, or psychology.

Language Requirement—For the Master's degree, French or German. In exceptional cases Spanish or Russian may be substituted by petition. For the Ph.D. degree, either (a) two foreign languages or (b) one foreign language and the option of a collateral field of knowledge.

Master's Degree—Offered under Plan A.

Doctor's Degree—Work is offered in physiological hygiene leading toward the Ph.D. degree.

Courses

P.H.191w. Science of Human Nutrition. Evaluation of nutritional status, surveys, special dietetics. (3 cred.; prereq. 8 cred. in biochemistry, 91, 92, or ♯; offered when demand warrants) Keys, Anderson

P.H.192w. Physiology of Exercise. Acute and chronic effects of exercise. (4 cred.; prereq. 92 or Phsl. 103 or equiv., and ♯; offered when demand warrants) Simonson, Taylor

P.H.194w. Human Factors in Industry. Job requirements, physiological cost of work, industrial fatigue, industrial hazards, environment, accidents, absenteeism. (3 cred.; prereq. ♯) Brozek

P.H.202f,w,s. Seminar in Physiological Hygiene. Nutrition; human physical fitness; gerontology; human adaptation in health and disease; geographical physiology; and related topics. (1 cred.) Staff

P.H.220f,w,s. Readings in Problems of Physiological Hygiene. (Cred. ar.; prereq. ♯) Staff

P.H.290f,w,s. Research in Physiological Hygiene and Related Areas. (Cred. ar.) Staff

** Offered only when eight or more students are registered.

PHYSIOLOGY

Professor
Maurice B. Visscher, M.D., Ph.D., *head*
John J. Bittner, Ph.D.
Ernst Gellhorn, M.D., Ph.D.
Nathan Lifson, M.D., Ph.D.
Victor Lorber, M.D., Ph.D.
Herbert S. Wells, M.D.

Associate Professor
Ernest B. Brown, Ph.D.
Joseph T. King, M.D., Ph.D.
Werner P. Koella, M.D.

Assistant Professor
Marthella Frantz, Ph.D.
John A. Johnson, Ph.D.
Carlos Martinez, Ph.D.

Instructor
Eugene D. Grim, Ph.D.

Prerequisites—For a major or minor in physiology, acceptable courses in general zoology or anatomy, general chemistry, organic chemistry, and college physics. Physical chemistry is desirable.

Minor—Students majoring in clinical subjects who desire a minor in physiology must have had the courses in these branches usually required of medical students.

Language Requirement—For the Master's degree, German, French, Russian, or Spanish. For the Doctor's degree, either (a) two foreign languages or (b) one foreign language and the option of a collateral field of knowledge.

Master's Degree—Offered under both Plan A and Plan B, the latter by petition.

Doctor's Degree—Work for the Ph.D. degree is offered to candidates whose background of training is approved by the department.

Courses

106s-107su.† Human Physiology. (Formerly 103, 104) Registration for 106 or 107 singly is not permitted, but students may register for lecture without laboratory. (15 cred.; prereq. organic chemistry, zoology, and neuroanatomy) Visscher, Gellhorn, others

113f,w,s,su. Problems in Physiology. Arranged with qualified students. Each student will be assigned a topic for special laboratory study. Conferences and reading. (3 cred. per qtr. or ar.; may be taken one or more qtrs.; prereq. 106-107 or equiv.) Visscher, Gellhorn, Lifson, King, Brown, others

114f,w,s. Seminar in Physiology. One or more seminars in various major fields of physiology will be offered each quarter. Interested students should obtain information concerning proposed offerings from the department office. (Hours and cred. ar.; prereq. satisfactory completion of a course equiv. to 106-107) Staff

124f. Seminar in Neurophysiology. (2 cred.; prereq. 106-107 with grade of B or better, or special examination) Gellhorn

124w.* Selected Topics in Advanced Neurophysiology. (1 cred., or 2 cred. by special arrangement for students preparing term papers; prereq. 106-107 with grade of B or better, or special examination) Gellhorn

201f,w,s,su.* Seminar in Physiology. For advanced students. (Cred. ar.) Visscher, staff

202.* Readings in Physiology. Topics will be selected for each student, and written reviews will be prepared and discussed. (1 to 3 cred.) Visscher, Gellhorn, King, others

203f,w,s,su.* Research in Physiology. (Hours and cred. ar.) Visscher, Gellhorn, King, Lifson, others

206w.* Seminar in History of Physiology and Related Sciences. (1 cred.) Visscher

PLANT PATHOLOGY AND BOTANY

Professor
Jonas J. Christensen
Clyde M. Christensen
Carl J. Eide
Helen Hart

Associate Professor
Milton F. Kernkamp
Thomas H. King

Assistant Professor
James E. DeVay
Louise Dosdall
David W. French
Thor Kommedahl
Raymond H. Landon

Instructor
Harold G. Heggeness
Matthew B. Moore

Prerequisites—

Plant pathology major: The minimum requirement is (a) three years (27 credits) in the basic plant sciences; (b) one year (9 credits) in plant pathology—preferably two years (18 credits).

Plant pathology minor: The minimum requirement is (a) three years (27 credits) in the basic biological sciences; (b) 5 credits in plant pathology.

Applied plant physiology and agricultural botany major: The minimum requirement is (a) three years (27 credits) in the basic plant sciences; (b) one year (9 credits) in plant physiology.

Applied plant physiology and agricultural botany minor: The minimum requirement is (a) three years (27 credits) in the basic plant sciences; (b) 5 credits in plant physiology.

Language Requirement—For the Master's degree, one foreign language. For the Doctor's degree, two foreign languages.

Master's Degree—Offered under Plan A and Plan B.

Doctor's Degree—Work for the Ph.D. degree is offered by this department.

Courses

PLANT PATHOLOGY

104w. Industrial Mycology. Fungi in relation to industrial processes and products. (3 cred.; prereq. 1 or 10 or 56; offered 1954-55 and alternate years) C. M. Christensen

105f,106w,107s.* Mycology. Morphology and taxonomy of fungi. (3 or 5 cred. per qtr.; prereq. 1 or 10 or 56 or equiv.; lect., lab., field work) Dosdall

111w. Diseases of Field Crops. Detailed study of diseases of field crops including symptomatology, etiology, and practical methods of control. (4 cred.; prereq. 1 or 10 or 120; lect., lab., greenhouse work) J. J. Christensen, Kernkamp

114w. Advanced Forest Pathology. A detailed study of wood rots, including a study of the deterioration of wood products caused by fungi. (3 cred.; prereq. 1 or 10; lect., lab.; offered 1954-55 and alternate years) French

115s. Diseases of Vegetable Crops. Detailed study of vegetable diseases, especially those important in Minnesota. (3 cred.; prereq. 1 or 10 or 120; lect., lab., field, greenhouse work; offered 1955-56 and alternate years) Eide

116s. Diseases of Fruit Crops. Detailed study of fruit diseases, especially those important in Minnesota. (3 cred.; prereq. 1 or 10 or 120; lect., lab., field, greenhouse work; offered 1954-55 and alternate years) King

117f. Virus Diseases of Plants. Nature of plant viruses and types of diseases they cause; emphasis on methods for studying virus diseases. (3 cred.; prereq. 1 or 10 or 120; offered 1955-56 and alternate years) King

118f. Bacterial Diseases of Plants. Bacteria as plant pathogens; representative types with particular reference to the techniques used in studying bacterial diseases of plants. (3 cred.; prereq. 1 or 10 or 120; offered 1954-55 and alternate years) Eide

119s. Principles of Plant Disease Control. General consideration of principles and practices in controlling plant diseases. (3 cred.; prereq. 1 or 10 or 120: lect., lab., greenhouse work) King

120f,w,s. Advanced Plant Pathology. General plant pathology. (3 cred., §1 or 10; prereq. 14 cred. in plant sciences or ‡; lect., lab., greenhouse work, special problems) French, Moore

141f,142w. Insects in Relation to Plant Diseases. (Same as Ent. 141-142) A study of the principal insect vectors and their habits; types of insect injuries affecting health of plants; modes of insect transmission and dissemination of plant disease; methods of rearing and handling insect vectors. (3 cred. per qtr.; prereq. 8 cred. in entomology or plant pathology) Granovsky, J. J. Christensen

143f. Methods. Theoretical and practical consideration of methods used in mycological and pathological research. (3 cred.; prereq. 1 or 10) Hart, Moore

156f. Advanced Study of Fungi. General characters of fungi; especially those used in identification; cultural and taxonomic procedures and practices. (3 cred., §56, 105, 106, 107; prereq. 9 cred. in botany or ‡) C. M. Christensen

203f,204w,205s,206su.* Research in Plant Pathology. Special assignment of work in laboratory and field problems in pathological research. (Cred. ar.) J. J. Christensen, staff

207f,208w,209s,210su.* Problems in Mycology. Research work along such lines as taxonomy of natural groups, fungus flora of particular regions, localities, or habitats; investigation of fungi involved in special industrial or natural processes; morphology or physiology of special forms. (Cred. ar.; prereq. 105-106-107; for minor or major) J. J. Christensen, C. M. Christensen, Dosdall

211w. History of Plant Pathology. The development of plant pathology as a science. (2 cred.; offered 1954-55 and alternate years) J. J. Christensen

213f,w,s.* Seminar. Critical review of progress and problems in plant pathology. (1 cred.) J. J. Christensen, staff

215f. Genetics of Plant Pathogens.** Physiologic specialization, sexuality, hybridization, mutation, and similar phenomena in plant pathogens, with emphasis on practical implications. (5 cred.; prereq. 1 or 10 and Agro. 131; offered 1954-55 and alternate years) J. J. Christensen, Kernkamp

216f. Physiology of Plant Pathogens. Physical and chemical requirements and effects of plant pathogens in relation to their parasitism. (3 or 5 cred.) DeVay

217s. Ecology of Plant Pathogens. The effect of environmental factors on the development of plant pathogens and plant disease epidemics. (3 cred.) Kernkamp

218w. Principles of Plant Pathology. Systematic consideration of the basic factors governing the development of plant diseases. (5 cred.; prereq. 1 or 10, Bact. 53, and 6 additional cred. in plant pathology) Eide

APPLIED PLANT PHYSIOLOGY AND AGRICULTURAL BOTANY

102w. Physiology of Seeds. Physiology of development, ripening, storage, dormancy, viability, and germination; processing and seed treatment in relation to viability. (3 cred.; prereq. 15 cred. in plant sciences or ‡) Heggeness

103f. Physiology of Crop Plants. A study of physiological factors affecting the growth and development of crop plants. (3 or 5 cred.; prereq. 15 cred. in plant sciences or ‡; lect., lab.) Heggeness

135f. Weed Control. Cultural and chemical methods of weed control; weed and seed laws pertaining to dissemination and control. (3 cred.; prereq. Agro. 1, Pl.Pa. 3; lect., lab., field work) Heggeness, Dunham

160s. Plant Histochemistry. The composition and function of the tissues of economic plants, including changes produced by chemical and biological agents.

** If there is sufficient demand for courses offered in alternate years, they will be given out of turn.

(3 cred.; prereq. 15 cred. in plant sciences or ‡; lect., lab.; offered 1954-55 and alternate years) Landon

161s. Technology of Fruits and Vegetables. A study of methods used in transporting, storing, and ripening fruits and vegetables. (3 cred.; prereq. 15 cred. in plant sciences or ‡; lect., lab.; offered 1955-56 and alternate years) Landon

162w. Temperature Relations of Crop Plants. A study of general temperature effects, with emphasis on low temperatures and prevention of low temperature injury. (3 cred.; prereq. 15 cred. in plant sciences or ‡; lect., lab.; offered 1954-55 and alternate years) Landon

163f. Applied Plant Physiology. A study of the applications of plant physiological principles to agriculture, horticulture, and forestry. (3 cred.; prereq. 15 cred. in plant sciences or ‡; lect., lab.; offered 1955-56 and alternate years) Landon

197s. Animal Diseases and Poisonous Plants. (Same as Vet. 197) Systematic study of important plants poisonous to animals. Special emphasis on identification, toxicology, diagnosis, and treatment. (3 cred.; prereq. Vet. 143, 170, 179, 188, ‡) Kommedahl

251f,252w,253s.* Seminar in Applied Plant Physiology. (1 cred. per qtr.) Landon, staff

254f,255w,256s,257su.* Research Problems in Applied Plant Physiology. Special assignment of work in applied plant physiology. (Cred. ar.) Landon

260f,261w,262s,263su. Research Problems in Agricultural Botany. Special assignment of problems in agricultural botany. (Cred. ar.) J. J. Christensen

POLITICAL SCIENCE

Professor
Lloyd M. Short
William Anderson
Asher N. Christensen
Werner Levi
Benjamin E. Lippincott
Clarence C. Ludwig
Lennox A. Mills
Harold S. Quigley

Associate Professor
Herbert McClosky
Charles H. McLaughlin
Arthur E. Naftalin
Mulford Q. Sibley
George A. Warp

Assistant Professor
John E. Turner

Prerequisites††—Courses in political science are open to all regularly enrolled graduate students who can meet course prerequisites. Before being accepted as a candidate for a graduate degree with a major or minor in political science, a student must satisfy his adviser that he is prepared for graduate work in the fields proposed for specialization. Candidates must have a minimum of 27 undergraduate credits in the major, but in exceptional cases completion of courses in other social sciences may be accepted as part of the prerequisites.

Language Requirement—For the Master's degree, one foreign language. For the Ph.D. degree, either (a) two foreign languages or (b) one foreign language and the option of a special research technique or a collateral field of knowledge.

Fields of Specialization—When a candidate selects one of the listed fields as part of the requirements for a degree, he is not necessarily required to take all the courses offered in that field. He is, however, required to prepare for examination in some extensive part of the field

†† A more detailed explanatory statement of prerequisites, fields and subfields, and requirements for the M.A. and Ph.D. degrees may be obtained from advisers or the office of the department.

that is dealt with in courses and seminars offered by the department. The recognized fields are:

1. American government and politics, comprising four subfields: (a) national and state government; (b) local government; (c) public administration; (d) public law.

2. Comparative government and politics, comprising four subfields: (a) Europe; (b) the Far East; (c) British Empire and Commonwealth of Nations; (d) Latin America.

3. Theory, comprising two subfields: (a) history of political ideas; (b) political theory.

4. International affairs, comprising four subfields: (a) international law and diplomacy; (b) international relations and organization; (c) regional international relations (Far Eastern, European, or Latin American); (d) colonial politics and administration.

5. Political behavior. This field is not at present available as a field of concentration.

General Requirement—All candidates for the Ph.D. degree or master of arts under Plan A are required to complete Pol. 229 (Scope and Methods of Political Science), or to present evidence of satisfactory completion of a similar course at another approved institution. Candidates for the Master's degree who are not in residence at a time when this course is offered are excused from the requirement.

Requirements for the Degree of Master of Arts

Plan A with Major in Political Science—The work leading to the Master's degree consists of at least three quarters of graduate study, estimated as follows: (1) at least 18 credits in political science in addition to Pol. 229; (2) at least 9 credits in the minor department; (3) satisfactory completion of a substantial thesis based upon independent research. Courses taken in the major should be grouped in two subfields of specialization, lying in either one or two fields, and those taken in the minor should consist of a single 9-credit course, or a three-quarter sequence of related courses totaling 9 credits.

Plan A with Minor in Political Science—Candidates with political science as the minor must take at least one 9-credit course or a three-quarter sequence of related courses lying in either one or two subfields and totaling 9 credits.

Plan B with Political Science as the Field of Concentration—Candidates for the Master's degree without thesis must take 21 to 27 credits in political science, of which at least 6 must be in courses numbered 200 or above. These courses should be a logical grouping selected from not more than four subfields in at least two, and not more than three, fields of specialization. Candidates must also take 18 to 24 credits in at least two related departments, a total program of 45 credits. Courses elected in political science along with those in the related fields should constitute an integrated plan of study. Normally at least two of the required research papers, if submitted in 3-credit courses, or one, if submitted in a

6- or 9-credit course, should be prepared for courses in the field of concentration.

Requirements for the Degree of Doctor of Philosophy

Major in Political Science—The candidate shall, with the approval of his adviser, choose three fields of specialization, one of which shall be designated as his thesis field or field of concentration. He must prepare for examination in one subfield in each of two fields, and in two subfields in the field of concentration, pursuing a program of courses and seminars in political science that will vary in content and amount according to his individual needs and the extent of his undergraduate work in political science and related fields. He will also satisfy requirements of the minor department. Work leading to the Ph.D. degree consists of at least three full years of graduate study. Course work requirements will be decreased for those who enter the Graduate School with advanced standing. The preliminary examination covers the entire major and minor; the final oral examination is devoted to the thesis and to relevant aspects of the field in which it is written.

Minor in Political Science—A candidate for the Ph.D. degree who elects political science as his minor shall prepare himself in two subfields in either one or two fields. At least 6 credits must be completed in courses numbered 200 or above.

Written Examinations—The department requires all candidates for the Ph.D., whether majoring or minoring in political science, and all candidates for the M.A. with major in political science, whether under Plan A or Plan B, to take assembled written preliminary examinations in each of the subfields of specialization included in their political science programs. Successful completion of these examinations in each subfield (i.e., C+ or better in minor fields, B or better in major fields) is prerequisite to permission to take oral examinations. Assembled written examinations ordinarily are scheduled only during the fifth week of the fall quarter and the third week of the spring quarter, except that examinations for M.A. candidates only will be given in the third week of each term of the Summer Session. Announcement of the examinations will be made in the Official Daily Bulletin, after which students intending to present themselves must register in the department office, indicating the subfields to be offered. Further details concerning the administration of the written examinations may be obtained from graduate advisers or from a mimeographed memorandum available in the office of the Department of Political Science.

Note—For information on work in public administration, see page 30; for international relations and area studies, see page 26.

Courses

101f.* Principles of the American Constitution I. Nature of constitutions, judicial review, separation of powers, national-state and interstate relations. (3 cred.; prereq. 1-2 or equiv.) Anderson

102w.* Principles of the American Constitution II. Powers of the national government, restrictions on the states. (3 cred.; prereq. 101 or equiv.) Anderson

103s.* Principles of the American Constitution III. Civil liberties and rights, due process and equal protection. (3 cred.; prereq. 101 or 102 or equiv.) Anderson

104-105-106.* American Constitutional Development. (3 cred. per qtr.; prereq. 9 cred. or Hist. 20-21-22; offered when staff permits)

108w.* Legislative Organization and Procedure. The structure and functioning of legislative bodies. (3 cred.; prereq. 6 cred.) Short

116w-117s.* Local Government. Nature of local government, areas, organization, major functions, state supervision, administration, finance. (3 cred. per qtr.; prereq. 9 cred. or #) Naftalin

118s.* Local Government: Legal Status, Powers, and Responsibilities. (3 cred.; prereq. 116; offered when staff permits) Naftalin

120f. Municipal Functions. A general survey of "line" functions: safety, health, welfare, works, utilities, etc. (3 cred.; prereq. 6 cred.) Ludwig

121w. Municipal Administration. A general survey of overhead administration, with special emphasis on fiscal phases. (3 cred.; prereq. 120 or #) Ludwig

122s.* Municipal Problems. Intensive individual research and preparation of term reports on selected topics. Individual conferences—no regular class. (3 cred.; prereq. 121 or #) Ludwig

123f.* City Planning. (Same as Arch. 104) General survey of the economic, governmental, social, and technical phases of city planning and group housing. (3 cred.) Vivrett, Caplow, Christensen, Filipetti, Vaile, Warp

124f.* Recent Social Legislation. Federal, state, and local programs in public assistance and social security with emphasis on major programs of the Social Security Act, health insurance, and housing. (3 cred.; prereq. 6 cred.) Christensen

126w-127s.* Government and the Economic Order. Powers of national, state, and local governments to regulate business enterprise. Policies with reference to trusts, public utilities, communication agencies, food and drug legislation, etc. Emphasis on legislative background, administrative problems, judicial interpretation of the statutes. (3 cred. per qtr.; prereq. 1-2 or 5) Warp

129w. Social Legislation and Social Institutions in the Scandinavian Countries. (3 cred.; prereq. Soc. 1 or #)

131f.* Public Administration: Organization and Areas; Administrative Responsibility. (3 cred.; prereq. 6 cred.) Short

132w.* Public Administration: Personnel Administration. (3 cred.; prereq. 131 or #) Short

133s.* Public Administration: Financial Administration. (3 cred.; prereq. 131 or #) Short

135.* Problems of Public Planning. Survey of the history, nature, objectives, and theory of public planning; planning organization and research; city and regional planning, natural resources, and social planning. (3 cred.; offered when staff permits) Warp

137f.* American Political Parties. Role and functions of parties in American government; composition and organization; process of nomination and policy formulation; regulation of organization and activities. (3 cred.; prereq. 6 cred. or 12 cred. in social science) Christensen

138s. American Political Campaigns and Elections. (3 cred.; prereq. 6 cred. or 12 cred. in social science) Naftalin

141f-142w.*† European Governments: Theory and Practice. (6 cred.; prereq. 6 cred. or 12 cred. in social science) Turner

143s.* Government of the U.S.S.R. and Adjacent States. (3 cred.; prereq. 6 cred.) Turner

145f. Government and Politics of the Scandinavian Countries. (3 cred.; prereq. course C or equiv. or #)

Psy.147s. Political Psychology. (3 cred.; Psy. 1-2, 4-5, and 9 cred. in social science) Bird

149f.* Government and Politics of the British Empire—India and the Tropical Colonies. (3 cred.; prereq. 6 cred. or #; offered 1954-55 and alternate years) Mills

150w.* Government and Politics of the British Empire—Development of Dominion Status.* (3 cred.; prereq. 6 cred. or #; offered 1954-55 and alternate years) Mills

151.* British Problems of Closer Union. Problems of unity within the British Dominions; regional unions with adjacent states. (3 cred.; prereq. 149, 150 with grade of C plus or better or #; offered when staff permits) Mills

153f.* Japanese Government and Politics. Constitutional and political development in Japan: political ideas, government, political parties, and problems. (3 cred.; prereq. 6 cred. or #) Quigley

154w.* Chinese Government and Politics. Constitutional and political development in China; political ideas, government, political parties, and problems. (3 cred.; prereq. 6 cred. or #) Quigley

