

The Bulletin *of the University of* **Minnesota**

*The College of Agriculture, Forestry,
and Home Economics*

Announcement of Courses for the Years
1938-1940



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THE COLLEGE OF AGRICULTURE, FORESTRY,
AND HOME ECONOMICS

FACULTY

ADMINISTRATION

Lotus D. Coffman, Ph.D., LL.D., President
Malcolm M. Willey, Ph.D., University Dean and Assistant to the President
Walter C. Coffey, M.S., LL.D., Dean of the Department of Agriculture
Edward M. Freeman, Ph.D., Dean of the College of Agriculture, Forestry,
and Home Economics
Edward E. Nicholson, M.A., Dean of Student Affairs
Anne D. Blitz, M.A., LL.D., Dean of Women
Rodney M. West, B.A., Registrar

AGRICULTURAL BIOCHEMISTRY

Professors Ross A. Gortner, Ph.D., D.Sc., Clyde H. Bailey, Ph.D., Leroy S.
Palmer, Ph.D.; Associate Professors David R. Briggs, Ph.D., Cornelia
Kennedy, Ph.D., W. Martin Sandstrom, Ph.D.; Assistant Professor
Reginald C. Sherwood, Ph.D.; Instructors Eleanor Barnes, M.S., Henry
Reitz, Ph.D., Charles F. Rogers, M.S.

AGRICULTURAL ECONOMICS

Professors Oscar B. Jesness, Ph.D., Austin A. Dowell, Ph.D., Warren C.
Waite, Ph.D.; Associate Professor George A. Pond, Ph.D.; Assistant
Professor Rex W. Cox, Ph.D.; Instructors E. Fred Koller, M.A., Percy
M. Lowe, M.S., Harry C. Trelogan, M.S.; Extension Specialists Spencer
B. Cleland, M.S., William H. Dankers, Ph.D., Daniel C. Dvoracek,
B.S., James B. McNulty, M.S.

AGRICULTURAL EDUCATION

Professor Albert M. Field, Ph.D.; Instructors Leigh Harden, B.S., Victor
E. Nylin, Ph.D.

AGRICULTURAL ENGINEERING

Professors William Boss, Harry B. Roe, C.E.; Associate Professors Arthur
J. Schwantes, M.S. in A.E., Mark J. Thompson, M.S.; Assistant Pro-
fessors Andrew Hustrulid, Ph.D., Jesse H. Neal, A.E., Ph.D., James
B. Torrance, B.S. in Agr., Arthur G. Tyler, B.S., Hall B. White, M.S.;
Instructors Clarence H. Christopherson, M.A., J. Grant Dent, Philip W.
Manson, B.S. in C.E., Loren W. Neubauer, M.S. in C.E., Joseph K.
Park, B.S. in A.E.

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AGRONOMY AND PLANT GENETICS

Professors Herbert K. Hayes, D.Sc., Forrest R. Immer, Ph.D., Harold K. Wilson, Ph.D.; Associate Professor Albert C. Arny, M.S.; Assistant Professor Iver J. Johnson, Ph.D.; Instructors Dean C. Anderson, M.S., Royse P. Murphy, B.S., Herman K. Schultz, M.S.; Extension Specialists Wallace W. Brookins, M.S., Ralph F. Crim, B.S. in Agr.

ANIMAL AND POULTRY HUSBANDRY

ANIMAL HUSBANDRY

Professors Walter H. Peters, M.Agr., Evan F. Ferrin, M.Agr., Laurence M. Winters, Ph.D.; Assistant Professors Philip A. Anderson, B.S. in Agr., Alfred L. Harvey, M.S., Donald W. Johnson, Ph.D.; Instructors Ralph E. Comstock, M.S., Willard W. Green, M.S.; Extension Specialists William E. Morris, M.S., Henry G. Zavoral, B.S.A.

POULTRY HUSBANDRY

Professor Hubert J. Sloan, Ph.D.; Instructor Thomas H. Canfield, B.S.; Extension Specialist Cora E. Cooke, B.S.

DAIRY HUSBANDRY

Professors James B. Fitch, M.S., Willes B. Cambs, M.A., Harold Macy, Ph.D.; Associate Professors William E. Petersen, Ph.D., Harold R. Searles, B.S. in Agr.; Assistant Professors Samuel T. Coulter, Ph.D., Thor W. Gullickson, Ph.D.; Instructors Nat N. Allen, Ph.D., Joe C. Olson, B.S.; Extension Specialists Edwin A. Hanson, B.S. in Agr., Ramer Leighton, B.S.

ENTOMOLOGY AND ECONOMIC ZOOLOGY

Professors William A. Riley, Ph.D., D.Sc., Arthur G. Ruggles, M.A., Maurice C. Tanquary, Ph.D.; Associate Professors Alexander A. Granovsky, Ph.D., Clarence E. Mickel, Ph.D.; Assistant Professors Harold H. Shepard, Ph.D., Gustav Swanson, Ph.D.; Instructors Donald M. Hatfield, M.A., Mykola H. Haydak, Ph.D., Alexander C. Hodson, Ph.D.