155w-156s.* Government and International Relations in Latin America. Analysis of factors that have conditioned constitutional and political organization of principal Latin-American states; their relations with other American nations; development and nature of the inter-American political system. (3 cred. per qtr.; prereq. 6 cred. or #) Christensen

160f.* American Political Thought. From colonial times to the present; Puritanism; the Constitution; utopianism; Calhoun; history of anarchist, socialist, populist, and syndicalist thought; social Darwinism; conservatism; development of legal theory; political thought and American literature. (3 cred.; prereq. 6 cred. or 12 cred. in social science or #) Sibley

161w.* Problems of Democracy. An analytical treatment; postulates and implications of the theory; moral foundations; democratic theory and the economic order; liberty and authority; equality; representation; spiritual order; democratic theory and practical politics; critics of democracy. (3 cred.; prereq. 6 cred. or 12 cred. in social science or #) Sibley

162s.* Recent Political Thought. Main currents from Marx to the present day; Marx, Marxism, and their critics; non-Marxist socialism; syndicalism; anarchism; Roman Catholic and Protestant theories; conservatism; conceptions of Gandhi; European legal theory; political thought in literature. (3 cred.; prereq. 6 cred. or 12 cred. in social science or #) Sibley

164f.* Development of Political Thought: Ancient. Hebrew ideas, Moses to the second Isaiah; classical Greek thought: Plato and Aristotle; primitive natural law; Cynics and Stoics; theory in Roman Republic and Empire; first-century Christianity. (3 cred.; prereq. 6 cred. or 12 cred. in social science or #) Sibley

165w.* Development of Political Thought: the Middle Ages. Early Christianity and the Church Fathers; moral theory and political theory; Empire and Church in ideology; Roman and canon law; theory of persecution; St. Thomas; fourteenth- and fifteenth-century conceptions; economics and politics. (3 cred.; prereq. 6 cred. or 12 cred. in social science or #) Sibley

166s.* Development of Political Thought: Early Modern. Machiavelli; the idea of sovereignty; Protestant conceptions; English Civil War; Hobbes, Spinoza, Locke; the idea of progress; Godwin, Burke, Rousseau; rise of romanticism; German idealism. (3 cred.; prereq. 6 cred. or 12 cred. in social science or #) Sibley

167f-168w-169s.* Political Behavior. Role of personality and leadership; functions of myth, ideology, and interests; group behavior and public opinion; factors in voting and elections; consequences of organization; attitudes and the psychology of political preference; quantitative techniques in measurement of political behavior. (3 cred. per qtr.; prereq. 6 cred. or 12 cred. in social science or #) McClosky

175f-176w†-177s.* Conduct of U.S. Foreign Relations. 175-176: Control of foreign relations; treaties, executive agreements; State Department; Foreign Service; other agencies. 177: Formation and control of foreign policy. (3 cred. per qtr.; prereq. 9 cred. or Hist. 93-94-95 or #) McLaughlin

180f-181w†-182s.* International Law. 180-181: Nature and sources of international law; international legal personality; nationality; territory; jurisdiction; diplomatic and consular agents; treaties. 182: Pacific settlement, war, neutrality. (3 cred. per qtr.; prereq. 9 cred. or ♯) McLaughlin

184f.* International Organization I. Development and conditions of success. (3 cred.; prereq. 6 cred. or ♯) Levi

185w.* International Organization II. International organs for the promotion of international cooperation. (3 cred.; prereq. 6 cred. or ♯) Levi

186s.* International Organization III. International administration; planning for international order. (3 cred.; prereq. 6 cred. or ♯) Levi

187f.* Problems of European Organization. Plans for political, economic, and social organization of Europe; present situation; politics of organization. (3 cred.; prereq. 6 cred. or ♯) Levi

191.* East Asia in International Relations I. The period of separatism. (3 cred.; prereq. 6 cred. or ♯; may be offered instead of 153 in 1955-56) Quigley

192.* East Asia in International Relations II. The period of inequality. (3 cred.; prereq. 6 cred. or ♯; may be offered instead of 154 in 1955-56) Quigley

193.* East Asia in International Relations III. Contemporary developments and problems. (3 cred.; prereq. 6 cred. or ♯; may be offered instead of 194 in 1955-56) Quigley

194s. The Far East in International Relations. (3 cred.; prereq. 6 cred. or ♯) Quigley

195.* Colonial Government and the Problems of Imperialism. Motives of American, British, Dutch, French, and Spanish colonization; ancient and modern imperialism. (3 cred.; prereq. 6 cred. or ♯; offered 1955-56 and alternate years) Mills

196.* Colonial Government and the Problems of Imperialism. Varieties of colonial rule in contemporary empires. (3 cred.; prereq. 195 or ♯; offered when staff permits) Mills

197.* The Mediterranean Area in World Affairs. Economic, political, and strategic conditions; postwar policies of the western and Asiatic states. (3 cred.; prereq. 25 or Hist. 125a-126a-127a) Mills

201w-202s.* Readings in American Government. (3 cred. per qtr.; prereq: ♯; offered when staff permits)

204w-205s.*† Seminar in Public Law. (3 cred. per qtr.; prereq. 18 cred. or ♯) Warp

207f-208w-209s.* Seminar in Jurisprudence. Selected topics in jurisprudence for social science students. The nature, end, and sanctions of law; its sources, forms, and modes of growth examined in typical systems; general juristic conceptions of rights, powers, duties and liabilities, persons, acts, things. (3 cred. per qtr.; prereq. 12 cred. or ♯; offered 1955-56 and alternate years) McLaughlin

210f-211w-212s.*† Special Seminar in Public Administration. (3 cred. per qtr.; registration only with consent of staff) Warp, Ludwig, Short

214w.* Seminar in Political Parties. (3 cred.; prereq. 12 cred. or ♯) Christensen

217w-218s.* Seminar in Comparative European Government. (3 cred. per qtr.; prereq. ♯) Levi

219-220-221.* Seminar in Political Power in the Modern World. (3 cred. per qtr.; prereq. 12 cred. or ♯; offered when staff permits) McClosky

222-223-224.* Seminar in Recent Political Thought, American and Foreign. Special reference to the problems of democracy. (3 cred. per qtr.; prereq. 12 cred. or ♯; offered when staff permits)

225f-226w-227s.* Readings in the Classics of Politics. Plato, Aristotle, Machiavelli, Hobbes, Locke, Rousseau, Mill, Marx, Lenin, Hitler. (3 cred. per qtr.; prereq. 164-165, which may be ¶, or ♯) Lippincott

228.* Seminar in Political Theory. Freedom and control in the democratic state. (3 cred.; prereq. 12 cred. or ♯; offered when staff permits) Lippincott

229f.* Scope and Methods of Political Science. The field of political science; relation to other studies; types of approach; research methods and techniques; bibliography. (3 cred.; prereq. ♯) Anderson

230f-231w-232s.* Seminar in Political Behavior. Intensive examination of selected topics in political behavior, including a review of available research bearing on these topics and an analysis of the research designs and techniques employed. (3 cred. per qtr.; prereq. 167-168-169 or ♯) McClosky

236w-237s.* Seminar in Federalism and Intergovernmental Relations. (3 cred. per qtr.; prereq. ♯) Anderson

238f-239w.* Seminar in the History and System of International Law. Historical development of the law of nations and of international judicial agencies; juristic theories of the character and sanctions of international law and of its relation to the state. (3 cred. per qtr.; prereq. 180-181 or ♯; offered 1954-55 and alternate years) McLaughlin

240s.* International Constitutional Law. Problems of interpretation and application of the Charter of the United Nations and of constituent instruments of other international agencies. (3 cred.; prereq. 180-181 or ♯; offered 1954-55 and alternate years) McLaughlin

241s.* Interdepartmental Seminar on East and South Asia. The topic, to be announced each year, will serve as a focus for approaches of several departmental disciplines to problems of the area. (2 or 3 cred.; prereq. major in East and South Asian Area Study, or ♯) Interdepartmental staff; consult Quigley, Mills, Levi

242f-243w-244s.* Topics in Colonization. Comparative study of the twentieth-century political and economic problems of American, British, Dutch, and French colonies. (3 cred. per qtr.; prereq. 195 or ♯) Mills

245f-246w-247s.* Seminar in East Asian Government and International Relations. (3 cred. per qtr.; prereq. 153-154 or equiv.) Quigley

248w-249s.* Seminar in International Organization. (3 cred. per qtr.; prereq. ♯) Levi

The following seminars, with credits arranged, offer opportunities for research and directed individual study:

251f-252w-253s.* Public Law. Anderson, Warp

254f-255w-256s.* American Government, Politics, and Administration. Anderson, Short, Christensen, Naftalin, Warp

257f-258w-259s.* American Constitutional Development.

261f-262w-263s.* Local Government. Anderson, Naftalin

264f-265w-266s.* Municipal Administration. Ludwig

267f-268w-269s.* Political Behavior. McClosky

271f-272w-273s.* Comparative European Government and Politics. Levi

281f-282w-283s.* Political Theory. Lippincott, Sibley

291f-292w-293s.* Far Eastern Government and International Relations. Quigley

294f-295w-296s.* Colonization and Imperialism. Mills

297f-298w-299s.* International Law and Relations. McLaughlin, Levi

POULTRY HUSBANDRY

Professor	Associate Professor	Assistant Professor
Elton L. Johnson	Thomas H. Canfield	Milo H. Swanson
Hubert J. Sloan	Robert N. Shoffner	

Prerequisites—For major and minor work students must furnish evidence of satisfactory preparation. Students will be required to make up deficiencies.

Major and Minor Work—With the approval of the adviser, courses in related fields may be accepted as part of the major and minor work.

Language Requirement—Candidates for the Master's degree may, upon the approval of the Graduate School, be exempted from the language requirement. For the Ph.D. degree the language requirement may be met by either (a) two foreign languages or (b) one foreign language plus a special research technique or a collateral field of knowledge.

Master's Degree—Offered under both Plan A and Plan B.

Doctor's Degree—The department offers work leading to the Ph.D. degree.

Courses

102w. Poultry Breeding. The principles of genetics and physiology of reproduction as applied to the breeding of poultry. (4 cred.; prereq. 1, Agro. 31) Shoffner

153s. Poultry Nutrition and Feeding. A study of the nutrient requirements of poultry and practical feeding systems. (3 cred.; prereq. 1, Ag.Bi. 1) Johnson

154f. Poultry Products. A study of the technology involved in the grading, processing, packaging, storage, and merchandising of poultry meats and eggs. (3 cred.; prereq. 1; lect., lab., field trips) Swanson, Canfield

214f,w,s.* Research in Poultry Husbandry. Problems assigned to fit the needs of the student. (Cred. ar.; prereq. ‡) Staff

215f,w,s.* Research in Poultry Nutrition. (Cred. ar.; prereq. 9 cred. in agricultural biochemistry or equiv.) Johnson

216f,w,s.* Research in Poultry Breeding. (Cred. ar.; prereq. 9 cred. in genetics or equiv.) Shoffner

217f,w,s.* Poultry Husbandry Seminar. Special assignments. (1 cred. per qtr.) Staff

218f,w,s.* Research in Poultry Products. (Cred. ar.; prereq. ‡) Swanson

PSYCHOLOGY

Professor
Paul E. Meehl
Ralph F. Berdie
Charles Bird
John G. Darley
Richard M. Elliott
Leon Festinger
Starke R. Hathaway
William T. Heron
Howard P. Longstaff
Donald G. Paterson
Miles A. Tinker
Edmund G. Williamson

Associate Professor
Kenneth E. Clark
Wilbur L. Layton
Kenneth MacCorquodale
William Schofield
Ben Willerman

Assistant Professor
James J. Jenkins
Ephraim Rosen
Wallace A. Russell
Stanley Schachter

Prerequisites—Courses in psychology are open to all regularly enrolled graduate students who can meet course prerequisites as listed in the *Class Schedule*. Before being accepted as a candidate for a graduate degree with a major or minor in psychology, a student shall satisfy his adviser that he is fully prepared to undertake graduate work in the fields of proposed specialization. In certain cases completion of preparatory courses in the fundamental sciences may be accepted as part of the prerequisites.

Major and Minor—All candidates should consult advisers in both the major and minor departments.

In general it is expected that all graduate students in psychology, either major or minor, shall have 15 credits of prerequisite work in psychology.

Language Requirement—For the Master's degree, one foreign language. For the Ph.D. degree, either (a) two foreign languages or (b) one foreign language and the option of a special research technique or a collateral field of knowledge.

Master's Degree—Offered under both Plan A and Plan B.

Doctor's Degree—Work leading to the Ph.D. degree is offered in this department.

Courses

101f-102w†-103s.* Experimental Psychology. An advanced treatment of emotions, psycho-physical methods, association, reaction time, sensation, and perception. After several experiments involving the use of standard equipment, the student completes a minor research project. (3 cred. per qtr.; prereq. 1-2, 4-5 or equiv. in another science; 1 lect., 4 lab. hours per week) Tinker

108f.* Systems of Psychology. A reading course on the chief systems or schools of theoretical psychology. A term paper is required. (3 cred.; prereq. preparation for advanced work in psychology, #) Elliott

114w. Human Behavior. An integrative approach, examining the background, development, and organization of human behavior. Consciousness and purpose are treated as properties of the living body. (3 cred.; prereq. 1-2, 4-5 or Zool. 1-2-3, or a course in philosophy) Elliott

118s. The Psychology of Language. The nature and forms of verbal behavior; motivational and emotional influences in the emission of speech; the problem of reference of meaning; internal language processes; etc. Emphasis on experimental data. (3 cred.; prereq. 9 cred. or 6 cred. and #) MacCorquodale

125f-126w. Psychology of Individual Differences. Quantitative studies of such factors as age, sex, race, and nationality, physical traits, family heredity, and environment in the causation of individual differences in abilities and temperament. (3 cred. per qtr.; prereq. 1-2, 4-5, or 5 cred. in statistics) Paterson, Jenkins

127f,w,s.* Projects in the Psychology of Individual Differences. (3 cred.; primarily for majors in Sequence C; prereq. 125-126) Paterson, Longstaff, Jenkins

128f-129w.* Psychology of Learning. Psychological theory: its characteristics and function. Critical analysis of all learning theories and their application to problems of normal and abnormal behavior. (3 cred. per qtr.; prereq. 9 cred.) Heron

130w,s. Vocational and Occupational Psychology. Psychology of individual differences in intelligence, aptitudes, interests, and training, with special references to vocational guidance and problems of vocational adjustment. (3 cred. per qtr.; prereq. 9 cred.; lect., lab.) Paterson

132f-133w.† Psychology of Motivation. Classical and contemporary theories of motivation. Elaboration of basic drives into motives, acquisition of new drives and goals; dynamics of the elaborated drive structure. Particular reference to motivation in complex situations involving set, level of aspiration, the Zeigarnik effect, frustration, etc. (3 cred. per qtr.; prereq. 9 cred.; offered 1955-56 and alternate years) Russell

135f-136w-137s. Occupational Counseling. Occupational information as used in counseling; study of educational and occupational training opportunities and requirements. Psychological technique in case analysis, interviewing, and remedial work. Types of vocational problems. Illustrative case histories. (2 cred. per qtr.; prereq. for 135-136, 9 cred. or #; for 137, 130)

140w. Social Psychology. Experimental investigations of group behavior. Emphasis on the place of emotions, drives, and personality traits in the adjustment of individuals to the demands of modern societies. (3 cred.; prereq. 1-2, 4-5, 9 cred. in a social science) Bird

141s. Social Psychology of Small Groups. Study of behavior of small groups. Communication and influence processes; factors related to group cohesion; problem-solving behavior of groups; relation of group structure to function; emergence of leadership and relation between leadership and group process; types of member participation. (3 cred.; prereq. 140) Willerman

144f-145w.† Abnormal Psychology. Normal and abnormal behavior contrasted. Emphasis on the dynamics, and particularly the social determinants, of personality maladjustments. (3 cred. per qtr.; prereq. 9 cred. in psychology, or 6 cred. in psychology and either Zool. 1-2-3 or 12 cred. in a social science) Bird, Rosen

147s. Political Psychology. Problems and points of view falling within the area of both political science and psychology. Importance of deriving techniques for identification of political attitudes. The part played by psychological factors in the determination of belief, propaganda, and public opinion. (3 cred.; prereq. 1-2, 4-5, 9 cred. in a social science) Bird

148w. Physiological Psychology. Elements of neural anatomy and physiology, tonus, neuromuscular set, integration, and the neural basis of learning. The treatment of these topics will stress their importance for psychology. (3 cred.; prereq. 1-2, 4-5 or Zool. 1-2-3 or ♯) Hathaway

151f. Animal Psychology. Historical, philosophical, and biological foundations; consciousness; motivation; learning; reasoning; judgment; abnormal behavior; social influences. (3 cred.; prereq. 1-2, 4-5 or equiv. in other sciences) Heron

152w,*153s.* Individual Investigations in Animal Psychology. (3 cred. per qtr.; prereq. 151) Heron

155s. Industrial Psychology. Psychological problems in industrial production with special reference to biomechanics (the adaptation of the machine to the capacities and limitations of the operator), work and effort, and the role of communication in an industrial organization. (3 cred.; prereq. 1-2, Math. 15-16 or equiv. or 10 cred. in statistics) Russell, Jenkins

156f.w.* Psychology of Advertising. Psychological analysis of basic principles underlying advertising and selling. Consumer research is stressed. Research techniques for investigating advertising problems and the analysis of consumer wants considered in detail. (3 cred.) Longstaff

160f.w. Psychology in Personnel Work. Psychology as applied to selection and retention of a stabilized personnel. The standardized interview; principles and technique of employment tests; methods of judging character qualities; the rating scale; personnel classification methods. (3 cred.; prereq. 1-2, 4-5 or 3 cred. in statistics, and principles of economics or ♯) Longstaff

165f. Advanced General Psychology. Reconsideration of the topics of general psychology with emphasis on behavior theory and the methods of science. Historical backgrounds, learning, motivation, emotion, and language. (3 cred.; prereq. 1-2 and one course in psychology above 50) MacCorquodale

167w. Techniques and Problems of Public Opinion Analysis. Emphasis on the determinants of opinion, formulation of questions, methods of sampling, social implications of polling, and applications of polling to elections, morale, and national and international issues. (3 cred.; prereq. course in statistics) Clark

168s.* Research Project in Public Opinion Analysis. Students in journalism will be assigned to problems in cooperation with technical advisers in journalism. (3 cred.; prereq. 167) Clark

171f-172w.† Clinical Psychology. A survey of the methods of clinical psychology emphasizing basic concepts and research problems, especially in a psychiatric setting. Theory of diagnosis, the history and mental status, structured tests, major diagnostic groups, psychological deficit, prediction,

psychotherapy, and interprofessional relations. (3 cred. per qtr.; prereq. 145 and a course in mental measurement or statistics) Meehl

200f-201w-202s.† History of Psychology I: European. Origin and development of scientific psychology. Men, schools, and methods. Emphasis on the experimental period, 1860 to the present. (1 cred. per qtr.; offered 1955-56 and alternate years) Tinker

203f-204w-205s.† History of Psychology II: American. Development of laboratories, departments, apparatus, texts, and journals. Present status. (1 cred. per qtr.; offered 1954-55 and alternate years) Tinker

207f-208w-209s. Group Dynamics. Structure and functioning of social groups. Problems of social change, leadership, productivity, communication, social influence, etc. (2 cred. per qtr.; prereq. ♯; offered 1954-55 and alternate years) Schachter

210f-211w-212s. Research Problems. Laboratory investigations. (Cred. ar.) Graduate staff

215f,216w,217s. Seminar in Special Areas of Psychology and Related Sciences. Program based on a syllabus of required and optional reading. Offered irregularly according to announcements in Official Daily Bulletin. (Cred. ar.)

219s. Psychology of Personality. A survey of some major methods, problems, and concepts in the field of personality. Introduction to some major theoretical approaches to personality, e.g., Murphy, Murray, Freud, Kardiner, factor-analytic studies of personality, etc. (3 cred.; prereq. abnormal psychology and undergraduate major in psychology or ♯) Rosen

220f-221w-222s.† Personality, Its Structure and Dynamics. The problem of units, traits, and levels in the description of personality; logical analysis of such concepts as motivation, habit and conflicts; dynamics of motivation; the factor-analytic approach; derived needs and functional autonomy; the problem of anxiety. (2 cred. per qtr.; prereq. 246, either 219 or 286, either 129 or 165 and written permission; class restricted to 3rd and 4th-year Ph.D. candidates in clinical psychology; offered 1955-56 and alternate years) Rosen, Russell

225f,w,s. Seminar in Contemporary Research. Discussion of the problems of psychology and related sciences and reports of research projects. Monthly meetings attended by the department staff and graduate students majoring in psychology. (2 cred.; open for cred. to Ph.D. candidates with major in psychology who have completed one year of graduate study; other graduate students urged to attend; offered only when specially announced in Official Daily Bulletin) Staff

230f-231w-232s. Field Work in Psychometrics and Applied Psychology. For qualified students. (Cred. ar.; prereq. written permission) Paterson, Berdie, Darley, Longstaff, Schofield, others

235f-236w-237s. Clinical Practice in the Student Counseling Bureau. Gives qualified students experience in use of psychological and related methods in dealing with individuals. (1 to 3 cred. per qtr.; prereq. consent of instructor and adviser) Berdie

240f,241w,242s. Seminar in Student Personnel Work. Topics and problems relating to content, development, and coordination of comprehensive student personnel programs. Critical review of current research being made by university personnel workers. (1 cred. per qtr.; prereq. ♯) Williamson

243f-244w.* Experimental Psychodynamics. The application of experimental methods to problems emphasized by the rise of clinical psychology. The relation of certain clinical concepts to learning and motivational theory. (3 cred. per qtr.; prereq. 144-145 and 128 or 165 or ♯; offered 1954-55 and alternate years) Russell

246s. Advanced Abnormal Psychology. Emphasis on psychoanalytic interpretations of the neuroses. (3 cred.; prereq. 144-145, 171) Bird

250f*-251w*-252s.* Topics in Psychology. Independent reading, tutorial conferences, and reports in any field of psychology, such as the psychology of sensation, reaction time, perception of space, Gestalt psychology, differential psychology, social and political behavior, personnel psychology, aes-

thetics, human and animal learning, etc., which meet the approval of one of the listed instructors. The chairman of the department will, if requested, assist the student in selecting the most appropriate instructor to guide reading in a particular field. (Cred. ar.) Graduate staff

253f-254w. Clinical Use of Projective Techniques. Restricted to physicians enrolled in graduate work in psychiatry or neurology. (1 cred. per qtr.; prereq. M.D. degree, ♯; offered 1954-55 and alternate years) Wirt

257f-258w-259s.† Methods of Research in Group Behavior. Methodology of laboratory and field research applied to small groups. Practice and participation in field studies and laboratory experiments. Techniques of observation, sociometry, interviewing, etc. (3 cred. per qtr.; prereq. ♯; offered 1955-56 and alternate years) Schachter

260f*-261w*-262s.* Seminar in Diagnostic and Therapeutic Interviewing. Recent experimental literature and interpretations in terms of clinical practice. Discussion and experimentation in the field of personality evaluation. (1 cred. per qtr.; prereq. ♯) Hathaway

265-266-267. Seminar in Advanced Clinical Psychology. A practicum in diagnosis and evaluation of personality traits and structure in relation to occupational and social roles. (1 cred. per qtr.; prereq. advanced statistics, Psy. 171-172, ♯; not offered) Hathaway

270f,s. Advanced Psychological Measurement. Lecture and basic text material the same as course 70, but graduate students must satisfy additional requirements either by analysis and interpretation of a set of research data, or by writing reports on advanced psychometric topics. (3 cred.) Clark

271f-272w-273s. Seminar in the Recent Literature of Psychology. Acquaints students with a variety of contemporary topics by survey and critical discussions. (1 cred. per qtr.; prereq. open to graduate students majoring in psychology who receive consent; not offered) Staff

274s. Preclinical Practicum in Clinical Psychology. A practicum course in the integration of clinical data to precede the psychometric clerkship. Representative case materials presented and discussed, emphasizing the organization of data from the life history, diagnostic interview, physician's findings, and psychometric tests into a meaningful personality description, aiming to develop the student's skills in diagnosis, prediction, and therapy. Training in the use of special tests and techniques will also be included. (2 cred.; open only to graduate majors in clinical psychology; prereq. 171-172, 291 or ¶291) Schofield, staff

280f-281w-282s. Psychology for Fellows in Psychiatry or Neurology. Open only to physicians enrolled in the Graduate School. (1 cred. per qtr.; prereq. M.D. degree, ♯; offered 1954-55 and alternate years) Meehl, staff

286s.* Advanced Biographical Psychology. Lecture and basic text material the same as in course 86 but graduate students must prepare under tutorial guidance a report based on recent literature in this field. (3 cred.) Elliott

290f. Introduction to Projective Techniques. Survey of the field of projective techniques, emphasizing theory, methodological considerations, and published studies of reliability and validity. Instruction in administration and scoring of some currently used devices, especially the Rorschach. (3 cred.; prereq. 144-145, 171-172) Rosen

291w. Practicum in Interpretation of Projective Techniques. (3 cred.; prereq. 290, ♯) Rosen

292w-293s. Seminar in Theoretical Problems of Group Functioning. Intensive consideration of theoretical problems in social psychology and the behavior of groups in connection with recent or current research. (2 cred. per qtr.; prereq. ♯) Festinger

295f-296w-297s. Seminar in Individual Differences and Applied Psychology. Advanced students meet for reports and discussion of contemporary trends in the psychology of individual differences and applied psychology. (1 cred. per qtr.; prereq. written permission) Paterson

299w. Tabulating Equipment Laboratory. Gives qualified students an opportunity to become acquainted with use of electric tabulating machines in

the treatment of research data. (1 cred.; prereq. P.H. 110, 111, or equiv.) Clark

Phil.244f-245w-246s. Philosophical Problems of Psychology. (3 cred. per qtr.; prereq. open to advanced graduate students in philosophy and psychology with written permission of instructor) Feigl

PUBLIC HEALTH

Professor
Gaylord W. Anderson, M.D., Dr.P.H., *director*
Herbert M. Bosch, M.P.H.
Ruth E. Boynton, M.D., M.S.
Harold S. Diehl, M.A., M.D., D.Sc.
Ruth E. Grout, Ph.D., M.P.H.
Marion I. Murphy, M.P.H.
J. Arthur Myers, M.D., Ph.D.
Stewart C. Thomson, M.P.H., M.D.
Alan E. Treloar, Ph.D.

Associate Professor
Richard G. Bond, M.S., M.P.H.
Theodore A. Olson, M.A.

Assistant Professor
Nora F. Cline
George S. Michaelsen, M.S.
Ruth von Bergen, M.P.H.

Lecturer
Henry Bauer, Ph.D.
Leslie W. Foker, M.D., M.P.H.
William A. Jordan, D.D.S., M.P.H.

Master's Degree—Offered under both Plan A and Plan B. All candidates for a Master's degree must take basic courses in (1) public health administration, (2) epidemiology, (3) statistics, (4) sanitation, (5) public health nursing, and (6) health education, unless specifically excused by the department.

[Inquiries concerning other work in public health, including courses of study leading to the degrees of master of public health and master of hospital administration, should be addressed to the Director of the School of Public Health, Millard Hall, University of Minnesota, Minneapolis 14.]

Courses

100f,s.† Elements of Preventive Medicine and Public Health. Occurrence and prevention of communicable, degenerative, and industrial diseases; protection of food, water, and milk; maternal and child health. (5 cred., 6 cred. for medical students; prereq. 3 or 50 or equiv. and a course in bacteriology) Anderson, Thomson

102f. Environmental Sanitation I. Methods for promoting man's health and comfort by controlling his environment. (3 cred.; prereq. 50 or 51 or 100 or concurrently with any of these) Olson, Bosch

103f,w,s.* Public Health Bacteriology. Bacteriologic and serologic diagnosis, public health laboratory administration and methods. (Cred. ar.; prereq. Bact. 101-102, 116, ‡) Bauer

104w*-105s. Epidemiology. Factors underlying the spread of infectious diseases, with detailed discussion of selected diseases; simple statistical and epidemiologic methods. (3 cred. per qtr.; prereq. 100, 140 or 110-111 must be taken concurrently or previously)

106w.* Public Health Administration. Structure, basic functions, and activities of public health agencies. (3 cred.; prereq. 100) Anderson

107f. Child and Adult Hygiene. (For physicians; others by permission) Maternal, child, and adult hygiene in public health programs. (3 cred.; prereq. 100; lect., lab., field trips) Boynton, others

109s. Institutional Sanitation. (For hospital administrators; others by permission) Sanitation practices in hospitals and other institutions. (3 cred.; prereq. 100, 106) Bosch, Bond

112. Public Health Engineering—Plan Examinations. (For engineers) 112aw: Water supplies. 112bs: Waste disposal systems. 112cs: Swimming pools and plumbing. (1 cred. per qtr.; prereq. 102, or ‡) Bosch

113. Public Health Engineering—Field Investigations. (For engineers; others by permission) 113aw: Water supplies. 113bs: Waste disposal. 113cs: Swimming pools and plumbing. (2 cred. per qtr.; prereq. 102) Bosch

114f. Environmental Sanitation II. Public health supervision of activities in field of sanitation. (2 cred., §112, 113, 116; prereq. 102) Bosch

115w. Food Sanitation. Sanitary problems in production, processing, and distribution of milk, meat, shellfish, and other foods; methods of public health supervision. (3 cred.; prereq. 100, 102) Olson

116s.* Public Health Engineering Administration. Administrative organization of environmental sanitation activities. (2 cred., §112, 113, 114; prereq. 102, 100 or 104, and 106 and two of the following: 112, 113, 115) Bosch

117f-118w. Sanitary Biology. Survey of plant and animal forms important in environmental sanitation, with special reference to disease vectors. (3 cred. per qtr.; prereq. ‡) Olson

119f,w,s,su. Field Practice in Environmental Sanitation. (Cred. ar.; prereq. ‡)

122s.* Public Health Administration Problems. Budgeting, program planning, and appraisal of public health procedures. (3 cred.; prereq. 106) Anderson

123f,w,s. Topics in Public Health. Selected readings and problems. (Cred. ar.; prereq. ‡) Staff

125s. Community Health Education Programs. Group procedures, community organization, public relations, and development and use of media. (3 cred.; prereq. 100, 106) Grout

126s. Industrial Health. Industrial hazards and their control. (3 cred.; prereq. 100, In.Ch. 1-2 or equiv., or consent of department) Foker

127s. Industrial Health—Nursing Aspects. Organization and administration of nursing service in industrial health programs. (1 cred.; prereq. ¶126)

129f,w,s. Field Work in Industrial Nursing. Visits to industrial health services; supervised experience in industrial medical unit. (Cred. ar.; prereq. 65)

133w,s. Mental Hygiene. Emotional factors underlying wholesome family relations; problems which interfere with successful adjustment in family and community life. (3 cred.; prereq. 62 or experience in public health nursing) Cline

135s. Conservation of Hearing. Detection, prevention, and amelioration of hearing impairments. (1 cred.; prereq. 100 and 62 or ¶) Boies, others

136s. Sight Conservation. Conditions that impair human vision; community programs of vision testing and correction of defects; sight conservation. (1 cred.; prereq. 100 and 62 or ¶) Hansen, others

137s. Dental Health. Conditions resulting in tooth decay and loss; preventive and corrective measures; mouth hygiene; community programs for dental health. (1 cred.; prereq. 100 and 62 or ¶) Jordan

139f,w,s. Special Field Work in Mental Hygiene. Experience in gaining further insight into handling problems of human dynamics in all age groups. (Cred. ar.; prereq. ‡) von Bergen, others

141s. Social and Economic Aspects of Medical Care. Social and economic forces affecting administration and financing of medical care; sickness insurance, group hospitalization; concern of government in provision of medical care. (3 cred.; prereq. ‡)

152f,w,s. Industrial Hygiene Engineering. Field and laboratory methods used by industrial hygiene engineers in study and control of occupational health hazards. (3 cred.; prereq. ‡) Michaelson

170w.* Supervision in Public Health Nursing. Supervision as guidance; methods of supervision; administrative functions; preparation and selection of supervisors. (3 cred.; prereq. 100, 133, and experience in public health nursing, or ‡) Murphy

171f.* Problems in Public Health Nursing. For advanced students; includes methods used in studies and doing one study. (Cred. ar.; prereq. 170 or ‡) Murphy

173f,w,s. Field Work in Supervision of Public Health Nursing. For public health nurses only. (Cred. ar.; prereq. 170 or ♯) Murphy

174s. Supervision Laboratory. Critical analysis of supervisory problems, procedures, and methods. (2 cred.; public health nurses only; prereq. 170 or ¶) Murphy

181f-182w-183s. Principles and Methods in Community Health Education. Group procedures, community organization, public relations, and development and use of media. (3 cred. per qtr.; prereq. ♯) Grout, others

190f,w,s. Field Work in Community Health Education. Three months of approved field experience. (Cred. ar.; prereq. 125, 181, 227) Grout, others

200f,w,s.* Research. Opportunities will be offered by the School and by the various collaborating organizations for qualified students to pursue research work. (Cred. ar.) Staff

210f,w,s. Seminar in Public Health. (Cred. ar.) Staff

212f,w,s. Seminar in Public Health Engineering and Sanitation. (Cred. ar.) Bosch

215f,w,s. Maternal and Child Health. (For physicians only, with permission) Study of administration and active participation in well child and antepartum conferences; psychosomatic problems of children. (Cred. ar.) Boynton

227f,w,s. Problems in the Community Health Education Programs. Independent study and experimentation in health education. (Cred. ar.; prereq. ♯) Grout, others

RADIOLOGY

For staff and courses of study offered, see the *Graduate Medical Bulletin.*

ROMANCE LANGUAGES

Professor
Walter T. Pattison
Raymond L. Grismer

Associate Professor
Emmert M. Brackney
Herbert E. Clefton
Guy F. Desgranges
Thomas B. Irving
Elizabeth Nissen

Assistant Professor
Rodolfo O. Floripe

Prerequisites—For major work, 27 Senior College credits or equivalent; for minor work, 18 Senior College credits or equivalent.

Language Requirement—A candidate for the Master's degree must have a reading knowledge of at least one modern language other than the language of his major field. Candidates for the Doctor's degree must have a knowledge of Latin equivalent to at least two years of high school Latin; a reading knowledge of a second Romance language; and, by the end of the first year of graduate work, a reading knowledge of an additional foreign language.

Master's Degree—Offered under both Plan A and Plan B.

Doctor's Degree—Offered in both French and Spanish.

Note—For information on work in comparative literature, see page 23.

Courses

FRENCH

100s. Practical French Phonetics. (3 cred.; prereq. 20 or 53-54 or ♯; offered when demand warrants)

103f-104w-105s.† French Syntax and Composition. Special studies in characteristic problems of French syntax. (3 cred.; prereq. 63 or ¶)

107s. Cours de Style. (3 cred.; prereq. 63-64 or ‡)

110f.* French Literature: Nineteenth Century. Chateaubriand and romantic prose. (3 cred.; prereq. 70-71-72 or 73-74) Falk

111w.* French Literature: Nineteenth Century. Romantic and realistic drama. (3 cred.; prereq. 70-71-72 or 73-74; offered 1954-55, alternates with 146) Carduner

112s.* French Literature: Nineteenth Century. Poetry: Lamartine to Mallarmé. (3 cred.; prereq. 70-71-72 or 73-74) Clefton

113. Ste. Beuve and the Modern French Critics. (3 cred.; prereq. 70-71-72 or ‡; offered when demand warrants)

115f*-116w*-117s.*†† French Literature: Seventeenth Century. 115: Formation of the classic ideal. 116: Corneille, Molière, Racine. 117: Moral and didactic literature. (3 cred. per qtr.; prereq. 70-71-72 or 73-74) Desgranges

118f-119w-120s.*†† French Literature: Eighteenth Century. 118: Beginnings of the philosophic movement, Bayle, Montesquieu, Diderot. 119: Voltaire. 120: Rousseau. (3 cred. per qtr.; prereq. 70-71-72 or 73-74) Clefton

121-122-123.* French Literature: Sixteenth Century. 121: The Rhétoriqueurs, Marot, Rabelais. 122: The Pléiade. 123: Montaigne, Amyot. (3 cred. per qtr.; prereq. 9 cred. in literature above 74 or ‡; offered when demand warrants)

130. French Romantic Poetry: Victor Hugo. (3 cred.; prereq. 70-71-72 or 73-74; offered 1955-56, alternates with 132) Clefton

131. Parnassian Poetry. (3 cred.; prereq. 70-71-72 or 73-74; offered when demand warrants) Clefton

132f. Baudelaire. (3 cred.; prereq. 70-71-72 or 73-74; offered 1954-55, alternates with 130) Clefton

146w.* Contemporary French Dramatic Literature. (3 cred.; prereq. 70-71-72 or 73-74; offered 1955-56, alternates with 111) Carduner

156s. French Realistic Novel. (3 cred.; prereq. 70-71-72 or 73-74; offered when demand warrants)

157. French Novel: France, Loti, and Bourget. (3 cred.; prereq. 70-71-72 or 73-74; offered when demand warrants) Brackney

158w. Contemporary French Novel I. Course conducted in French. (3 cred.; prereq. 70-71-72 or 73-74; offered 1954-55, alternates with 159) Desgranges

159w. Contemporary French Novel II. Continuation of 158. Social problems. (3 cred.; prereq. 70-71-72 or 73-74; offered 1955-56, alternates with 158) Desgranges

171f-172w-173s.† History of French Language. Lectures and illustrative texts giving the development of the French language from its origins to the nineteenth century. Especially intended for prospective teachers. (1 cred. per qtr.; prereq. one year of Latin or ‡) Brackney

181f-182w-183s.*¶ Movement of Ideas in French Literature. 181: Sixteenth and seventeenth centuries. 182: Nineteenth century. 183: Contemporary period. (3 cred. per qtr.; prereq. 70-71-72 or 73-74) Desgranges

201f-202w-203s. Old French Phonology and Morphology. Lectures on the origin and development of the French language, with practical exercises and reports on assigned topics. (2 cred. per qtr.) Brackney

204f-205w-206s. Reading in Old French Literature. Introductory course in reading of Old French. Different types of literature read and their origin and development discussed. Collateral reading required. (2 cred. per qtr.) Brackney

207f-208w-209s. Old Provençal. Reading in early Provençal literature with special attention to the poetry of the troubadours. (2 cred. per qtr.) Brackney

222f-223w-224s. French Seminar. Classical Period. (2 cred. per qtr.; not offered 1954-55)

†† Students may enter any quarter with consent of instructor.

225f-226w-227s.* French Seminar. Nineteenth Century. (3 cred. per qtr.; offered 1954-55) Desgranges

230f-231w-232s. Research Methods and Material. (1 cred. per qtr.) Grismer

259f-260w-261s.* Directed Readings in Romance Languages. (Cred. depends upon amount of work accomplished) Staff

ITALIAN

159f-160w.†† Dante. The *Divina Commedia.* (3 cred. per qtr.; prereq. one course above 50; offered 1954-55) Nissen

161f-162w. The Sixteenth Century. Reading of texts and study of literary influences. (3 cred. per qtr.; prereq. one course above 50; not offered 1954-55)

164s. Dante (in English). Lectures, reading, and discussion of the *New Life* and the *Divine Comedy.* (3 cred.; prereq. ‡; offered 1954-55) Nissen

SPANISH

103f-104w-105s. Spanish Syntax and Composition. (1 cred. per qtr.; prereq. 60 or ¶; offered when demand warrants) Pattison

110f-111w-112s.*†† Spanish Literature: Nineteenth Century. (3 cred. per qtr.; prereq. 65-66-67 or 68-69; offered 1954-55, alternates with 174-175-176) Pattison

115f-116w-117s.*†† Spanish Literature: Seventeenth Century. 115: The drama. 116: The novel. 117: Lyric and epic poetry. (3 cred. per qtr.; prereq. 65-66-67 or 68-69; offered 1955-56, alternates with 155-156-157) Grismer

120. The Ballad. (3 cred.; prereq. 65-66-67 or 68-69; not offered 1954-55)

130. Cervantes: Don Quijote. (3 cred.; prereq. 65-66-67 or 68-69; not offered 1954-55) Grismer

131. The Picaresque Novel. (3 cred.; prereq. 65-66-67 or 68-69; not offered 1954-55) Grismer

140f-141w-142s.†† Contemporary Latin-American Literature. (3 cred. per qtr.; prereq. 65-66-67 or 68-69 or 74-75-76) Floripe

143-144-145.* Colonial and Nineteenth-Century Latin-American Literature. (3 cred. per qtr.; prereq. a survey of the literature of Spain or Latin America; offered when demand warrants)

155f-156w-157s.*†† Spanish Literature: Sixteenth Century. 155: The drama. 156: Cervantes and the novel. 157: Poetry, the mystics. (3 cred. per qtr.; prereq. 65-66-67 or 68-69; offered 1954-55, alternates with 115-116-117) Grismer

161f-162w-163s.* Hispano-Arabic Culture. (3 cred.; prereq. 4 and ‡; offered 1955-56) Irving

171f-172w-173s. History of the Spanish Language. (3 cred.; prereq. 4 or one year of Latin or ‡; offered 1954-55) Grismer

174-175-176. Contemporary Spanish Literature. 174: The drama. 175: The novel. 176: Poetry. (3 cred. per qtr.; prereq. 65-66-67 or 68-69; offered 1955-56, alternates with 110-111-112) Pattison

230f-231w-232s. Research Methods and Materials. (1 cred. per qtr.; not offered 1954-55) Grismer

241f-242w-243s.* Old Spanish Philology. (2 cred. per qtr.) Grismer

244-245-246.* Old Spanish Literature. Every year a different genre is studied, such as the epic. Subject to be decided by arrangement with students. (2 cred. per qtr.; not offered 1954-55)

250f-251w-252s.* Spanish Seminar. (2 cred. per qtr.) Pattison

253f-254w-255s.* Seminar in Spanish-American Literature. (2 cred. per qtr.; not offered 1954-55)

259f-260w-261s. Directed Readings in Romance Languages. (Credit depends on amount of work accomplished) Staff

†† Students may enter any quarter with consent of instructor.

SCANDINAVIAN

Professor	Associate Professor	Visiting Lecturers
Alrik Gustafson	Lynwood G. Downs	
Lawrence D. Steefel	Paul L. Holmer	

Prerequisites—In the Department of Scandinavian Languages and Literatures: for major work, 27 credits in language and literature, 18 of which must be in Scandinavian, and reading knowledge of any one of the Scandinavian languages; for minor work, 18 credits in language and literature, 12 of which must be in Scandinavian.

In Scandinavian Area Studies, see special bulletin, *Program in Scandinavian Area Studies.*

Language Requirement—Candidates for the Master's degree must have reading knowledge of one modern language other than the language of his major field.

Master's Degree—In the Department of Scandinavian, offered under both Plan A and Plan B; and in Scandinavian Area Studies, only under Plan B.

Note—For information on work in comparative literature, see page 23.

Courses

161f.*§§ Scandinavian Novel of the Late Nineteenth Century. The "great tradition" in the modern Scandinavian novel, and the circumstances, intellectual and political, social and economic, out of which it grew. (3 cred.; prereq. 4-5-6 or 10-11-12 or 8 cred. in literature) Gustafson

162w.*§§ Contemporary Scandinavian Novel. Characteristic trends in Scandinavian life and thought in the twentieth century as expressed in the between-the-wars novel. (3 cred.; prereq. 4-5-6 or 10-11-12 or 8 cred. in literature) Gustafson

171f.*§§ Ibsen and the Beginnings of the Modern Drama. Intensive examination of the plays of Ibsen, especially with reference to the role he has played as "the founder" of the modern European drama. (3 cred.; prereq. 4-5-6 or 10-11-12 or 8 cred. in literature) Gustafson

172w.*§§ Strindberg and the Drama in Revolt and Transition. Strindberg as master of the naturalistic drama and as "the father of modernity" in the European and American theater since his day. (3 cred.; prereq. 4-5-6 or 10-11-12 or 8 cred. in literature) Gustafson

173s.*§§ Contemporary Scandinavian Theater. The Scandinavian theater today, particularly with reference to its "experimental" trends both in dramatic composition and staging. (3 cred.; prereq. 4-5-6 or 10-11-12 or 8 cred. in literature) Gustafson

191f-192w-193s. Readings in the Scandinavian Literatures. Intensive readings in representative texts—Danish, Norwegian, or Swedish. (3 cred. per qtr.; prereq. 4-5-6 or 10-11-12) Gustafson

195f-196w-197s. Old Norse Language and Literature. (Same as Ger. 195-196-197) Knowledge of one Germanic dialect is recommended. (3 cred. per qtr.; offered 1955-56) Downs

215-216-217.* Studies in Scandinavian Romanticism. (3 cred. per qtr.; not offered 1954-55)

§§ A knowledge of a Scandinavian language is not required of those enrolled in these courses who are not pursuing major work in Scandinavian.