FORESTRY

Professors Henry Schmitz, Ph.D., John H. Allison, Ph.B., M.F., Edward G. Cheyney, B.A., Raphael Zon, B.A., B.S., F.E.; Associate Professor Thorwald S. Hansen, Ph.D.; Assistant Professors Alan J. Bailey, Ph.D., Randolph M. Brown, M.F., M.S., Louis W. Rees, Ph.D.; Instructors Henry Hansen, B.S., Ralph Lorenz, B.S.

HOME ECONOMICS

Professor Wylle B. McNeal, M.A.; Associate Professors Alice Biester, M.A., Alice M. Child, M.A., Harriet I. Goldstein, Jane M. Leichenring, Ph.D., Isabel Noble, Ph.D.; Assistant Professors Frances Dunning,

M.S., Ethel L. Phelps, M.S., Lucy A. Studley, M.A.; Instructors Margaret Brew, M.S., Carlotta M. Brown, Eva Donelson, Ph.D., Vetta Goldstein, Ethel R. Gorham, M.A., Hope H. Hunt, Ph.D., Georgia Johnson, M.S., Hedda Kafka, M.A., Grace Kern, M.S., Mildred King, M.S., Mary J. Satorius, M.A., Ruth F. Segolson, B.S., Barbara Weismann, B.E.

HOME ECONOMICS EDUCATION

Professor Wylle B. McNeal, M.A.; Associate Professors Clara M. Brown, M.A., Harriet I. Goldstein; Assistant Professor Ella J. Rose, M.A.

HORTICULTURE

Professors William H. Alderman, B.S.A., Wilfrid G. Brierley, Ph.D., Rodney B. Harvey, Ph.D.; Fred A. Krantz, Ph.D.; Assistant Professors Troy M. Currence, Ph.D., Lewis E. Longley, Ph.D., Arthur N. Wilcox, Ph.D.; Instructors Ernest Angelo, Ph.D., Arthur E. Hutchins, Ph.D., James D. Winter, M.S.; Assistant Louis Sando.

PLANT PATHOLOGY AND BOTANY

Professors Edward M. Freeman, Ph.D., Rodney B. Harvey, Ph.D., Elvin C. Stakman, Ph.D., Julian G. Leach, Ph.D.; Associate Professor Jonas J. Christensen, Ph.D.; Assistant Professors Carl J. Eide, Ph.D., Alvin H. Larson, B.S.; Instructors Clyde M. Christensen, Ph.D., Louise Dossdall, Ph.D., Helen Hart, Ph.D., Raymond H. Landon, Ph.D., Matthew B. Moore, M.S., Ian W. Tervet, B.S.

PUBLICATIONS AND RURAL JOURNALISM

Assistant Professor Harold L. Harris, B.S.

RHETORIC

Assistant Professors Robert C. Lansing, M.A., William J. Routledge, B.A.; Instructors James I. Brown, M.A., Ralph G. Nichols, M.A., William Randel, M.A., Marjorie H. Thurston, M.A.

SOILS

Professors Frederick J. Alway, Ph.D., Clayton O. Rost, Ph.D.; Assistant Professor Paul R. McMiller, M.S.

VETERINARY MEDICINE

Professors Clifford P. Fitch, D.V.M., D.Sc., Willard L. Boyd, D.V.S.; Associate Professor Howard C. H. Kernkamp, D.V.M., M.S.; Assistant Professor Martin H. Roepke, Ph.D.

For faculty of departments in other colleges contributing required and elective courses see the respective catalogs of these colleges.

GENERAL INFORMATION

ADMISSION

New students are admitted at the opening of any quarter provided a suitable program can be arranged. Prospective students, however, are advised to enter at the opening of the fall quarter if possible.

All students entering for the first time must submit their credentials to the registrar's office, University Farm, St. Paul.

Admission is either by certificate (in the case of graduates of accredited schools) or by examination.

For details of admission requirements see the Bulletin of General Information.

Graduates of the schools of agriculture of the University of Minnesota who have completed the two summers of supervised work offered in the school course, one additional school year, and one additional summer's work, or the equivalent thereof, will be admitted to the College of Agriculture, Forestry, and Home Economics.

Applicants for admission are urged to present physics (1 unit) and chemistry (1 unit), for entrance. If not completed in the high school, additional work in these subjects will have to be taken in the University. Applicants for admission to Forestry, Science Specialization Curricula, or the Wildlife Management Curricula are urged to complete higher algebra in high school. Exemption from college mathematics requirements will be made in accordance with the placement tests of the Department of Mathematics (see page 87).