218f-219w-220s.* Studies in Late Nineteenth-Century Scandinavian Literature. (3 cred. per qtr.) Gustafson

221f-222w-223s.* Dramatic Interpretative Problems in Strindberg. (3 cred. per qtr.) Gustafson

Ger.113f-114w. Gothic. An introduction to Germanic linguistics and to a comparative study of Indo-European languages. (3 cred. per qtr.; prereq. Ger. 80 and 11 cred. above Ger. 59 or equiv.; not offered) Downs

Ger.176-177-178. Problems and Research Trends in Germanic Philology. 176: The Germanic languages. 177: The Germanic literary tradition. A comparative discussion of native and foreign records of the Old Germanic Period. 178: Linguistic geography. (3 cred. per qtr.; prereq. two Germanic dialects; not offered)

Hist.122f-123w-124s.§§ History of the Scandinavian Countries. (3 cred. per qtr.) Steefel

Hist.176bf-177bw-178bs.* Scandinavian History. (3 cred. per qtr.) Steefel

Phil.137w.§§ Kierkegaard and Scandinavian Philosophy. (3 cred.; prereq. one course from Phil. 50-51-52 or ‡) Holmer

Pol.129w.*§§ Social Legislation and Social Institutions in the Scandinavian Countries. (3 cred.; prereq. Soc. 1 or ‡)

Pol.145f.*§§ Government and Politics of the Scandinavian Countries. (3 cred.; prereq. Pol. C or equiv. or ‡)

Soc.117s.*§§ Scandinavian Folk Movements: Their Social and Political Significance. (3 cred.; prereq. Soc. 1 or ‡)

SLAVIC AND ORIENTAL LANGUAGES

Assistant Professor
Thomas F. Magner

Associate Professor
Thomas B. Irving

Assistant Professor
Richard B. Mather
Pearl C. Niemi
Donald C. Swanson

Instructor
Robert H. Brower

The following are offered as courses in a minor program or as related fields (in linguistics and comparative philology, area studies, comparative literature), but, for the present, no graduate degrees are offered in these fields.

Courses

CHINESE

Chin.101f-102w-103s. Advanced Chinese. Readings in Chinese historical, literary, or philological texts, selected according to student's needs. (2 to 3 cred. per qtr.; prereq. 51-52-53 or equiv.) Mather

Chin.110f-111w. Chinese Literature in Translation. A survey in the best available English translations of Chinese belles-lettres from the first millenium B.C. to the present. 110: *ca.* 1000 B.C. to *ca.* A.D. 600. 111: *ca.* 600 to the present. (3 cred. per qtr.; prereq. 6 cred. in literature; knowledge of Chinese not required; offered 1954-55) Mather

JAPANESE

Jap.101f-102w-103s. Advanced Japanese. Readings in modern prose and poetry; introduction to the classical language. (3 cred. per qtr.; prereq. 51-52-53) Brower

Jap.110f-111w. Japanese Literature in Translation. Chronological survey of Japanese literature from the eighth century A.D. to the present; lectures,

§§ A knowledge of a Scandinavian language is not required of those enrolled in these courses who are not pursuing major work in Scandinavian.

discussions, reports, readings in translations. 110: Primitive, classical, and feudal periods to *ca.* 1400. 111: Feudal and modern periods from *ca.* 1400 to the present. (3 cred. per qtr.; prereq. 6 cred. in literature; knowledge of Japanese not required; offered 1955-56) Brower

SANSKRIT

Skt.128f-129w-130s. Readings in Sanskrit. Descriptive grammar; interpretation of Vedic and Classical Sanskrit texts. (3 cred. per qtr.; prereq. at least two Senior College courses in early Indo-European languages, preferably Greek, Gothic, or Latin) Swanson

Skt.131f-132w. Introduction to Sanskrit. Phonology and morphology from a comparative point of view. (2 cred. per qtr.; prereq. at least two Senior College courses in early Indo-European languages, preferably Greek, Gothic, or Latin) Swanson

SEMITIC

Sem.121f-122w-123s. Introduction to Arabic Grammar and Reading. (3 cred. per qtr.; prereq. two courses above 50 in any foreign language; offered 1955-56) Irving

SLAVIC

Slav.101f-102w-103s. Russian Literature in Translation. 101: Pushkin, Lermontov, Gogol. 102: Turgenev and Dostoevski. 103: Tolstoy and the period from 1880. (3 cred. per qtr.; prereq. 8 cred. in literature; no knowledge of the Russian language required) Niemi

Slav.113f-114w-115s. Old Church Slavic (Old Bulgarian). An introduction to Slavic linguistics. Descriptive grammar based on earliest texts and comparison of OCS with other Indo-European languages. (3 cred. per qtr.; prereq. Skt. 131-132 or equiv.; offered 1954-55) Magner

Slav.125f-126w-127s. History of the Russian Language. A linguistic analysis of the development of the Russian language from the time of the earliest records to the present. (3 cred. per qtr.; prereq. 51-52-53 or equiv.; offered 1955-56) Magner

Slav.131f-132w-133s. Russian Poetry—Nineteenth Century. (3 cred. per qtr.; prereq. 71-72-73 or #) Niemi

SOCIAL WORK

Professor
John C. Kidneigh
Richard G. Guilford
Elio D. Monachesi

Associate Professor
Werner W. Boehm
Gisela Konopka
Verval J. Mueller
Ruby B. Pernell
Lyndell Scott
Malcolm B. Stinson
Dorothy A. Whitmore

Assistant Professor
Maurice F. Connery
Helen J. Yesner

Instructor
Henriette E. Saloshin

Lecturer
Janet King
Alma M. Laabs
Hyman S. Lippman
Juanita Luck
Marvin Sukov

Prerequisites—An applicant of satisfactory scholastic record, character, and professional qualifications whose Bachelor's degree was granted by a recognized college or university may be admitted by the dean of the Graduate School upon recommendation of the Admissions Committee of the School of Social Work.

A candidate for admission to the School of Social Work must present 39 quarter credits in social sciences, i.e., in sociology, political science, economics, psychology, history, or anthropology, including one or more courses in at least three of these social sciences, and a course in statistics.

Application blanks and instructions regarding admission may be secured from the School of Social Work, 400 Ford Hall, University of Minnesota, Minneapolis 14.

Applications and transcripts in duplicate must be filed in advance of the registration date. Beginning graduate students are admitted only fall quarter. Persons with previous training and experience may be admitted at the quarter which makes progression from their previous training feasible.

An application for admission is considered first by the School of Social Work, then recommended to the dean of the Graduate School for approval and admission. Acceptance of candidates is based upon: evidence of ability to meet standards of graduate work as indicated by high grades, including psychological tests when available, and evidence of stability of personality and aptitude in interpersonal relationships.

Advanced standing may be granted for work done in other approved schools of social work, limited by the rules stated herein.

Language Requirement—For the Master's degree, a foreign language is not required, but is strongly recommended. For the Ph.D. degree, two foreign languages with the option of substituting for one of these a special research technique or a collateral field of knowledge.

Master's Degree—The degree of master of social work requiring two years of graduate study will be awarded to students who fulfill the following requirements:

1. Ninety credits including a 9-quarter credit degree project (as indicated in the following) must be presented with an average grade of B or better.
2. A sequence must be completed in each of the groups of courses lettered B, C, D, and E including at least one course each in administration, casework, community organization, group work, and research.
3. A project of 9 quarter credits consisting of seminar research papers or a single research report requiring independent work under faculty supervision which shows capacity for critical evaluation and analysis must be presented. Preferably all 9 credits should be earned under the supervision of one faculty member.
4. Not less than 45 credit hours must be earned in residence at the University of Minnesota with an average grade of B or better.
5. Not more than 45 credit hours will be accepted by transfer and then only if earned in an accredited school of social work. Credits accepted for transfer shall show an average of B or better.
6. Not more than 9 credit hours earned in extension courses will be accepted to apply on degree requirements and then only if the grade received is B or better and the course (a) was taught by a member of the graduate faculty, (b) is numbered above 100, (c) carries the same title and content as a corresponding course in the regular curriculum.
7. The candidate must pass a written examination or an oral examination conducted by a committee of three or more members of the graduate faculty.

8. All credits offered for the degree must have been earned within seven years preceding the quarter in which the degree is conferred.
9. Following completion of 40 graduate credits, not less than 15 of which must have been earned at the University of Minnesota, and not later than the end of the quarter preceding the quarter in which the degree is to be conferred, the student shall apply for admission to candidacy for the degree, using the appropriate application form. The application for candidacy will be reviewed by the faculty of the School of Social Work and recommended to the Graduate School dean, through the appropriate graduate group committee, for acceptance or rejection.
10. Not later than the beginning of the final quarter's work and after admission to candidacy, the student shall submit, through his major adviser, a program of all credits presented for the degree upon the appropriate degree program form.

Students who began their work prior to fall quarter, 1948, may complete a program already started for the master of arts degree in social work under either Plan A or Plan B. Such students may, in lieu of completing requirements for the master of arts degree in social work, become candidates for the degree of master of social work provided they fully meet all standards indicated above.

Doctor's Degree—Students who have the Master's degree in social work from this school, or the comparable Master's degree from a school of social work accredited by the Council on Social Work Education, may, if their records are distinctly superior, become candidates for the Ph.D. degree in social work (requiring at least two years of post-Master's graduate work).

[Students may be awarded a certificate in social work on the completion of 45 quarter credits. For detailed information consult the *Bulletin of the School of Social Work.*]

Courses

A. SPECIAL TOPICS AND READINGS COURSES

201f,202w,203s. Special Topics in Social Work. (Cred. ar.) Staff

206f,207w,208s. Readings in Social Work. Independent study under tutorial guidance. (Cred. ar.) Staff

B. FIELD WORK

210f-211w-212s. Field Instruction in Social Work I. Field practice in social work process under direct supervision. (Cred. ar.; prereq. ¶265 or ¶275 or equiv.) Staff

215f-216w-217s. Field Instruction in Social Work II. Field practice in social work process under direct supervision. (Cred. ar.; prereq. 212) Staff

218f,219w,220s. Field Instruction in Social Work III. Field experience in social work process under direct supervision. (Cred. ar.; prereq. MSW degree) Staff

221f,w,s. Seminar for Clinical Field Instructors. (Cred. ar.; limited to persons engaged in supervising students in field work) Staff

C. THE SOCIAL SERVICES

225f. Public Welfare I. Historical development and functions of present-day public welfare programs. (3 cred.) Guilford

226w. Public Welfare II. Continuation of Public Welfare I. (2 cred.; prereq. 225) Guilford

228s. The Child and the State. Development of the rights of the child in relation to parental rights as evidenced in child labor laws, the juvenile courts, adoption, aid to dependent children, the changing status of the illegitimate child, and public organization for more effective administration of laws relating to child dependency, delinquency, and neglect. (3 cred.) Guilford

229w. Legal Aspects of Social Work. Legal information for social workers to furnish background for understanding social problems having legal implications; legal process; and legal rights of recipients. (3 cred.)

230f. Seminar in Social Work in Child Caring Agencies. (Cred. ar.; prereq. 267 or ‡) Guilford

231f. Seminar in Social Work in Family Service Agencies. (Cred. ar.; prereq. 267 or ‡) Boehm

233f. Seminar in Social Work in Medical Settings. (Cred. ar.; prereq. 267 or ‡) Mueller

234f. Seminar in Social Work in Public Welfare. (Cred. ar.; prereq. 226 or ‡) Stinson

235f. Seminar in Social Work in Psychiatric Settings. (Cred. ar.; prereq. 267 or ‡) Connery

236s. Seminar in Social Work in the School. (Cred. ar.; prereq. 267 or ‡) Laabs

237f. Seminar in Social Work with Juvenile and Adult Offenders. (Cred. ar.; prereq. 267 or ‡)

239w. Seminar in Social Agencies and Institutions. (Cred. ar.; prereq. one of the seminars numbered from 230 to 238 inclusive, or consent of the director) Staff

240s. Seminar in Social Work as a Profession. (Cred. ar.; prereq. 239 or ‡) Staff

241w. Seminar: The History of Social Work. A consideration of the historical backgrounds of the modern social work movement and the evolution of the theory underlying it. (Cred. ar.; primarily for doctoral students) Scott

242s. Seminar: Social Work Education. (Cred. ar.; prereq. MSW degree)

243. International Social Welfare. (3 cred.; prereq. ‡)

245f,w,s. General Seminar in the Social Services. (Cred. ar.; prereq. grad. social work students) Staff

D. HUMAN GROWTH AND BEHAVIOR

248f-249w-250s. Concepts of Human Growth and Behavior in Social Work Practice I-II-III. Consideration of the socio-psycho-biological factors associated with individual and group development, as applied to social work practice. (3 cred. per qtr.; prereq. ¶210-211-212 or ‡) Mueller, Bush

251f. Concepts of Human Growth and Behavior in Social Work Practice IV. Presentation of clinical cases of psychosomatic and psychiatric illness and discussion of implications for social work practice. (2 cred.; prereq. 250, ¶215) Anderson

252w. Concepts of Human Growth and Behavior in Social Work Practice V. Survey of selected psychometric methods and theories with specific consideration of the use of these data in social work practice. (2 cred.; prereq. 250, ¶216)

253s. Concepts of Human Growth and Behavior in Social Work Practice VI. Use of psychiatric consultation in social work practice. (2 cred.; prereq. 250, ¶217) Lippman

256f,w,s. General Seminar in Concepts of Human Behavior in Social Work Practice. (Cred. ar.; prereq. grad. social work students) Staff

E. SOCIAL WORK PRACTICE

260s. Principles of Administration in Social Work. A technical study of the process of transforming social policy into social services. (3 cred.) Kidneigh

261s. Supervision in Social Casework. Principles of supervision applied to supervisory process in agencies offering casework services. (2 cred.; prereq. 260 and #)

262f. Supervision in Social Group Work. Principles of supervision applied to the supervision of volunteers and others working in agencies offering group work services. (2 cred.; prereq. 260, 277, ¶215) Saloshin

263w. Administration in Social Group Work. Principles of administration as applied to sub-executive positions in agencies offering group work services. (2 cred.; prereq. 260, 278, ¶216) Pernell

264s. Seminar in Social Work Administration. (Cred. ar.; prereq. 226 and 260 or #) Kidneigh

265f. Social Casework I. An introduction to the philosophy and processes, methods and skills of social casework. (3 cred.; prereq. ¶210) Whitmore

266w,267s. Social Casework II-III. A continuation of Casework I emphasizing a critical analysis of casework process and development of skill. (2 cred. per qtr.; prereq. 265, ¶211-212) Whitmore

268f,269w. Social Casework IV-V. Advanced casework method focused primarily on treatment methods. (2 cred. per qtr.; prereq. 267, ¶215-216) Boehm, Scott

271s. Community Organization. An analysis of the process by which groups and individuals within a community work together to equate social services to community need and establish social policy for the planning and coordination of social services. (2 cred.)

274f. Seminar in Community Organization. (Cred. ar.; prereq. 271) Kidneigh

275f,s. Social Group Work I. An introduction to the social group work method. (3 cred.; fall quarter open to social work students only, spring quarter open to other grad. students) Konopka

276w. Social Group Work II. A continuation of Group Work I with emphasis on the role of the worker in group process, group formation and social forces, focused on the development of skill. (2 cred.; prereq. 275, ¶211) Saloshin

277s. Social Group Work III. Intensified understanding of the individualization process in working with groups. (2 cred.; prereq. 276, ¶212) Konopka

278f. Social Group Work IV. Advanced group work method. (2 cred.; prereq. 277, ¶215)

279w. Social Group Work V. Group work with individuals in groups for treatment purposes, including a consideration of group therapy. (2 cred.; prereq. 278 or #) Konopka

281Aw-281Bs. Use of Program in Groups I. Understanding and use of program as a tool in meeting the needs of the individual in the group, and of the community. Consideration of skill and planning in executing program activities. (2 cred. for 281A, 1 cred. for 281B; prereq. 275) Saloshin

282f. Use of Program in Groups II. Program planning and execution related to principles and practices of the discussion method. (1 cred.; prereq. 275) Pernell

285f,w,s.* Special Studies in Social Work. (Cred. ar.; fulfills 9 cred. requirement for degree project) Staff

290w,s. Seminar in Recent Research in Social Work. (Cred. ar.; primarily for doctoral students) Scott

295f,w,s. General Seminar in Social Work Methods. (Cred. ar.; prereq. #) Staff

298f-299w-300s. General Seminar in Social Work. (Cred. ar.; prereq. MSW degree) Kidneigh, Boehm, Konopka, Stinson

SOCIOLOGY

Professor
Elio D. Monachesi
Lowry Nelson
Arnold Rose
George B. Vold
Malcolm M. Willey

Associate Professor
Theodore Caplow
Don Martindale
Henry W. Riecken, Jr.
John Sirjamaki

Assistant Professor
Roy G. Francis
Charles E. Ramsey

Instructor
Arthur L. Johnson
Martin J. Taves

Prerequisites—For major work, 18 quarter credits; for minor work, 12 quarter credits.

Language Requirement—For the Master's degree, one foreign language. For the Ph.D. degree, either (a) two foreign languages or (b) one foreign language and the option of a special research technique or a collateral field of knowledge.

Master's Degree—Offered under Plan A except in special cases when Plan B may be followed by petition and approval of the graduate faculty.

Doctor's Degree—Work for the Ph.D. degree is offered under the general rules of the Graduate School.

Note—For information on work in statistics, see pages 31-33.

Courses

I. SOCIAL PROBLEMS AND SOCIAL POLICY

100s. Contemporary Penology. Analysis of some of the more important developments in recent attempts at the treatment of criminals and the prevention of crime. (3 cred.; prereq. 1, 53, 15 cred. in social science, child welfare, education, philosophy, or psychology, or ‡) Vold

101f. Criminological Theories—Historical and Contemporary. Consideration and evaluation of major historical and contemporary theories of criminal behavior. (3 cred.; prereq. same as 100) Vold

102s. Adult Parole and Probation. Critical examination of problems and practices in the supervision of adult criminals. (3 cred.; prereq. same as 100; offered 1954-55 and alternate years) Vold

103f. Juvenile Courts and Probation. Historical, legal, and social aspects of juvenile courts and probation. A critical survey of juvenile courts and probation work based upon a consideration of the nature of delinquent behavior. (3 cred.; prereq. 53) Monachesi

104f. Police Problems and Practices in the United States. Personnel, organization, and public relations of police forces. Special attention to successful techniques of integrating police work with other community agencies. (3 cred.; prereq. same as 100; offered 1955-56 and alternate years) Vold

106f. City Planning. (Same as Arch. 104 and Pol. 123) General survey of economic, governmental, social, and technical phases of city planning and group housing. (3 cred.) Anderson, Caplow, Filipetti, Vaile

111w. Population Trends. Cultural and social phases of population change as related to the institutional aspects of both rural and urban life. Population policy considered with particular reference to the U. S. (3 cred.; prereq. 1, 15 cred. in social science, child welfare, education, philosophy, or psychology, or ‡) Francis

112s. World Population Problems. Population policy, both historical and present-day, in Europe, Asia, and other selected areas but with emphasis on the U. S. Some discussion of the field of population and power politics. (3 cred.; prereq. same as 111) Francis

115s. Social Aspects of Housing and Standards of Living. Housing of the masses in relation to problems arising in urban overcrowding, population

distribution, and standard of living as affected by distribution of national income, and factors related to personal and social disorganization. (3 cred.; prereq. same as 111) Caplow

116s. Population Theory in the Scandinavian Countries. (3 cred.; prereq. 1 or #)

117s. Scandinavian Folk Movements: Their Social and Political Significance. (3 cred.; prereq. 1 or #)

II. SOCIAL PSYCHOLOGY AND SOCIAL PROCESSES

120f,w. Social Psychology. Summary of research and theory regarding the relation of the individual to social groups. Emphasis on the socialization process; effects of social interaction and isolation; individual behavior under conditions of social organization and disorganization; collective behavior in the crowd, the mass, the public, and the institution. (3 cred.; prereq. same as 111) Rose

121s. Advanced Social Psychology. An examination of the methods of acquiring knowledge in social psychology, with analysis of outstanding pieces of research. The studies examined are concerned with the social psychology of small groups, neurotic behavior, mass behavior, and the making of political and economic choices. A major aim is to familiarize the student with current thinking and research in this field in the light of concepts and theories presented in the introductory course in social psychology. (3 cred.; prereq. 120 or #) Rose

122w. Sociology of Conflict. Manifest forms of antagonism among groups of persons; causes of conflict; methods of resolving through accommodation; the role of conflict and social change. (3 cred.; prereq. same as 111) Vold

123w. Intergroup Relations. Interaction of racial and cultural groups in America. Processes leading to group contact; characteristics and contributions of ethnic groups in the U. S.; mechanisms and problems of group adjustment. Democratic theory and practice; sources of prejudice; contemporary status of principal minority groups; international implications; trends and proposed solutions. (3 cred.; prereq. same as 111) Rose

124s. Social Mobility. Relationship of social mobility to a system of social stratification. Analysis of vertical and horizontal mobility. Relationship of social mobility to social organization. Social mobility in contemporary societies with special reference to the U. S. (3 cred.; prereq. same as 111) Ramsey

III. SOCIAL ORGANIZATION AND SOCIAL INSTITUTIONS

140f,s. Social Organization. Organization and structure of social groups; basic culture patterns of economic, political, and social institutions. Integration and disintegration of social groups and institutions. Essentials of social dynamics. (3 cred.; prereq. same as 111) Sirjamaki

141f,w,s. The Family. Evolution of the family: development of family unity or disunity, the roles of the several members of the family, methods of investigation of the family. (3 cred.; prereq. same as 111) Johnson

142. Religion as a Social Institution. (3 cred.; prereq. same as 111; not offered)

143. The Newspaper as a Social Institution. (3 cred.; prereq. same as 111; not offered)

144w. Social Stratification. Social stratification as a phase of social organization. Analysis of caste; estates and social classes. Analysis of social stratification in contemporary societies with special reference to the U. S. (3 cred.; prereq. 140, 15 cred. in social science, child welfare, education, philosophy, or psychology, or #) Ramsey

145w. Urban Sociology. Introduction to study of the city as a social organization. Emphasis on analysis of urbanism as a way of life, and on relationship between spatial and social configurations. A brief research project under supervision, using material drawn from the Twin Cities, is required. (3 cred.; prereq. same as 111) Sirjamaki

146f. Industrial and Occupational Sociology. Analysis of the occupational group, the factory, and the business enterprise as social institutions, with attention to contrasting functions of formal and informal organization, and to the significance of cooperation, authority, communication, status, and group norms in the working situation. (3 cred.; prereq. 1, 15 cred. in sociology, psychology, political science, or economics) Caplow

147w. Social Institutions of Modern France. A general review of French demography, class structure, ecological and regional patterns, industrial organization, educational and religious institutions, bureaucratic forms, and other aspects of French society in the twentieth century. An attempt is made to supplement description from an American point of view with the perspective of French social theory. (3 cred.; prereq. 20 cred. in sociology, economics, or political science, or ♯; reading knowledge of French desirable but not essential; offered 1955-56 and alternate years) Caplow, Rose

148f. Comparative Rural Societies: Latin America. A survey course which will include in part the following topics: demographic characteristics, systems of agriculture, settlement patterns, class and caste, family life, and level of living; other social institutions and social change. (3 cred.; prereq. 20 cred. in sociology, economics, or political science, or ♯; offered 1955-56 and alternate years) Nelson

149w. Comparative Rural Societies: Western Europe. Course organized essentially along lines like that for Latin America (148). (3 cred.; prereq. 20 cred. in sociology, economics, or political science, or ♯; offered 1955-56 and alternate years) Nelson

150s. Modern German Social Structure. An examination of the social order and institutions of twentieth-century Germany against a background of demography and ecological developments. (3 cred.; prereq. 20 cred. in social science, or ♯; offered 1954-55 and alternate years) Martindale

IV. RURAL LIFE AND WELFARE

160f. Rural Community Organization. Historical evolution, ecological characteristics, and demography of the rural community; the social processes, stratification, assimilation, conflict, and cooperation as manifested in rural society. (3 cred.; prereq. same as 111) Nelson

161s. Rural Community Analysis. Primarily for prospective rural teachers and extension workers. Emphasis on methods of making field studies of communities. (3 cred.; prereq. 1, 15 cred. in social science or ♯) Ramsey

162w. Rural Social Institutions. Factors in rural environment that condition the functioning of rural social institutions, including the family, school, church, local government, health, and welfare. (3 cred.; prereq. same as 111) Nelson

V. THEORIES OF SOCIAL CHANGE AND SOCIAL ORDER

170f. Analytical Social Theory. Examination of major problems of sociological theory; survey of main types of sociological theory (positivistic, rationalistic, idealistic); study of major theoretical concepts. (3 cred.; prereq. same as 111) Martindale

171w. Social Life and Cultural Change. Examination of theories of social change with attention to their methodological problems. Materials drawn from the comparative social thought and structure of antiquity utilized as basic data for analysis. (3 cred.; prereq. same as 111) Martindale

172s. Backgrounds of Modern Social Thought. Major trends of social thought from the Renaissance to the nineteenth century with attention to those factors contributing to the origin of sociology. (3 cred.; prereq. same as 111) Martindale

VI. RESEARCH METHODS AND TECHNIQUES

180w,s. Methods of Social Research. Major methods employed in social research including consideration of their advantages and limitations when applied to specific types of research problems. (3 cred.; prereq. 45 or equiv.; winter

quarter for graduate students in social work only; spring quarter for all other students) Monachesi

181s. Problems in Rural Social Research. Methods currently used by students in investigating rural society; class reports on recent samples of rural research. (2 cred.; prereq. same as 111) Nelson

182f. Statistical Methods. Selected problems of social relationship described, analyzed and interpreted by means of the common statistical methods. (3 cred.; prereq. same as 111) Francis

183s. Problems in Social Measurement. Theoretical analysis of problems involved in measuring social variables, including consideration of problems of reliability, validity, and standardization in construction of new measuring instruments. (3 cred.; prereq. 45 or 182 or equiv.; offered 1955-56 and alternate years) Monachesi

184f-185w-186s. Field Work and Laboratory Training in Social Research. Open to students whose records in statistical and research courses indicate ability to carry on individual research projects to advantage under some supervision. (2 cred. per qtr.; prereq. 45 or 182, which may be ¶; offered 1955-56 and alternate years) Ramsey

VII. SEMINARS

200w-s.* Seminar: Research Problems in Criminology. (2 cred. per qtr.; offered 1955-56 and alternate years) Vold

201f-202w.* Seminar: Research Problems in Social Conflict. (2 cred. per qtr.; offered 1954-55 and alternate years) Vold

203f-204w-205s.* Seminar: Research Problems in Juvenile Delinquency. (2 cred. per qtr.; offered 1954-55 and alternate years) Monachesi

210f-211w-212s.* Seminar: Problems in Population Research. (2 cred. per qtr.; offered 1954-55 and alternate years) Francis

220f-221w-222s.* Seminar: Social Psychology. (2 cred. per qtr.) Rose

223f-224w-225s.* Seminar: Research in Problems of Modern Mass Society. (2 cred. per qtr.; not offered) Rose

230f-231w-232s.* Seminar: Research in Group Structure and Function. (2 cred. per qtr.; offered 1954-55 and alternate years) Riecken

233f-234w-235s.* Seminar: Methods for the Evaluation of Social Action Programs. (2 cred. per qtr.; offered 1955-56 and alternate years) Riecken

238f-239w.*† Seminar in Principles of Sociology. (3 cred. per qtr.) Monachesi, Sirjamaki

241f-242w-243s.* Seminar: Research Problems in the Family. (2 cred. per qtr.; offered 1954-55 and alternate years) Johnson

245f-246w.* Seminar: Research in Urban Sociology. (2 cred. per qtr.; offered 1955-56 and alternate years) Caplow

247s.* Seminar: Research in Large Scale Organization. (2 cred.; offered 1955-56 and alternate years) Caplow

260f.* Seminar: Research in Rural Social Policy. (2 cred.; offered 1955-56 and alternate years) Nelson

261w.* Seminar: Research in the Rural Community. (2 cred.; offered 1955-56 and alternate years) Nelson

262s.* Seminar: Research in Rural Social Theory. (2 cred.; offered 1955-56 and alternate years) Nelson

263f.* Seminar: Research Methods in Rural Sociology. (2 cred.; offered 1955-56 and alternate years) Ramsey

270f-271w-272s.* Seminar in Social Theory. (2 cred. per qtr.) Martindale

280f-281w-282s.* Seminar: Recent Developments in Sociological Research Techniques. (2 cred. per qtr.; offered 1955-56 and alternate years) Francis

284f-285w-286s.* Seminar: Statistical Theory in Relation to Social Theory and Practice. (2 cred. per qtr.) Ramsey

297f-298w-299s.* General Seminar. (Cred. ar.) Staff

SOILS

Professor	Associate Professor	Assistant Professor
William P. Martin	Alfred C. Caldwell	Harold F. Arneman
Paul M. Burson	John M. MacGregor	
Paul R. McMiller		

Prerequisites—For major work, at least two years of work in chemistry, including both quantitative analysis and organic chemistry, and one year of work in general physics are essential. With approval of the adviser, courses in physical and plant sciences may be accepted as part of the major work.

Language Requirement—For the Master's degree, reading knowledge of one foreign language is advised although not required. For the Ph.D. degree, either (a) two foreign languages or (b) one foreign language and the option of a special research technique or a collateral field of knowledge.

Master's Degree—Offered under Plan A and Plan B.

Doctor's Degree—Work for the Ph.D. degree is offered under the general requirements of the Graduate School.

Courses

103s. Principles of Soil Erosion. Causes and forms of erosion; relation of erosion to climate, vegetation, slope, soil type, and soil management. Practices used in controlling soil erosion. Organizations dealing with soil conservation. (4 cred.; prereq. 4; field trips required) MacGregor

104s. Soil Mapping. Practice in identification and mapping of soil types in the field; preparation of soil maps and gathering of field data. (3 cred.; prereq. 108, 109; offered 1954-55 and alternate years) Arneman

108w. Physical Properties of Soils. Determination of physical constants of soils, including mechanical composition. (3 cred.; prereq. 4; lect., lab.) McMiller, Arneman

109s.* Soil Genesis and Classification. Genesis, nature, and distribution of the soil types of Minnesota; development of soils as influenced by climatic, topographic, geologic, and vegetative factors and their classification; productivity ratings of Minnesota soils. (3 cred.; prereq. 4, 108) McMiller

110w.* Chemistry of the Soil. Chemical composition of soils, organic matter, mineral matter, ionic exchange. Soil nutrient elements and factors affecting their availability. (3 cred.; prereq. 4) MacGregor

111f. Field and Laboratory Studies of Soils. Soil texture, structure, and color, soil reaction; nutrient deficiencies; lime and fertilizer materials; fertilizer plot techniques and interpretation of yield data; soil maps, their use and interpretation. (3 cred.; prereq. 4; lect., lab., field) Arneman

202f,w,s,su.* Research Problems in Soils. Individual laboratory or field work upon special problems in soil fertility, soil physics, soil chemistry, or soil erosion other than the student's major thesis. Arrangements must be made in advance. (2 to 5 cred.) Martin, Burson, McMiller, Caldwell, MacGregor, Arneman

203f,w. Seminar in Soils. Assigned reading, reports, and discussions on soils topics. (1 cred.) Martin

205w. Soil Colloids. Clay, colloidal clay; chemical composition of clay fraction; crystalline nature of soil colloids; clay minerals; base exchange and other reactions of the colloidal complex; the stability of suspensions; flocculation of inorganic soil colloids. (3 cred.; prereq. Ag.Bi. 119; offered 1954-55 and alternate years) Caldwell

206w.* Soil Physics. Mechanical composition of soils, physical characteristics of soil colloids; soil consistence, structure, water, air, temperature, tillage; physical properties of soils in relation to runoff and erosion. (3 cred.; prereq. 108; offered 1955-56 and alternate years) Caldwell

207w. Advanced Soils. Principles of soil formation; chemical properties of soils, soil colloids, soil organic matter, reaction; physical properties of soils, soil temperature, structure, soil water; soil microbiology. (3 cred.; prereq. one year of chemistry) Caldwell

208s. Soil Fertility. Principles of soil fertility and conservation. Use of farm manure, green manure, lime and fertilizers in fertility maintenance. Relation of fertilizer materials to crop sequences and rotations. (3 cred.; prereq. 4; lect., assigned readings)

SPEECH

Associate Professor
William S. Howell, *chairman*

Professor
Bryng Bryngelson
Howard Gilkinson
Ernest H. Henrikson
Ralph G. Nichols
Frank M. Whiting
E. William Ziebarth

Associate Professor
Kenneth L. Graham
Frank M. Lassman
Donald K. Smith
David W. Thompson

Assistant Professor
Arthur H. Ballet
William W. Fletcher
Paul Ptacek

Prerequisites—For major work, 18 credits in speech. A comprehensive entrance examination is a prerequisite for graduate work in theater.

Language Requirement—For the Master's degree, one foreign language. For the Doctor's degree, either (a) two foreign languages or (b) one foreign language and the option of either a special research technique or a collateral field of knowledge.

Master's Degree—Offered under both Plan A and Plan B. Under Plan B, the candidate must earn from 21 to 27 credits in graduate courses in speech and the remaining credits in related graduate courses selected with the approval of his adviser.

Additional reading requirements in dramatic literature for a candidate emphasizing theater are to be selected with the approval of his adviser.

Doctor's Degree—In consultation with his major adviser the candidate will elect three of the following areas of study: theater, oral interpretation of literature, rhetoric, general speech, speech pathology, radio, voice science. The choice of a minor is subject to the approval of the major and minor advisers.

The student may earn the Ph.D. degree in speech pathology.

Additional reading requirements in dramatic literature for a candidate emphasizing theater are to be selected with the approval of his adviser.

Examination—Except in speech pathology a written comprehensive examination in the three phases of speech elected by the student is required for formal admission to candidacy for the Ph.D. degree.

Courses

101f-102w-103s.*‡ Argumentation and Persuasion. Theories of modern motivational rhetoric. Analysis of persuasive speaking; practice in preparation and delivery of oral argument. (3 cred. per qtr.; prereq. 1-2 or 5, Psy. 1-2, 10 cred. in social science) Howell

105f.* Theory of Reading and Acting. The forms of literature; speech elements in literature; aesthetics of auditory and visual symbols. Collateral readings,

speech problems, reports. (3 cred.; prereq. 81-82-83, Psy. 1-2; offered 1954-55 and alternate years) Thompson

106f,w,s. Discussion. Cooperative thinking; recognition and definition of problems, critical analysis, examination of possible solutions. Planning, preparing for, participating in, and leading classroom, public, and radio discussions. (3 cred.; prereq. 1-2 or 5) Howell

107f. Platform Reading. Advanced course in the oral reading of selected plays. Speech melody, rhythm, platform technique. Problems in aesthetic analysis. Lecture recitals. (3 cred.; prereq. 81-82-83; offered 1955-56 and alternate years) Thompson

109f.* Classical Rhetoric. (3 cred.; prereq. 101-102-103, Psy. 140 or ♯; offered 1955-56 and alternate years) Smith

110f. British Rhetoric and Oratory. Critical study of British orators, their works, the historical setting. British rhetorical theory. (3 cred.; prereq. 1-2 or 5, 109 or ♯; offered 1954-55 and alternate years) Smith

111f-112w-113s.‡ Stage Direction. Advanced course in practice and theory of stage direction, including aesthetics of the theater, analysis of the play, casting, centering attention, rhythm, reading, climaxes, organization for production, the unified whole. (3 cred. per qtr.; prereq. 91, 92, or 93 and ♯) Whiting

115f-116s. Playwriting and Production. Problems of dramatic form and content in writing. Original one-act or full-length plays. The best plays will be produced in the University Theatre. (3 cred. per qtr.; prereq. 31, 32-33 or ♯) Thompson

117s. Writing Radio Drama. Problems and techniques of aural drama, illustrated by the writing of an original radio drama through the stages of scenario, rough draft, and final draft. (3 cred.; prereq. 1-2 or 5, 31, 32-33, 65-66, and ♯) Thompson

119f.* Introduction to Speech Correction. Basic orientation in speech correction. Analysis of common disorders of speech, their characteristics, prevention, and elimination. Forms a basis for more advanced study in speech pathology or for basic understanding of the field. (3 cred.; prereq. 1-2 or 5) Henrikson

122f.* Introduction to Research. Selection of problems for research; techniques of investigation; preparation of the thesis. Required of all graduate majors in speech. (3 cred.; prereq. 1-2 or 5, Psy. 1-2) Gilkinson

124w. Experiments in General Speech. Studies of the correlates of speech skills, audience reactions, and speech improvement. (3 cred.; prereq. 1-2 or 5, Psy. 1-2) Gilkinson

126s.* History and Criticism of Public Address. Historical and critical studies of oratory. Study of orators: education and training, style, speech composition, topics and issues, historical settings. (3 cred.; prereq. 1-2 or 5, Psy. 1-2) Gilkinson

131f. Creative Dramatics. Principles and methods of developing original dramatizations with children. Observation of children's classes in creative dramatics. Readings, projects, term papers. (3 cred.; prereq. 1-2 or 5, 31, elementary education major or ♯, Ed.C.I. 63 recommended) Graham

132s. Children's Theater. Theory and practice of selection, direction, and production of plays for children's audiences, coordinated with current productions of the Young People's University Theatre. (3 cred.; prereq. 1-2 or 5, 31 or ♯) Graham

140f. Introduction to Voice Science. Consideration of fundamental aspects of the phonetic, anatomic, physiologic, and physical bases of speech. (3 cred., §141 or 142; prereq. 1-2 or 5, Psy. 102) Fletcher

141w. Anatomy and Physiology of the Voice Mechanism. Respiration, articulation, and phonation; practical applications to speech improvement. (3 cred.; prereq. 1-2 or 5, 67, 140, Psy. 4-5, or ♯) Fletcher

142s. Physical Bases and Instrumentation of Speech. Relationship of basic principles of sound to speech mechanism. Analysis of speech sound production. Application of mechanical and electronic equipment to speech; basic theory and uses. (3 cred.; prereq. 1-2 or 5, 67, 140, Psy. 4-5 or #) Fletcher

152f. Hearing Disorders. Basic orientation to audiology. Physiology and anatomy of auditory mechanism. Symptomatology and pathology of hearing disorders, their medical and surgical treatment. Clinical and classroom management, including discovery programs, hearing aids, language development, lip reading, speech correction, auditory training, psychology of hard-of-hearing and deaf,. vocational guidance, educational channels. (3 cred.; prereq. 1-2 or 5, 61, 67, Psy. 1-2, or #) Lassman

153w. Audiometry and Hearing Aids. Theory and practice of clinical and group audiometry; screening and diagnostic techniques, pure tone and speech audiometry; hearing conservation programs. Characteristics of modern hearing aids; selection and usage problems. (3 cred.; prereq. 1-2 or 5, 61, 67, 152, Psy. 1-2, or #) Lassman

155s.* Lip Reading and Lip Reading Methods. Positions and movements involved in English speech and the current methods used in teaching lip reading. (3 cred.; prereq. 1-2 or 5, Psy. 1-2 or #) Lassman

157s. Clinical Practice in Audiology. Supervised practice with communication problems of deaf and hard-of-hearing persons, including lip reading, auditory training, language development, speech conversation, etc. (3 cred.; prereq. 152, 153, 155 or #) Lassman

162w-163s.*†‡ Speech Pathology. Physiological and psychological aspects of organic and functional speech problems. Theories of stuttering. Diagnosis, case histories, and treatment of speech cases. Observation of clinical diagnosis and treatment. (3 cred. per qtr.; prereq. 1-2 or 5, 61, 67, 119, #) Bryngelson (w), Henrikson (s)

164f-165w-166s.*‡ Clinical Methods and Practice in Speech Pathology. (Same as Ed.C.I. 174-175-176) Study of cases and practice in clinical diagnosis and remedial treatment. (3 cred. per qtr.; prereq. 1-2 or 5, 61, 67, 119, 162-163, and E.Psy. 142) Bryngelson

169w.* Speech and Language in Human Behavior. Basic orientation in place of speech and language in human behavior. Individualized projects and collateral reading. (3 cred.; prereq. #) Henrikson

170w. Radio and Television Programming. An intensive study of the theory and practice of radio and television programming. An examination of the principles of program effectiveness and a study of the program policies of the industry. The building and production of experimental programs with special emphasis on the talk, discussion, and round table. (3 cred.; prereq. 65 or 66, or #)

171f-172w-173s.*‡ History of the Theater. A study of the plays, arts, and crafts of the theater from their beginnings to the present. Special reports and projects. (3 cred. per qtr.; prereq. 1-2 or 5, 31) Graham

181f-182w-183s.‡ Readings in Speech. Directed reading and the preparation of reports on selected subjects. (Cred. ar.; prereq. 1-2-3 or 5-6 and 6 additional cred., #) Staff

191f-192w-193s.*‡ Technical Stage Problems. Advanced study in theory of scenic design, theater, architecture, stagecraft, and lighting. Special projects and reports. (3 cred. per qtr.; prereq. 111, 112, 113) Whiting, Josal

201f,w,s.* General Seminar. Survey of current literature and general problems in the field of speech. (1 cred. per qtr.; prereq. #) Gilkinson, Smith

203f-204w.‡ Debate Coaching. Study of literature concerning and methods of directing extracurricular interscholastic public speaking, discussion, and debate activities. Each student directs preparation and practice of a group of undergraduate student speakers. (2 cred. per qtr.; prereq. 1-2 or 5, 101-102-103, Psy. 1-2, 10 cred. in social science) Howell

207f-208w-209s.*‡ Seminar in Persuasion. Study of contemporary public address. Critical examination of literature of persuasion, methods in the study of

persuasion. (3 cred. per qtr.; prereq. 1-2 or 5, 101, 102, 103, Psy. 1-2, 140, 10 cred. in social science) Howell

211f-212w-213s.*‡ Seminar in Dramatic Theory. Analysis of the critical theory of theatrical arts. Major trends in drama as related to dramatic production. (3 cred. per qtr.; prereq. 171-172-173 and 9 cred. in dramatic literature) Ballet

221f-222w-223s.*‡ Seminar in Oral Interpretation of Literature. Problems of silent and oral reading. Theories of speech in relation to language and types of literature. (3 cred. per qtr.; prereq. 1-2-3 or 5-6, 81-82-83, 105, 122, Psy. 74) Thompson

231f-232w-233s.*‡ Seminar in Advanced Speech Problems. Analysis and evaluation of research methods in the general field. (3 cred. per qtr.; prereq. undergraduate major in speech, or equiv., ♯) Gilkinson

241f-242w-243s.*‡ Seminar in Radio Research. Analysis and evaluation of research methods in mass communication by radio. Examination of research literature. (2 cred. per qtr.; prereq. ♯) Ziebarth

261f-262w-263s.*‡ Seminar in Speech Pathology. Study of significant literature in speech pathology, with emphasis on analysis and evaluation of research methods. (3 cred. per qtr.; prereq. 1-2-3 or 5-6, 61, 67, 122, 162-163, Psy. 1-2, or ♯) Henrikson

271f,w,s.* Seminar in Hearing. Major experimental research in psychophysiological and psychoacoustical nature of hearing. Critical analysis of theory, experimental method, and treatment of data. (3 cred.; prereq. 152, 153, 155, ♯) Lassman

275f-276w-277s.‡ Seminar in Rhetoric. History and critical study of rhetorical theory. Examination of research in rhetoric. (3 cred. per qtr.; prereq. 1-2 or 5, 109 or ♯) Smith

281f-282w-283s.‡ Seminar in Organic Disorders of Speech. Consideration of anatomical, physiological, and neurological abnormalities that are characterized by disorders of speech or voice. Pertinent literature with emphasis on medical sources. (2 cred. per qtr.; may be repeated with consent; prereq. 261-262-263, ♯) Brown

291f-292w-293s.*‡ Research. Open to graduate students engaged in research on special problems. (Cred. ar.) Staff

Engl.184f-185w-186s.‡ Interpretation of the Drama. (3 cred. per qtr.; prereq. 6 cred. above Engl. 50, Engl. 55-56 advised) Reisman (f), Coxe (w,s)

Scan.171f.* Ibsen and the Beginnings of the Modern Drama. Intensive examination of the plays of Ibsen, especially with reference to the role he has played as "the founder" of the modern European drama. Knowledge of Scandinavian not required. (3 cred.; prereq. 4-5-6 or 10-11-12 or 8 cred. in literature) Gustafson

Scan.172w.* Strindberg and the Drama in Revolt and Transition. Strindberg as master of the naturalistic drama and as "the father of modernity" in the European and American theater since his day. Knowledge of Scandinavian not required. (3 cred.; prereq. 4-5-6 or 10-11-12 or 8 cred. in literature) Gustafson

Scan.173s.* Contemporary Scandinavian Theater. The Scandinavian theater today, particularly with reference to its "experimental" trends in both dramatic composition and staging. Knowledge of Scandinavian not required. (3 cred.; prereq. 4-5-6 or 10-11-12 or 8 cred. in literature) Gustafson

SURGERY

Including Divisions of General Surgery, Neurosurgery, Experimental Surgery, Orthopedic Surgery, Urology, Proctology, Anesthesiology, and Dental Surgery

For staff and courses of study offered, see the *Graduate Medical Bulletin.*

VETERINARY MEDICINE

Professor
Martin H. Roepke
John N. Campbell
Reuel Fenstermacher
Henry J. Griffiths
Howard C. H. Kernkamp
Benjamin S. Pomeroy

Associate Professor
Harvey H. Hoyt
Ralph L. Kitchell
George W. Mather
Robert A. Merrill
Jay H. Sautter
Alvin F. Sellers
Alvin F. Weber

Assistant Professor
Dale K. Sorensen

Prerequisites—Graduate students who desire to take their major work in veterinary medicine must present a D.V.M. degree or its equivalent from a recognized veterinary medical college.

Major Work—Candidates taking major work for their Master's degree or Doctor's degree may, upon approval of the adviser, select courses in the various departments of the University including the Medical School.

Language Requirement—For the Master's degree, one foreign language. For the Doctor's degree, either (a) two foreign languages or (b) German and the option of a special research technique or a collateral field of knowledge.

Master's Degree—Offered only under Plan A.

Doctor's Degree—Work for the Ph.D. degree is offered.

Courses

101f-102w-103s. Veterinary Anatomy. Gross anatomy of domestic animals. (7 cred. for 101, 5 cred. for 102, 4 cred. for 103; open to graduate students with consent; enrollment limited) Kitchell

104f,w,s. Special Studies in Veterinary Anatomy. Individual problems for further study in animal anatomy. (1 to 3 cred. per qtr.; prereq. 101) Kitchell, Weber

105w. Veterinary Neuroanatomy. A functional study of the gross and microscopic anatomy of the central nervous system and special sense organs of domestic animals. (3 cred.; prereq. 101, 111, #) Kitchell

106w. Veterinary Surgical Anatomy. Topographical anatomy of domestic animals as applied to surgery and the practice of veterinary medicine. (1 cred.; prereq. 103, 170, #) Kitchell, Arnold

107f. Animal Gross and Microscopic Anatomy. General systematic presentation of microscopic and gross anatomy of the animal's body emphasizing the digestive, blood, vascular, and respiratory systems. (5 cred.; prereq. Zool. 14-15 or #) Kitchell, Weber

108w,s. Special Animal Gross and Microscopic Anatomy. Detailed study of individual species selected by the student with the consent of the instructor. Emphasis on study of the nervous, digestive, and the reproductive systems. (3 cred.; prereq. 107) Kitchell, Weber

109w. Anatomy, Physiology, and Hygiene of Poultry. General anatomy of the fowl, the physiology of digestion and reproduction, and prevention and control of the more important diseases affecting chickens and turkeys. (3 cred.; prereq. Zool. 14-15, Po.Hu. 1) Pomeroy

111f-112w-113s. Veterinary Microscopic Anatomy and Embryology. Microscopic studies of the various tissues and organs, including embryology, of domestic animals. (6 cred. for 111, 5 cred. for 112, 4 cred. for 113; open to graduate students with consent; limited enrollment) Weber

115w. Avian Gross and Microscopic Anatomy. Gross and microscopic anatomy of the chicken and certain significant anatomical areas of other fowl. (5 cred.; prereq. 107; offered 1954-55 and alternate years)

119w. Seminar in Veterinary Anatomy. (1 cred.; prereq. 101, 111, or #) Kitchell, Weber

121s,122f,123w. Veterinary Bacteriology. Morphology, classification, and characteristics of pathogenic bacteria. Principles of infection and immunity and studies of bacteria, viruses, yeasts, molds, and actinomycetes associated with animal diseases. Limited enrollment. (5 cred. for 121, 6 cred. for 122, 4 cred. for 123; prereq. 10 cred. in zoology, 13 cred. in chemistry, #) Pomeroy, Lindorfer

125f. Poultry Diseases. Lectures on diseases of poultry. (3 cred.; prereq. 123, 153, 162, #) Pomeroy

126s. Dairy Hygiene. The effect of bovine diseases and sanitation on quality and safety of milk and milk products. (4 cred.; prereq. 123, 179, #) Olson

127s. Veterinary Public Health. Functions of veterinary public agencies and of epidemiologic methods in the study of animal diseases. (2 cred.; prereq. 123, 179, #) Anderson

135f, 136w. Animal Physiology. Physiology of circulation, respiration, digestion, kidney function, endocrine function, reproduction, nervous system, and special senses in domestic animals. Limited enrollment. (8 cred. for 135, 7 cred. for 136; prereq. 103, 113, Ph.Ch. 103 or #) Sellers, Good

137f,w,s,su. Problems in Animal Physiology. (Cred. ar.; prereq. 135, 136 or Phsl. 106-107) Sellers

140s. Seminar on Animal Physiology. (2 cred.; prereq. 136 or #) Sellers, Good

143w. Veterinary Clinical Pharmacology. Continuation of general pharmacology with emphasis on clinical aspects in domestic animals. (3 cred.; prereq. Phcl. 105, #) Stowe, Hammond

151f,152w,153s. Veterinary Pathology. Descriptions, discussions, and gross microscopic demonstrations of tissue reactions including retrogressive and inflammatory changes, neoplasms, and reparative processes. (4 cred. for 151, 5 cred. for 152, 6 cred. for 153; prereq. 103, 113, 135 or equiv. with #) Sautter, Kernkamp

154s. Veterinary Clinical Pathology. Application and interpretation of laboratory tests used in clinical diagnosis in domestic animals. (2 cred.; prereq. 152, #) Rehfeld

155f. Meat Hygiene. Lectures and discussions of meat inspection procedures and regulations; consideration of various infections, degenerative and disease processes affecting meat. Trips to local packing plants to observe details of antemortem and postmortem inspection procedures. (3 cred.; prereq. 153) Sautter

157f,w,s,su. Veterinary Postmortem Pathology. Autopsies, techniques, examination of tissue sections, preparation of records and diagnosis. (1 to 3 cred. per qtr.; prereq. 153, #) Sautter, Kernkamp

158f,w,s,su. Veterinary Surgical Pathology. Neoplasms, surgical biopsies, postmortem material, review of pertinent literature. (1 to 3 cred.; prereq. 153, #) Sautter, Kernkamp

161w. Veterinary Parasitology. Systematic and biological study of the protozoan and arthropod parasites of animals. Emphasis on their relationships to disease and the principles of parasite control. (4 cred.; prereq. 103, 113 or equiv., #) Griffiths

162s. Veterinary Parasitology. Helminth parasites and parasitic diseases of animals with emphasis on principles of control. (6 cred.; prereq. 161) Griffiths

168w. Diseases of Fur-bearing Animals. Etiology, symptomatology, and treatment of diseases of fur-bearing animals. (2 cred.; prereq. 123, 186, #) Fenstermacher

170s. Veterinary Clinical Diagnosis. Procedures of physical diagnosis and restraint of animals. (3 cred.; prereq. 136, 151) Hoyt, staff

171df,171ew,171fs.† Clinical Conferences. Group discussion of clinical cases. (1 cred. per qtr.; prereq. 170, #) Staff

172f. Animal Surgery. Anesthesia, asepsis, hemostasis, preoperative and postoperative care and surgical techniques. (6 cred.; prereq. 170, #) Arnold

173w. Special Animal Surgery. Operative practices and etiology, diagnosis, treatment, and surgical diseases of large animals. (5 cred.; prereq. 172, #) Arnold

174s. Advanced Animal Surgery. Continuation of 173 in operative practices and procedures requiring more skillful techniques. (3 cred.; prereq. 173, #) Arnold

177f,178w,179s. Large Animal Medicine. Diseases of large animals. (5 cred. per qtr.; prereq. 170, #) Sorensen

180w,181s. Infectious Diseases of Domestic Animals. Lectures and discussions of diagnosis, treatment, and control of diseases of domestic animals caused by infectious agents. (5 cred. per qtr.; prereq. 179, #) Hoyt

185s. Small Animal Medicine. Medical and surgical diseases of small animals. (4 cred.; prereq. 178, #) Mather

186f. Small Animal Medicine. Continuation of 185. (4 cred.; prereq. 165, #) Mather

188f,189w,190s. Clinical and Laboratory Practice. Medical, obstetrical, surgical, ambulatory, and postmortem clinics of animals. (5 cred. per qtr.; prereq. 170) Staff

191f,192w,193s. Clinical and Laboratory Practice. Medical, obstetrical, surgical, and ambulatory clinics of animals. (5 cred. per qtr.; prereq. 190, #) Staff

194s,195w. Veterinary Obstetrics and Problems of Animal Reproduction. Lectures and laboratory studies on anatomical and physiological factors of reproduction, diseases of the newborn, obstetrical and sterility problems, and artificial insemination. (3 cred. for 194, 5 cred. for 195; prereq. 190, #) Zemjanis

196f. Veterinary Radiology. Preparation and interpretation of radiographs and fluoroscopic examinations in veterinary medicine, consideration of radiant energy as a therapeutic agent, and discussion of protective measures against radiation hazards. (3 cred.; prereq. 190, #) Spurrell

197s. Animal Diseases and Poisonous Plants. Systematic study of important plants poisonous to animals. Emphasis on identification, toxicology, diagnosis, and treatment. (3 cred.; prereq. 143, 170, 179, 188, #) Sorensen, Larson

201f,w,s. Advanced Veterinary and Poultry Pathology. Clinical material, collateral reading, and conferences. (Cred. ar.; prereq. #) Kernkamp, Fenstermacher, Pomeroy, Sautter

205f,w,s. Advanced Veterinary Bacteriology. Clinical material, collateral reading, and conferences. (Cred. ar.; prereq. #) Pomeroy, Fenstermacher

209f,w,s. Advanced Clinical Technique. A more detailed application of clinical techniques in diagnosis and therapy of animal diseases. (Cred. ar.; prereq. #) Hoyt, Mather

213f,w,s. Veterinary Obstetrics and Gynecology. Affords more comprehensive training in disorders and diseases of reproduction of domestic animals through studies on clinical material, collateral reading, and conferences. (Cred. ar.; prereq. #) Staff

217f,w,s. Seminar in Veterinary Medicine. Special assignments and review of research problems in veterinary medicine. (1 cred.) Kernkamp, staff

230f,w,s,su. Research in Veterinary Medicine. (Cred. ar.) Staff

240w,s. Advanced Veterinary Parasitology. The more important parasites of domestic animals, their identification, life histories, economic importance, and relationship to disease. (Cred. ar.; prereq. 161, 162 or equiv.) Griffiths

ZOOLOGY

Professor
Dwight E. Minnich
Samuel Eddy
Alexander C. Hodson
Clarence E. Mickel
Sheldon C. Reed
Albert G. Richards
Otto H. Schmitt
Nelson T. Spratt
H. Burr Steinbach

Associate Professor
Magnus Olson
Franklin G. Wallace

Assistant Professor
David J. Merrell
Dwain W. Warner

Instructor
Joseph G. Gall

Prerequisites—For major work, Zool. 1-2-3, and at least 18 credits of advanced work approved by the department; for minor work, Zool. 1-2-3, or the equivalent.

Language Requirement—For the Master's degree, one foreign language. For the Doctor's degree, two foreign languages, of which one must be German.

Master's Degree—Offered under both Plan A and Plan B.

Doctor's Degree—The Department of Zoology offers work leading to the Ph.D. degree.

Courses

100f,101w,102s. Zoological Techniques. These course numbers are a special arrangement for the making up of certain deficiencies in background course work. For election of these course numbers majors must consult major advisers, others, the department chairman. (Cred. ar., not to exceed 3 cred. per qtr.)

109w. Sense Organs. Survey of the structure and function of the sense organs of invertebrate and vertebrate animals. (3 cred.; prereq. 15 cred., ♯; lect., dem.) Minnich

110s. Animal Reactions. Survey of the nervous system, effectors, and behavior patterns of animals. (3 cred.; prereq. 15 cred., ♯; lect., dem.) Minnich

112f. Advanced General Physiology. Interactions between cells and environment; enzyme actions and general protoplasmic structure and metabolism. (3 cred.; prereq. 15 cred., ♯; lect., lab.) Steinbach

113w. Special Topics in Advanced General Physiology. (3 cred.; prereq. 15 cred., ♯; lect., lab.) Steinbach

117f. Animal Ecology. General ecology stressing ecological principles and land communities. (3 cred.; prereq. 15 cred. in zoology or entomology; lect., lab., assigned reading, field trips) Eddy

118w. Animal Ecology. Experimental approach to study of environmental factors affecting animal populations. (3 cred.; prereq. 15 cred. in zoology or entomology; lect., lab.) Hodson

119su. Limnology. Conditions for life in the water and distribution of aquatic animals. (4 cred.; prereq. 15 cred. in zoology or entomology; lect., lab., assigned reading, field trips; offered at Itasca Park Biological Station) Eddy

120s. General Ecology of Insects. Emphasis on its application to problems in economic entomology. (3 cred.; prereq. 117, 118; lect., field trips, reading) Hodson

121f. Ichthyology. Taxonomy and habits of North American fishes with special reference to those of upper Mississippi drainage. (3 cred.; prereq. 15 cred.; lect., lab.) Eddy

125f-126w-127s. Advanced General Entomology. Morphology, biology, and classification of insects. (3 cred. per qtr.; prereq. 52 or equiv. or ♯; lect., lab., frequent field trips in 127s) Mickel

128f-129w. Insect Physiology. General and comparative physiology of insects, a survey of the organ systems and their functioning in various insects. Emphasis on research methods and evaluation of data. (4 cred. per qtr.; prereq. 15 cred. in zoology or entomology, ♯; lect., lab., reading) Richards

140s. Biological Microscopy. Survey of microscopic optics, histology, and histochemistry with emphasis on the limits and the interpretation of microscopical data. (4 cred.; prereq. ♯; offered 1955-56 and alternate years) Richards

144f. Medical Entomology. The principal arthropods noxious to man and animals, especially those which are vectors of disease. (3 cred.; prereq. 15 cred. in zoology or entomology, ♯; lect., lab.) Barr

145w. Parasitic Protozoa. Structure, life histories, and economic relations of protozoal parasites of man and animals. (3 cred.; prereq. 15 cred., ♯; lect., lab.) Wallace

146s. Helminthology. Worm parasites of man and animals, their structure, life histories, and biological relationships. (3 cred.; prereq. 15 cred., ♯; lect., lab.) Wallace

155f,156w,157s. Biophysics. Theoretical and experimental aspects of biology that can be studied by quantitative physical means. 155: Tissue ultrastructure (biostatics) as revealed by hypermicroscopy, birefringence, X ray, electron and radioactive means, and by colloidal and micellar phenomena. 156: Dynamics of biophysical systems; excitatory state, contraction, secretion, synthesis. 157: Integrative biophysical systems; stability of systems, transmission of information, sensory mechanisms. (Cred. ar.; prereq. 28 cred. distributed between physics and biology, ♯, physical chemistry and general physiology recommended; schedule ar.; any section may be taken separately) Schmitt

160w-161s. Cytology. Survey of cell structure and behavior with special reference to genetic cytology and cellular physiology. (3 cred. per qtr.; prereq. 15 cred. and ♯; lect., lab. work, seminar reports) Gall

170f. Advanced Genetics. General laws involved in heredity and variation, with their applications to microorganisms, higher plants, and animals exclusive of man. (3 cred.; prereq. 15 cred. including 83, or ♯; textbooks, lect., lab.) Reed, Merrell

171w. Genetics of Speciation. Application of genetics to the study of mechanisms of evolutionary change. (3 cred.; prereq. 15 cred. including 83, or ♯) Merrell

175s. Human Genetics. Inherited characters in man, particularly from the point of view of medicine with some reference to the relation of genetics to marriage and to social conditions. (3 cred.; prereq. 83, ♯; lect., lab.) Reed

182s. Experimental Embryology. Growth, differentiation, and metabolism of developing organisms. (5 cred.; prereq. 15 cred. including 50 or 59 or equiv.) Spratt

183w,184w,185w. Physiology of Development. Trains advanced students in the organization, presentation, and evaluation of the results of research in experimental embryology. 183: Chemical embryology (metabolic aspects of growth, differentiation, and morphogenesis). 184: Embryonic differentiation, including neuroembryology. 185: Endocrines in development, including sex differentiation. (4 cred.; prereq. 182 or equiv., ♯; offered successive winter quarters) Spratt

Note—For additional courses in the related economic field see Entomology and Economic Zoology in this bulletin.

197f-198w-199s.* Problems. Advanced work in some special line. (Cred. ar.; prereq. 1-2-3, special requirements) Staff

201-203.* Research in Entomology. Mickel

211-213.* Research in Ecology. Eddy

217-219.* Research in Physiology. Minnich, Steinbach, Richards

221-223.* Research in Biophysics. Schmitt

233-235.* Research in Embryology. Spratt

237-239.* Research in Cytology. Gall

251-253.* Research in Genetics. Reed

261-263.* Research in Parasitology. Wallace

291-293. General Seminar.

296-298.* Seminar in Special Research Fields.

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Bulletin of the

UNIVERSITY OF MINNESOTA

Graduate Training in Public Administration 1954-1956

UNIVERSITY OF MINNESOTA

Board of Regents

The Board of Regents is composed of The Honorable Ray J. Quinlivan, St. Cloud, First Vice President and Chairman; The Honorable George W. Lawson, St. Paul, Second Vice President; The Honorable James F. Bell, Minneapolis; The Honorable Daniel C. Gainey, Owatonna; The Honorable Richard L. Griggs, Duluth; The Honorable Marjorie J. Howard, Excelsior; The Honorable Lester A. Malkerson, Minneapolis; The Honorable Charles W. Mayo, Rochester; The Honorable Karl G. Neumeier, Stillwater; The Honorable E. E. Novak, New Prague; The Honorable A. J. Olson, Renville; and The Honorable Herman F. Skyberg, Fisher.

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PUBLIC ADMINISTRATION CENTER

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Eugene K. Dahlman, Research Assistant (1954-55)
Richard T. Gay, Research Assistant (1954-55)
Frank U. Koehler, Research Assistant (1954-55)
James A. True, Research Assistant (1954-55)

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Graduate Training in Public Administration

The demand for young men and women with specialized training in public administration has increased remarkably in recent years. This increased demand may be accounted for by the expansion in the number and complexity of governmental functions performed by national, state, and local governments in the United States, by the greater recognition of the important role of the administrator in the efficient and economical performance of those functions, and by the development of an organized body of knowledge in the field of administrative organization and procedure which, if mastered by the student, can contribute materially to the value and effectiveness of his services in an administrative position.

Junior administrative positions are found in substantial numbers in the central, departmental, and bureau offices of government which are charged with responsibility for administrative planning and research, personnel management, fiscal administration, and organization and methods work. They are located also in many of the line or operating departments and their subdivisions, where the duties involve general assistance to administrative heads such as applied research on administrative problems, the writing of memoranda, the drafting of regulations and reports, and the facilitating of interagency transactions of various kinds.

The attractiveness of careers for capable, well-trained young people in governmental administration has been enhanced by the establishment of positions such as management assistant, administrative assistant, administrative analyst, budget examiner, personnel technician, and research assistant at entrance levels, by the filling of such positions through open competitive examinations or other merit system procedures, and by the payment of salaries comparable to those offered by private employment. The recent popularity of the city manager form of government has created numerous new opportunities for careers in municipal management. Private research organizations and consulting firms provide additional career opportunities. And the teaching of public administration offers a rewarding career for a limited few.

EDUCATION FOR PUBLIC ADMINISTRATION

Universities and colleges in the United States have responded in increasing number to the demand for young men and women with special training in public administration. As late as 1920, only eight institutions offered training in public administration. A survey made in 1952 revealed that 105 colleges and universities not only offered special training in public administration but also offered the Master's degree for concentration in the field. This survey also indicated that fifty-four institutions offered an internship program and/or field training.

The University of Minnesota has made several significant contributions to this educational development. A conference on University Training for the National Service, sponsored jointly by the University and the United States Civil Service Commission, was held on the campus in 1931 during which attention was drawn to the need of training for the administrative as well as for the scientific and technical positions in the national government. President Lotus D. Coffman of the University served as chairman of the Commission of Inquiry on Public Service Personnel whose report in 1935 served to emphasize the importance of administration and the career principle in the search for better government personnel in the United States.

Professor William Anderson served first as a member and later as chairman of the Committee on Public Administration of the Social Science Research Council which furnished national leadership and encouragement of research and training in the public administration field.

PUBLIC ADMINISTRATION TRAINING AT THE UNIVERSITY OF MINNESOTA

The graduate training program in public administration at the University of Minnesota was established in the fall of 1936, though instruction in this field had been given both at the undergraduate and graduate levels for a number of years prior to that time. The program was conducted from 1936 to 1945 with the financial assistance of the Rockefeller Foundation. The program is the major activity of the Public Administration Center of the Department of Political Science. The faculty of that department is aided and advised in the conduct of the program by an all-University faculty committee representing the colleges, schools, and departments most immediately concerned with training for public service.

In addition to the graduate training program, an undergraduate major in political science is offered with concentration in public administration, and a Certificate in Public Administration is offered in the General Extenson Division.

The Schools of Business Administration, Forestry, Public Health (including Hospital Administration), and Social Work, the Library School, and the Department of Educational Administration all offer undergraduate and graduate programs in various phases and specialties of public administration. Students in the graduate training program in public administration who have the essential prerequisites may take part of their course work in these schools and departments.

ADMISSION

Admission to the graduate training program is open to two classes of students. Graduates of accredited colleges and universities who have the scholastic ability to undertake graduate studies and a personal aptitude for administrative work but who are without previous governmental employment experience are admitted as pre-service students. College and university graduates who have had employment experience in governmental agencies and who give evidence of intellectual and administrative ability are admitted as in-service students.

For both pre-service and in-service students a liberal education with emphasis upon the social sciences, or a professional education in some field of recognized importance in government service, is deemed most desirable as preparation for graduate study in public administration.

Applications for admission should be filed with the director of the Public Administration Center, 354 Ford Hall. It is desirable to make early application for admission because the facilities of the Center limit the number of students who may be admitted. Normally, students enter the program at the beginning of the fall quarter, but, in exceptional cases and to the extent that satisfactory study programs can be arranged, students will be admitted at the beginning of the winter and spring quarters.

FELLOWSHIPS, ASSISTANTSHIPS, AND STUDENT AID

The University offers one half-time research fellowship and three half-time research assistantships in the Public Administration Center. The fellow receives $198.75 per month, the assistants $156. Applications for the fellow-

ship and the assistantships should be filed on or before February 15, though late applications will be considered when the circumstances warrant. Appointments will be announced on or about April 1.

The Municipal Reference Bureau, various research projects in the social sciences at the University, and local citizen organizations offer additional opportunities for employment to graduate students. The Joint Reference Library normally engages several part-time student assistants.

Applicants for admission to the program also may apply for general University fellowships and scholarships. (See the current *Bulletin of the Graduate School* and the printed announcement of assistantships and fellowships issued each year.) A number of dormitory counselorships are available for selected graduate students. The Student Employment Bureau assists students in finding part-time work either on or off campus. In addition, loan funds have been set up to help any student who is making normal progress towards his educational objective.

FEES

Tuition fees for residents per quarter	
6 credits or less, or thesis only	$ 23.00
More than 6 credits	46.00
Tuition fees for nonresidents per quarter	
6 credits or less, or thesis only	55.00
More than 6 credits	110.00
Incidental fee	14.00
Matriculation deposit (first quarter in residence)	3.00
Graduation fee	10.00
Fee for binding Master's thesis	2.50

All of the fees mentioned above apply to the regular session and are effective during 1954-1955. For the Summer Session fees, see the *Bulletin of the Summer Session.*

For additional information concerning fees and registration, see the *Bulletin of General Information.*

COURSES OF STUDY

No fixed curriculum has been established for students enrolled in the training program. A graduate seminar in public administration is required and is the core subject of the program. Courses in constitutional and administrative law are strongly recommended for those who have not had equivalent courses as undergraduates. The remainder of the courses included in the student's program of study are selected with regard to his previous preparation, his special field of interest, and the requirements of government employment, and without regard to specific major and minor fields of study.

Since World War II, the students in the training program have been enrolled in 247 courses in 22 departments of the University. The courses which have appeared most frequently in the programs of students during this period include the following:

Political Science
- Seminar in Public Administration
  - I. Organization and Management
  - II. Financial Administration
  - III. Personnel Administration
- Seminar in Public Law
  - I. Administrative Responsibility
  - II. Administrative Procedure
- Principles of the American Constitution
- Local Government
  - I. Structure and Legal Status
  - II. Organization, Officers, and General Procedures
- Municipal Functions
- Recent Social Legislation
- Government and the Economic Order
- American Political Parties
- Problems of Democracy

Economics and Business Administration
- Advanced Economic Theory
- General Manpower Economics
- Labor Legislation
- Introduction to Industrial Relations
- Introduction to International Economics
- Public Finance
- State and Local Taxation

Psychology
- Vocational and Occupational Psychology
- Psychology and Personnel Work

INTERNSHIP TRAINING

For those pre-service students who desire them, internships in appropriate governmental departments or agencies—national, state, or local—will be arranged by the University through negotiations with suitable internship supervisors. The purpose of the internship is to provide the student an opportunity to observe and to participate in administrative organization and operations in a governmental agency under careful supervision to the end that he may achieve an integration of theory and practice in public administration. In prior years, internships have been arranged by the University in a wide variety of national and state departments and with city managers. In recent years, more and more governmental units have offered paid trainee positions, which are in the nature of internships. For students who are unable to obtain one of these positions and still desire internship training, unpaid internships will be arranged.

DEGREES

Master of Arts in Public Administration

The graduate training program in public administration leads to the degree of master of arts in public administration (M.A.P.A.). The requirements for this degree are the same as for the general master of arts degree, Plan A or B, in the Graduate School with the following important exceptions:

(a) A single integrated course of study is substituted for the customary major and minor fields of work.
(b) A working knowledge of statistics or accounting may be substituted for the required reading knowledge of one foreign language.
(c) Candidates for the degree, Plan A, must receive a grade of B or better in at least two-thirds of their course work, and a grade of not less than C in all other courses offered for the degree. For Plan B candidates, a B average in all courses is required.

The preparation of a thesis is required under Plan A. The thesis must deal with some governmental administrative problem. Pre-service students may prepare their theses in connection with their internship training or in residence. In-service students are encouraged to prepare their theses on some problem of interest to their respective governmental employer. Illustrative of the type of research projects undertaken by students in previous years are the following thesis titles: "The Communications System of the United States Department of State As It Pertains to the Foreign Service," "Federal Control of Personnel Standards in the Minnesota State Classified Service," "A Study of the Informal Procedures of the National Labor Relations Board," "The Selection of Unskilled Workers for Positions in Governmental Agencies," "Human Relations in City Management: A Case Study," "The Administration of a Volunteer Civic Organization: The League of Women Voters of Minnesota."

Under Plan B, additional course work is substituted for the thesis requirement. A student must take 45 quarter credits of course work, instead of the 27 credits required under Plan A, and write three term papers.

The degree of master of arts in public administration may be obtained at the end of one academic year of full-time graduate study, though many students extend their studies over a longer period, including one or more summer terms. Some government employees in the Twin Cities area engage in part-time graduate work over a period of several years.

For detailed information concerning the requirements of the Master's degree, Plans A and B, consult the current *Bulletin of the Graduate School,*

which may be obtained by writing to the Office of Admissions and Records, University of Minnesota, Minneapolis 14.

Doctor of Philosophy

The University does not offer a doctorate in public administration. However, advanced graduate students who are interested in majoring in this field with a view to careers in teaching or in government service are advised to become candidates for the doctorate in political science, with public administration as the major field of study and with a minor or minors in closely related social science departments.

Certificate in Public Administration

Students who find it inconvenient to take regular graduate courses and who do not desire a degree may pursue a program of courses leading to a certificate in public administration. The courses are offered in the evenings and are intended primarily for employees of governmental agencies in the Twin Cities area. Courses used for the certificate may also be applied toward a degree. However, only six to nine hours of evening courses offered by the University's General Extension Division may be applied toward the Master's degree. For details concerning the certificate program, write to General Extension Division, University of Minnesota, Minneapolis 14.

FACILITIES FOR STUDY AND RESEARCH

The University has provided a study room for graduate students in public administration in the University Library Building. This room also houses a portion of the special joint reference library which contains an excellent collection of some 40,000 books, documents, pamphlets, periodicals, and other materials covering every field of public administration. The room is adjacent to the Municipal Reference Bureau, the League of Minnesota Municipalities, and a social science seminar reading room which furnishes reserve book reading material for many of the courses in which the students are enrolled. The University Library provides ready access to, and special facilities for the use of, its approximately 1,300,000 volumes, a large proportion of which are in the social sciences, including extensive serial document and periodical collections. The Law Library, with its 200,000 volumes, is immediately adjacent to the main University Library. The Industrial Relations Center, with its rich research library, is situated nearby.

The University of Minnesota is in the midst of an important area of governmental activity, with the regional offices of many of the national departments and agencies located in both of the Twin Cities, with the state capitol in St. Paul, and with county and municipal offices in each city. These numerous and varied governmental units provide an unexcelled opportunity for research and field trips and a source of experienced public administrators who generously serve as lecturers and luncheon speakers from time to time. A Minnesota chapter of the American Society for Public Administration holds frequent meetings which are open to the students in the training program.

PLACEMENT OF GRADUATES

The Public Administration Center regularly brings to the attention of students civil service examinations and other employment opportunities for which they are qualified. While the Center cannot guarantee placement of individual students, the staff members of the Center make every effort to find job opportunities for those who successfully complete the graduate training program. Also, the staff is greatly interested in the careers of former

students and frequently is able to further the advancement of alumni by suggesting them for more responsible positions. A Newsletter, a Directory, and alumni meetings in Minneapolis, Washington, and other cities serve to develop an *esprit* among Minnesota graduates.

INFORMATION CONCERNING FORMER STUDENTS

During the first seventeen years, 1936-1953, of the graduate training program in public administration 203 students studied under the guidance of the staff of the Public Administration Center. A survey made early in 1954 revealed that 54 per cent of those who have passed through the program are now in government service, 3 per cent in quasi-governmental work, 11 per cent in education, 6 per cent in military service, 13 per cent in business, and 13 per cent miscellaneous (mostly housewives). Of those in government service, about half are serving as chiefs, assistant chiefs, and assistants to chiefs of administrative units or as city managers. Most of the remainder are serving as personnel, finance, organization and methods, and research officers. Median salaries of the seventeen classes which have passed through the program range from $4,275 for the 1952-53 class to $12,500 for one of the early classes. Four of the seventeen classes reported median salaries in excess of $10,000.

The following selection of position titles held by former students (one from each of the seventeen classes) is suggestive of the types of positions for which graduates of the public administration training program may strive.

1936-37 Regional Director, Region 9, United States Department of Health, Education, and Welfare

1937-38 Executive Vice President, Research and Planning Council, San Antonio, Texas

1938-39 Adviser on International Organizations, Administration, and Budgetary Matters, United States Mission to the United Nations

1939-40 Director, Division of Management Research, United States Department of the Interior

1940-41 Senior Associate, Cresap, McCormick, and Paget (management consulting firm)

1941-42 Deputy Director, Programme and Financial Management Division, United Nations Technical Assistance Board

1942-43 Associate Professor, Swarthmore College, and Staff Director, Inter-University Case Program

1943-44 Executive Secretary, Mayor's Council on Human Relations, Minneapolis

1944-45 Classification Officer, National Institutes of Health, United States Department of Health, Education, and Welfare

1945-46 Executive Secretary, Hennepin County Welfare Board

1946-47 Village Manager, Glencoe, Illinois

1947-48 Personnel Officer, Minnesota Department of Employment and Security

1948-49 Assistant Director, Wyoming Agricultural Extension Service

1949-50 Senior Personnel Technician, Washington State Personnel Board

1950-51 Assistant Chief, Systems Division, Directorate of Program Administration, Headquarters, Air Research and Development Command

1951-52 Assistant Director, Bureau of Municipal Research and Service, University of Oregon

1952-53 Management Trainee, Atomic Energy Commission

9/24/54
9/23/54

Bulletin of the
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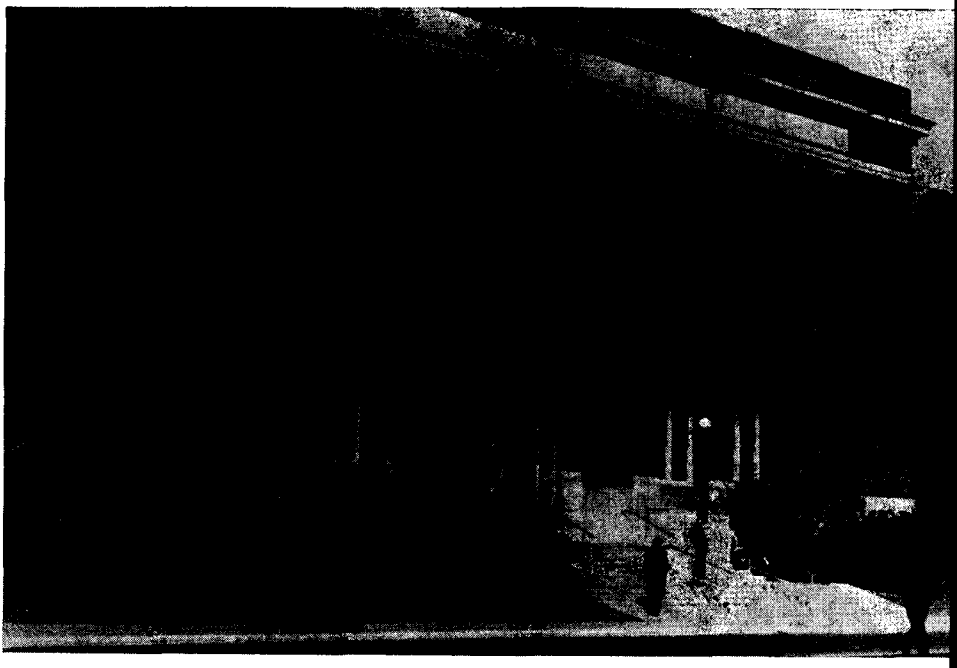

Law School 1954–1956

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William T. Middlebrook, B.A., M.C.S., Vice President, Business Administration
Robert Edward Summers, M.S., M.E., Dean of Admissions and Records
Edmund G. Williamson, Ph.D., Dean of Students

LAW SCHOOL

Faculty

Maynard E. Pirsig, B.A., LL.B., Professor of Law and Dean of the Law School
Kenneth M. Anderson, B.A., LL.M., Professor of Law
Edward S. Bade, B.A., LL.M., Professor of Law
Kenneth Culp Davis, B.A., LL.B., Professor of Law
Stanley V. Kinyon, B.A., LL.B., Professor of Law
Leon M. Liddell, B.A., LL.B., B.L.S., Professor of Law and Law Librarian
William B. Lockhart, M.A., LL.B., S.J.D., Professor of Law
David W. Louisell, B.S.L., LL.B., Professor of Law
Robert C McClure, B.S.L., LL.B., Professor of Law
Monrad G. Paulsen, A.A., B.A., J.D., Professor of Law
Henry Rottschaefer, B.A., J.D., S.J.D., Professor of Law
Charles Alan Wright, B.A., LL.B., Associate Professor of Law

Part-time Faculty

Irving R. Brand, B.S.L., LL.B., Special Lecturer in Law
Paul S. Carroll, B.A., LL.B., Special Lecturer in Law
Leonard E. Lindquist, B.S.L., LL.B., Special Lecturer in Law
Walter F. Rogosheske, B.S.L., LL.B., Special Lecturer in Law
Paul L. Spooner, Jr., B.A., LL.B., Special Lecturer in Law
Mayo H. Stiegler, B.S.L., LL.B., Special Lecturer in Law

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Supplement to the

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Law School 1954–1956

Requirements for Admission

By vote of the Law School faculty, the last sentence on page 5, *Bulletin of the Law School 1954-1956*, which reads, "A legal aptitude test is not required," should be deleted and the following substituted therefor:

> **"The taking of the Law School Admission Test given by the Educational Testing Service of Princeton, New Jersey, will be a requirement for admission to the Law School for all students planning to enter in the fall of 1955 or later. No particular score need be obtained. The results will be used in counseling and advising students who enter the Law School."**

The test will be given April 23 and August 6, 1955, at the University of Minnesota, as well as at numerous other test centers throughout the United States. Application blanks and information pamphlets about the test are obtainable from the Student Counseling Bureau, 101 Eddy Hall, University of Minnesota, Minneapolis 14; or from the Educational Testing Service, 20 Nassau Street, Princeton, New Jersey. The completed application form together with the required fee must be received in Princeton at least ten days prior to the test date.

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The Law School is in the process of improving its criteria for admission. The minimum requirement has been and still is not less than 90 quarter credits at the University of Minnesota or other accredited college, with a grade point average equal to that required for graduation by the college from which the credit is received. In addition, each applicant has been and still is required to take the Law School Admission Test given by the Educational Testing Service of Princeton, New Jersey. Heretofore the results of the test have been used in counseling and advising students, and no particular score has been required. For admission for the year 1956-57, the same requirements must be met and, in addition, the applicant's score on the Law School Admission Test, considered together with his prelaw scholastic record and such other tests or interviews as may be required, must indicate a reasonable prospect for success in law studies. Further change in the admission requirements may be made for 1957-58.

The Law School Admission Test is given 4 times yearly at 100 or more examination centers throughout the country. It will be given on April 21 and August 11, 1956 at the University of Minnesota, as well as at many other centers. On April 21 the test will be given in Alaska, Austria, Germany, Hawaii, Japan, and Korea. The fee for the test is $10. Application blanks and information pamphlets about the test are obtainable from the Student Counseling Bureau, 101 Eddy Hall, University of Minnesota, Minneapolis 14, Minnesota; or from the Educational Testing Service, 20 Nassau Street, Princeton, New Jersey. The completed application form together with the required fee must be received in Princeton at least 10 days prior to the test date.

Applicants are urged to take the April 21 test in order to facilitate the processing of their application.

Requirements for the Degree of Bachelor of Laws

At the faculty meeting on April 25, 1955, the following amendment to the *Bulletin of the Law School* for 1954-1956 was adopted:

"The requirements for the degree of bachelor of laws, referred to on pages 6 and 9 of the Law School Bulletin, for students entering the Law School with a B.A. degree or its equivalent, are fulfilled by completion of three years in the Law School plus 15 credits. The 15 credits may be earned by attending a summer session in this or another accredited Law School."

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Law School

The practice of law is only one of the opportunities open to a law graduate. Even in the practice of law there are widely different areas which the lawyer may enter. There is the general practice of law, either alone or in partnership, or in a junior position in a large legal metropolitan firm. The conditions of practice in a city differ substantially from those in the smaller communities. A substantial number of positions are constantly open to law graduates in government service, both nationally and locally. There is also a constantly increasing demand by large business organizations for lawyers in their legal departments. These positions frequently lead to important executive responsibilities. The study of law also opens up avenues to public service which lawyers render through election and appointment to various public offices. Demand for law graduates from law schools of good reputation is currently good, particularly for those with good law school records.

There is no certain test or means of determining without trial and before entering the Law School whether a student will be able to be successful in law studies. This School does not require a legal aptitude test before entering. In general a student with a good record in high school and in college has a better prospect of attaining success in his law work. Important qualities are an analytical mind combined with an interest in human, social, and public affairs. A good training in English, both in high school and college, is important. Foreign languages and mathematics are not essential but ability in mathematics is an indication of probable success in the Law School. Ability in public speaking and success in courses primarily of factual content are not indications of aptitude for law study though they may contribute in other respects. The amount of college work taken has not been shown to result in improved ability to do law school work, although for purposes of a general education it is desirable.

Employment opportunities in Minneapolis and St. Paul are substantial. However, students are strongly advised to limit their outside work to the minimum. If a substantial amount of employment is necessary the amount of work taken in school should be reduced accordingly.

In selecting a school the student should make certain that its degree will qualify him for admission to the bar of the state in which he intends to practice. Some states, for example, require registration in their state before commencing the study of law. Others require an academic degree. The American Bar Association and the Association of American Law Schools will provide the prospective applicant with a list of the schools they have approved as complying with the minimum standards fixed by these associations. As a condition of approval, a school must require two years of academic work preceding a full-time four-year law school program or three years of academic work preceding a three-year program.

GENERAL INFORMATION

The Law School of the University of Minnesota was established in 1888. It is a charter member of the Association of American Law Schools and is on the approved list of the American Bar Association.

The University is located in a large metropolitan center within easy access to federal, state, and local courts and governmental units and to their records. Judicial, legislative, and administrative hearings may be attended by students of the school. Public officials and judicial personnel may also be consulted. The library of the Law School contains approximately 208,000 volumes and is one of the large law school libraries in the United States. The general library of the University, containing approximately 1,700,000 volumes, is in close proximity to the School. These facilities provide unusual opportunities for study and research. The State Law Library, located in the State Capitol Building at St. Paul, Minnesota, is also available to students of the School.

Method of Instruction

The "case system" is the basic method of instruction. This consists of a study of selected judicial decisions in each course. A legal research and writing program extends, in progressive stages, through the four years of instruction. Seminar and tutorial courses are also available to advanced students. Under the four-year program described below, emphasis is placed on the study and use of the contributions to the legal system from nonlegal sources such as economics, political science, humanities, philosophy, and the like. The aim of the School is to provide a thorough and basic training in the law and legal techniques for the practice of law, combined with an understanding of the purposes and ideals of the administration of justice and of the legal profession, and to add to the qualifications for the leadership that is expected of the profession in the functioning of the democratic processes.

The faculty consists chiefly of resident, full-time professional law teachers who devote their time to teaching, research, and public service in their respective fields. The procedure courses are taught by men trained and experienced in actual litigation.

The Minnesota Plan

The four-year law school plan, pioneered by this School in 1930, is designed to meet the demands of modern law practice and to prepare the graduate for the larger responsibilities of the legal profession. The professional status of the lawyer demands a thorough training in the law and its techniques. But he must also have some comprehension of the purposes and methods of the legal system and the administration of justice, and of his own role and responsibilities as a lawyer and citizen if he is to provide the leadership necessary for the improvement of the law and for the advancement and development of his community and country. To enable the development of a program directed to these objec-

tives the Law School course has been extended to four years. It is felt that these aims can be better attained by this means than by extending the required period of study prior to entry into the Law School.

The first and second years in the Law School are directed to basic courses in substantive law such as Criminal Law, Contracts, Torts, Legal Research, Property, Constitutional Law, etc. The third year is concerned to a large extent with procedural law incident to the trial of a law suit and electives chosen by the student.

During the last two years courses are available which provide both technical training and unusual opportunities for a broadened conception of the legal order and the administration of justice and a better understanding of the relation of the law to other disciplines. These courses include Modern Social Legislation, Judicial Administration, International Law, Legislation, Administrative Law, Trade Regulation, Jurisprudence, Labor Law, the several seminars, and others. Thus, in Labor Law, the economic and social aspects of the labor movement are included in the study of the law of labor relations. It also includes a laboratory program in which students are taken through the arbitration and collective bargaining processes with the aid of experienced instructors. Again, the Seminar in Criminal Law is conducted jointly by the professor of Criminal Law and a specialist in post conviction procedures and administration.

Under the Minnesota Plan, the nontechnical aspects of the law are considered more particularly in the last two years, after the student has mastered the technique and art of legal reasoning and is grounded in a substantial area of the law. But in some of the earlier courses as well as in Criminal Law and Introduction to Private Law, these aspects of the subject are given special consideration. Since the law is essentially a form of social control and is concerned principally with problems of human affairs, courses generally in the Law School afford, in varying degrees, occasion for training in the technical science of law on a broad base.

During the last two years, with the approval of the dean's office, the student may elect up to 21 quarter credits of advanced work in other departments. With a substantial knowledge of law as a background, the student is in a better position to exercise a sound judgment as to the areas in which he should extend his understanding. The substantial number of electives in the third and fourth years permits a large degree of specialization both in the Law School and in other departments of the University.

Students entering the Law School with a B.A. degree or its equivalent may qualify for the LL.B. degree in three and one-half years.

Requirements for Admission

To be admitted to the Law School an applicant must have earned 90 quarter credits at the University of Minnesota or other accredited college with an average required for graduation by the college from which the credit is received. The number of required credits is not reduced by excess honor points. A legal aptitude test is not required.

The following courses, outlined by the Law School for the two years of college work required, are designed to provide an elementary knowledge of fields with which lawyers should be familiar. A distinct prelaw course is available in the College of Science, Literature, and the Arts of this University.

Accounting: Econ. 27, Accounting Survey (5 cred.) or Econ. 24-25-26, Principles of Accounting (9 cred.)

Economics: Econ. 6-7, Principles of Economics (10 cred.)

English: Engl. A-B-C, Freshman English (15 cred.) or Comp. 4-5-6, Freshman Composition (9 cred.) or Comm. 1-2-3, Communication (12 cred.) and Comp. 30, Advanced Writing for Prelegal Students (3 cred.)

History: Hist. 70-71-72, English Constitutional History (9 cred.)

Humanities: Hum. 1-2-3, Humanities in the Modern World (15 cred.)

Philosophy: Phil. 1A-2A-3A, Selected Problems of Philosophy, Selected Problems of Logic, Selected Problems of Ethics (9 cred.) or Phil. 1, 2, 3, Problems of Philosophy, Logic, Ethics (15 cred.)

Political Science: Pol. A-B (first two quarters of A-B-C), The State in the Modern World (6 cred.); and either Pol. C (3 cred.) or Pol. 25, World Politics (3 cred.)

Psychology: Psy. 1-2, General Psychology (6 cred.)

Suggested electives to make up the total of at least 90 credits or for such additional work as the student may desire to take:

Econ. 3, Elements of Money and Banking

Hist. 1-2-3, Civilization of the Modern World

Hist. 20-21-22, American History

Hum. 21, 22, 23, American Life I, II, III

N.Sci. 1-2-3, Orientation in the Natural Sciences; or N.Sci. 4-5-6, The Physical World; or N.Sci. 7-8-9, General Biology

Other courses in anthropology, economics, political science, sociology, and speech.

Courses designed for the development of physical skills or artistic talents and other courses not primarily of intellectual content may not be used for admission to the Law School.

If academic work additional to the two years is taken before entering the Law School, the foregoing courses will serve as a basis for advanced work in the same fields. Such advanced work in accounting, business, and writing courses is helpful to law practice. Likewise, a deeper insight into the problems of human affairs, with which the law deals, will be gained in the areas indicated.

Students in high school, who intend to qualify for later admission to the Law School, should study in a penetrating manner such courses as history, English, higher arithmetic, natural science, and courses dealing with current social problems.

Applicants who have a bachelor of arts or equivalent degree and a satisfactory scholastic record are admitted to a three-and-one-half-year law course, leading to the degree of bachelor of laws.

The requirements for admission of nonresidents of Minnesota are as above-specified except that the academic record should be better than average, as determined by the dean of the Law School. Applications from nonresidents must be accompanied by a credential examination fee of $5.

Students are admitted to the Law School only in the fall of the year. For dates of registration see the *Bulletin of General Information.* Application forms for admission may be obtained by writing to the Dean of Admissions and Records, University of Minnesota, Minneapolis 14.

Seven-Year Combined Courses in Arts and Law, Leading to the Degrees of Bachelor of Arts and Bachelor of Laws

This course requires three years of college work and four years in the Law School. The first two years of the college work may be taken in any accredited college, but the third year must be taken in the College of Science, Literature, and the Arts of this University. All three years of college work may be taken before entering the Law School, or two years before entering the Law School, and the third year after the completion of one year or more of law work. The latter plan enables the student to select college work in which he may become interested during his law course. The three years of college work should include the subjects specified on page 6 for the prelaw course.

Further details concerning this combined course may be obtained from the *Bulletin of the College of Science, Literature, and the Arts.*

Seven-Year Combined Course in Business Administration and Law, Leading to the Degrees of Bachelor of Business Administration and Bachelor of Laws

This program consists of two years of prelaw and prebusiness work as specified below, approximately one and one-half years in the School of Business Administration instead of the full two-year program, and three and one-half years in the Law School instead of the full four-year program thus qualifying for both the bachelor of business administration and the bachelor of laws degrees in seven years.

The prelaw and prebusiness work must amount to 90 credits, exclusive of quality credits, and shall include the regular prelaw course except Econ. 27 and in addition Econ. 5 (Elements of Statistics) and Econ. 24-25-26 (Principles of Accounting).

There are two options for the remaining five years:

A. The first year exclusively in the Law School and the second year exclusively in the School of Business Administration, or vice versa. The third and fourth years exclusively in the Law School and the fifth year to be divided between the two schools, approximately half of the program being in each school.

B. The distribution of both the business and law course throughout the five-year program.

The course requirements in business administration include the general core group courses exclusive of B.A. 51-52-53, Business Law. This amounts to a total of 36 credits. Substitutes such as Econ. 185 for B.A. 77, B.A. 184 for B.A. 89 may be made with the approval of an adviser. The remaining courses—approximately 32 credits—may be elected from the Senior College courses in economics and business administration with the approval of an adviser.

The course requirements in the Law School include all the courses of the first and second years, the required courses of the third and fourth years, and electives sufficient with the required courses to make a total of approximately 68 credits in the last two years.

Students will be registered for the joint program in the Law School and the School of Business Administration throughout the five-year period. Their programs will be subject to approval of an adviser from the Law School and an adviser from the School of Business Administration.

Combined Course in Law and Engineering

The Law School and Departments of Civil, Electrical, and Mechanical Engineering of the Institute of Technology have arranged for a joint program leading to degrees of bachelor of laws and bachelor of civil, electrical, or mechanical engineering. The details of the program may be obtained at the departmental offices or the office of the College of Engineering.

Combined Course Leading to the Degrees of Bachelor of Laws and Master of Science in Library Science

The Law School and the Library School offer a combined program leading to the respective indicated degrees. Those who are interested should consult the dean or the librarian of the Law School.

Training Project in Delinquency Control

The Law School is a joint sponsor with the Department of Sociology and the School of Social Work of a program for the training of personnel working in the field of juvenile delinquency. The regular course in Criminal Law given in the Law School will be required of students pursuing this program. The Seminar in Advanced Criminal Law is open to graduate students in the School of Social Work and the Department of Sociology upon approval of the instructors in the seminar and of the dean of the Law School.

Those interested in pursuing the undergraduate program should consult the Department of Sociology.

Degree of Bachelor of Science in Law

This degree is conferred upon those who enter the Law School without an academic degree and who have completed the first two years of work in the Law School with an average of at least 70 under the numerical system of grading used in this School. For those who do not intend to continue in the Law School beyond these two years and to qualify for the LL.B. degree, special adjustment in programming in both prelaw and law work may be made by the Law School to meet special needs and interests. This degree does not qualify for admission to the bar.

Degree of Bachelor of Laws

Those who have completed the first two years in the Law School with an average of 73 for the two years or have earned an average of 75 in one of them and not less than 70 in the other, may continue in the Law School as candidates for the bachelor of laws degree. Two additional years of work in the Law School are required of those who do not enter

with an academic degree, 21 credits of which may be earned in other departments in courses of Senior College standing and approved by the dean's office.

Courses required for the degree include Pleading, Practice, Evidence, and Legal Ethics taken in the third year. Students under the four-year program are required in addition to take courses in Modern Social Legislation, Legislation, Judicial Administration, and one seminar course.

Students entering with a B.A. degree must complete three and one-half years in the Law School.

An average of 75 in the third and fourth years is required to qualify for this degree. The degree is a prerequisite for admission to the bar of this and most other states.

Degree of Master of Laws

A candidate for this degree must have a bachelor of laws degree from this School or from another law school which is a member of the Association of American Law Schools. He must also present a superior scholastic record in his undergraduate law work. The specific program of study is planned for the individual candidate and directed toward his special purposes and interests. Ordinarily a thesis, making a substantial contribution and worthy of publication, is expected. Candidates who, in their undergraduate law work, did not receive training in the basic courses of the Minnesota four-year plan are expected to devote some course hours in these areas.

Advanced Standing

No credit is given for time spent in private reading or for study in a law office. The candidate for graduation must spend the required time in residence, either at this Law School or at some other school which is a member of the Association of American Law Schools. A student coming from such other law school must have the preliminary education required for admission to this school and must spend at least one year in attendance at this school before he can qualify for a degree. Advanced standing will be given only to students with satisfactory records, and credit may be withdrawn because of poor work in this School. Candidates should forward a transcript of their record in both prelaw and law work.

Reserve Officers Training Corps

The four-year program of the Law School permits an entering student to begin his work in any of the branches of the ROTC and to complete the requirements for a commission at the end of his final year in the Law School.

Six credits for ROTC work will be accepted toward the prelaw requirements. They cannot be used in fulfillment of the requirements for the LL.B. degree.

For further information consult the *Bulletin of General Information* and the *Bulletin of Army, Navy, Air ROTC*, or call at the Military Science and Tactics office, 106 Armory.

Expenses

Careful estimates of the expenses of a student attending the Law School, together with other general information useful to students, are to be found in the *Bulletin of General Information,*** to be had upon application to the Office of Admissions and Records. The estimated expense of a law student who is a resident of Minnesota is $1,086 per year.

Fees

All University fees are subject to modification without notice

Tuition fee per quarter (resident)	$ 53.00
Tuition fee per quarter (nonresident)	125.00
Credit hour fee (resident)	4.50
Credit hour fee (nonresident)	10.50
Incidental fee per quarter	14.00
Deposit fee (first quarter only)	5.00
Special examination fee	5.00
Graduation fee	10.00
Large diploma fee	5.00

Loan Funds

The following loan funds, made possible through the generosity of the respective donors, are available to Law School students of good character and scholarship, who have completed one year in the Law School:

Frank B. Kellogg Loan Fund—A bequest of $25,000 by the late Frank B. Kellogg.

Henry J. Fletcher Memorial Aid Fund—Consisting of gifts totaling $6,000 from Charles L. Horn, LL.B. '12, given to perpetuate the memory of the late Professor Henry J. Fletcher and to assist students attending the Law School.

Law Alumni Loan Fund—Approximately $30,000 donated by alumni and friends of the Law School. Loans are without interest for two years.

Applications for loans from these funds should be made at the dean's office.

Scholarships

Scholarships are awarded periodically, as the funds permit, on recommendation of the Law School faculty from the following funds:

Curtis Lloyd Jensen Scholarship—A fund of $10,000 bequeathed by Verna Blanche Jensen in memory of her brother, Curtis Lloyd Jensen, LL.B. '35, the income to be used for scholarship for Law School students of high character, all-around promise, and need.

Weed Munro Scholarship—A bequest of $1,000, and a residuary fund after the death of life beneficiaries, to establish a Weed Munro Scholarship in the Law School.

** See *Bulletin of General Information* for the provisions as to privilege fees for late registration.

Law Faculty Scholarship—A fund of $9,500 donated by members of the Law School faculty for scholarships in the Law School.

Garwood Lippincott Scholarship—Established in memory of Garwood Lippincott, president of the Student Editorial Board of the *Minnesota Law Review*, 1941-42, who gave his life in the service of his country. The sum of $250 is to be awarded annually to a member of the Student Editorial Board of the *Minnesota Law Review* who has completed one year's work on the board, such member to be selected by the student officers of the board for that year.

Charles B. Wartenbe Fund—Consisting of a gift of $2,000 from Mrs. Virginia Dixon Wartenbe, given in memory of her husband, a graduate of the class of 1905, to be used as a scholarship fund or for law library acquisitions.

Minnesota State Bar Foundation Scholarships—Each year this foundation, representing the bar of the state of Minnesota, provides several scholarships to needy and outstanding students of the School.

Wilbur H. Cherry Memorial Scholarship Fund—A fund totaling approximately $55,000 created through the efforts of the Minnesota Law Alumni Association and the generosity of alumni and friends in memory of the late Professor Wilbur H. Cherry for scholarships to needy and promising students of the Law School.

Students qualified for scholarships from the funds listed above should make their applications at the dean's office.

Honors

The Minnesota Law Review, now in its thirty-ninth year, is a legal periodical of the Law School. In addition to leading articles on law and related subjects, notes and comments on recent developments of the law are prepared by an editorial board consisting of students who, on the basis of their high scholastic achievements, become candidates for election to the board. Membership is a high honor and an opportunity for experience in research and writing, which is of unexcelled value in the development of professional and technical skills.

Order of the Coif—The School has a chapter of the Order of the Coif, a national honorary society of law students. Election to the society is made by the faculty at the close of the senior year from the 10 per cent of the graduating class highest in scholarship.

Student Government

Student Council—The Student Council consists of two representatives from each class and two representatives of the faculty. The council, as representative of the student body, plays an important role in the administration of the school. It supervises the functioning of the honor system under which examinations in the School are written. It has charge of social functions involving the School as a whole, such as the activities of Law School Day. It serves as an important medium for the exchange of views and suggestions between staff and students with respect to questions arising in the course of Law School operations. The council,

as representative of the student body, is a member of the American Law Students Association sponsored by the American Bar Association.

Associate Membership, Minnesota State Bar Association

A student in his senior year may become an associate member of the Minnesota State Bar Association upon payment of $1 dues. This entitles him to all the privileges of full membership except the right to vote. He may attend meetings and receives copies of *Bench and Bar,* an Association publication. Lectures by leading practitioners are sponsored by a committee of the Association on topics of special interest to those about to enter the legal profession. Membership is voluntary but is favored by the School.

University Calendar

The annual calendar will be found in the *Bulletin of General Information* which may be obtained by application to the Office of Admissions and Records, University of Minnesota, Minneapolis 14.

COURSES OF STUDY

The normal course load consists of 16 hours per week in the first, second, and fourth years and 15 hours in the third year. Additional work cannot be taken without the dean's approval.

Attendance at all classes and at all special lectures is required. All students in the Law School are required to serve as jurors or witnesses in proceedings before the Practice Court.

All courses in the first and second years are required. Pleading, Practice, Evidence, and Legal Ethics are required in the third year.

Those under the four-year program are required to take, in addition, Legislation, Modern Social Legislation, and Judicial Administration—the last two in the fourth year. In addition, one seminar is required.

Courses in the Law School

FIRST YEAR

Agency. Text to be announced. (3 cred.) Ar.

Contracts. Fuller, *Basic Contract Law.* (9 cred.) Kinyon

Criminal Law. Paulsen, mimeographed materials. (6 cred.) Paulsen, Ellingston

Introduction to Private Law. Text to be announced. (3 cred.) Pirsig

Introduction to Public Law. Davis, mimeographed materials. (3 cred.) Davis

Legal Accounting. Schapiro and Wienshienk, *Cases and Materials on Law and Accounting.* (3 cred.) Wright

Legal Research I. Price and Bitner, *Effective Legal Research;* Gowers, *Plain Words.* (3 cred.) Liddell

Property I. Fraser, *Cases and Readings on Property.* (9 cred.) Dukeminier

Torts. Schulman and James, *Cases on Torts* (2nd ed. 1952). (9 cred.) Lockhart

SECOND YEAR

Banking and Negotiable Instruments. Steffen: *Cases on Commercial and Investment Paper* (2nd ed.). (6 cred.) Kinyon

Constitutional Law. Freund, Sutherland, Howe, and Brown, *Constitutional Law Problems and Other Problems.* (6 cred.) Lockhart

Legal Research II. Wiener, *Effective Appellate Advocacy;* Price, *A Practical Manual of Standard Legal Citations.* (6 cred.) Dukeminier

Private Corporations. Ballantine and Lattin, *Cases and Materials on the Law of Corporations.* (6 cred.) Rottschaefer

Property II. Bade, *Cases on Real Property and Conveyancing.* (6 cred.) Bade

Remedies. Wright, *Cases on Remedies.* (6 cred.) Wright

Sales. Honnold, *Cases and Materials on the Law of Sales and Financing; Uniform Commercial Code,* with comments. (6 cred.) McClure

Trusts. Powell, *Cases on Trusts; Essays on Trusts.* (6 cred.) Anderson

THIRD AND FOURTH YEARS

Administrative Law. Davis, *Cases on Administrative Law.* (6 cred.) Davis

Administrative Law Seminar. No text. (3 cred.) Davis

Conflicts. Cheatham, Goodrich, Griswold, and Reese, *Cases and Materials on Conflict of Laws* (3rd ed.). (4½ cred.) Paulsen

Creditors Remedies. Moore and Countryman, *Debtor's and Creditor's Rights with Bankruptcy Pamphlet.* (6 cred.) Ar.

Criminal Law Seminar. No text. (3 cred.) Paulsen, Ellingston

Estate Planning Seminar. Shattuck and Farr, *An Estate Planner's Handbook.* (3 cred.; prereq.: must have completed Trusts, Wills, Taxation) Bade

Evidence. McCormick, *Cases and Materials on the Law of Evidence.* (6 cred.) Louisell

Family Law. Jacobs and Goebel, *Cases and Materials on Domestic Relations;* Spellman, *Successful Management of Matrimonial Cases;* Paulsen, mimeographed materials. (3 cred.) Paulsen

Income Taxation. Surray and Warren, *Federal Income Taxation* (1953 ed.); *Commerce Clearing House on Income Taxation.* (4½ cred.) Anderson

Insurance. Patterson, *Cases on the Law of Insurance* (2nd ed.); and either Vance, *Vance on Insurance* (3rd ed.), or Patterson, *Essentials of Insurance Law* (1935). (4½ cred.) Kinyon

International Law Seminar. Briggs, *The Law of Nations* (2nd ed.). (6 cred.) Liddell

Judicial Administration. Pirsig, *Cases and Materials on Judicial Administration.* (6 cred.) Pirsig

Jurisprudence. Fuller, *The Problems of Jurisprudence.* (6 cred.) Rottschaefer

Labor Law Practice. Matthews, *Labor Relations and the Law* (1953). (1½ cred.) Lockhart

Law of Labor Relations. Matthews, *Labor Relations and the Law* (1953). (4½ cred.) Lockhart

Legal Ethics. Pirsig, *Cases and Materials on Legal Ethics.* (1½ cred.) Louisell

Legislation. Read and McDonald, *Cases and Other Materials on Legislation.* (6 cred.) McClure

Local Government Law Seminar. Fordham, *Local Government Law.* (3 cred.) Wright

Modern Pleading. Clark, *Cases on Modern Pleading.* (4½ cred.) Wright

Modern Social Legislation. Riesenfeld and Maxwell, *Modern Social Legislation.* (6 cred.) Anderson

Mortgages. Campbell, *Cases on Mortgages of Real Property.* (3 cred.) Bade

Practice. Wright, *Wright's Minnesota Rules;* Louisell, mimeographed materials. (12 cred.) Louisell

Security Transactions. *Uniform Commercial Code,* with comments; mimeographed materials. (3 cred.) McClure

Trade Regulation. Schwartz, *Free Enterprise and Economic Organization.* (4½ cred.) Davis

Wills and Administration. Mechem and Atkinson, *Cases on Wills and Administration* (4th ed.). (3 cred.) Bade

Courses in Other Departments

Students under the four-year program in their third and fourth years may elect not to exceed 21 credits of work in other departments of the University approved by the dean's office. The Senior College courses

listed on page 15 may presently be taken without further application. The list is based on courses selected by students and approved by the School in areas contributing to the cultural and professional development of the lawyer. The list is subject to change. A student may apply for approval of other courses on a showing of their value to him. Only in exceptional circumstances will a Junior College course be approved.

On completion of a course, a report of its contributions to the student's development must be made to the dean's office in such form as may be specified. Credit in the Law School may be withheld in the absence of such a report.

Economics and Business

Elementary Accounting: Combined Course
Money and Banking
Transportation Services, Charges I
Business Statistics
Survey of Office Management
Life Insurance
Income Tax Accounting
Investments
Intermediate Accounting I
Intermediate Accounting II
Introduction to Industrial Relations
Elements of Public Finance
Principles of Accounting
Insurance Principles
Economics of Money and Banking
Manpower Economics, Labor Problems
Corporation Finance
Government Regulation of Business
Business Cycles
Labor Movements
Economics of Marketing
Public Finance
The Modern Corporation

English

American Literature

History

Civilization of Modern World
English History
American History
American Diplomatic History
Continental Europe
World War II
Social and Intellectual History of the United States
Europe in the Twentieth Century
Readings in Medieval English History

Humanities

Humanities in the Modern World
European Heritage

Philosophy

General History of Philosophy
Principles of Philosophy
Plato
Philosophy of Law
Introduction to American Philosophy
Elements of Symbolic Logic and Semantics
History of Religions

Political Science

National Government in the United States
Principles of the American Constitution
Legislative Organization and Procedure
Municipal Administration
Social Legislation and Social Institutions in the Scandinavian Countries
Foreign Relations
American Political Parties
Government, Politics of British Empire
American Political Thought
Problems of Democracy
Political Thought
Municipal Problems
Recent Political Thought

Psychology

Abnormal Psychology
Topics in Psychology

Social Science

Public Affairs Forum

Sociology

Social Problems
Elements of Criminology
Case Method: Study of Human Problems
Social Aspects of Housing
Intergroup Relations
The Family
Rural Community Organization

Speech

Argumentation and Persuasion