Every prospective student in agriculture is urged to obtain, before entering college, at least six months' practical experience on a farm. Entering students whose farm experience credentials are not satisfactory will be examined as to their familiarity with farm practices, and farm experience will be required during the college course in accordance with the results of these examinations. For students who major in dairy husbandry at least three of the six months of approved farm experience must be on an accredited dairy farm or in a well-organized dairy manufacturing plant. For students majoring in agricultural education see farm experience requirement under Agricultural Education Curriculum, page 31.

ADVANCED STANDING

Advanced standing credit is allowed provisionally subject to one year of satisfactory work in residence. Credits in courses from any recognized institution of college grade are accepted so far as such courses are equivalent in subject-matter to required or elective work of the curriculum. Students desiring to transfer to this college after completing two years or less in a junior college or an institution in which the technical courses are not available may do so with little or no loss of credit by arranging their work to correspond as closely as possible with the following suggestions:

Pre-Agriculture and Pre-Forestry Courses in Junior Colleges

Students from accredited junior colleges who have completed the general requirements described below will be admitted to the junior class in the agricultural and forestry courses. The amount of additional time required to complete the work for the degree of bachelor of science will depend (1) upon the quality and quantity of work which such students can do and (2) upon the special curriculum which they elect. Many of these curricula may be completed in two years by students who maintain at least the average quality and quantity of work. Additional work in summer sessions or regular quarters may be necessary in some of the special curricula. Since a large number of fields of specialization are open to students, and since these curricula vary so greatly in the subject-matter courses required, it is impossible to make any more specific statement. The requirements given below can be satisfied in the average junior college which offers a fundamental arts and science curriculum. Students in some junior colleges can select additional subjects which may be directly applicable and very helpful in the field of specialization to be followed later. Students who have not completely met the requirements will be given proportional credit.

1. A total of 90 quarter credits (1 semester credit = 1.5 quarter credits)
2. Required courses:
 - (a) Botany 9 to 15 credits; general chemistry 10 to 15 credits; zoology 9 to 15 credits; rhetoric and English 9 to 15 credits.
 - (b) At least two of the following: Mathematics 9 to 15 credits; economics 9 to 15 credits; modern language 15 credits.
 - (c) Electives. Sufficient to bring total credits to a minimum of 90.

The following is a general list of electives applicable in one or more of the specialization fields. These subjects are, of course, not equally applicable in all fields. Sociology, psychology, economics, physics, history, advanced mathematics, technical business, agriculture, and engineering subjects, advanced English, public speaking, mechanical drawing, freehand drawing, surveying, qualitative, quantitative, and organic chemistry, advanced courses in zoology and botany, bacteriology, modern language (especially French and German). For prospective forestry students, physics and especially surveying are recommended.

Home Economics Courses in Junior Colleges

In planning the work in the Junior College with the idea of transferring to one of the home economics curricula the prospective transfer student should keep in mind that home economics, English, physical, biological, and social science courses are required in the freshman and sophomore years.

The prospective student should be familiar with the general requirements and attempt to satisfy them when planning the program of the first two years.

Credit may be allowed for such courses as listed above and for elective credits not listed.

REGISTRATION

In planning registration note particularly (a) prerequisites, (b) classes of students (fr., soph., jr., or sr.) to which courses are offered, (c) number of credits, (d) quarter or quarters offered, and be sure that provision is made in registration for the proper sequence of continuation courses.

Registration for courses as electives in other colleges of the University must be in conformity with regulations of the college offering the course.

Elective courses in the College of Science, Literature, and the Arts are separated into Junior College courses (numbered 1 to 49) open to freshmen and sophomores, and Senior College courses (numbered 50 to 99) open to juniors and seniors. In addition to satisfying other prerequisites a minimum of 90 credits and an honor point ratio of at least 1.0 must be earned before registering for a Senior College elective.

PSYCHOLOGICAL EXAMINATION

All new students are required to take a psychological examination on entrance as a part of the matriculation procedure. Admission, however, does not depend upon the results of the examination.

EXAMINATION IN ENGLISH COMPOSITION

All freshman students are required to take the placement test in English. Students with exceptionally high scores may be exempted from part or all of the courses in freshman rhetoric.

PLACEMENT TESTS

The college desires to bring about the best correlation possible between the technical courses in the fields of agriculture, forestry, and home economics, as taught in the schools of agriculture, in the high schools, and in other institutions. Where students have taken considerable work in these technical courses, it may be desirable for them not to be required to repeat a part or all of this work in the elementary courses in the college. The amount of work taken in the preparatory school and the quality of that work, and, finally, the question as to whether or not the subject-matter course has been used for entrance to the University, must be taken into consideration. In general, two possibilities for placement tests are offered:

1. For subjects not used for entrance to the University and in which the student has had adequate training, examinations may be taken for full credit in the elementary technical course in the college. These examinations may be taken during the first six weeks of residence without fee. After that time, a five-dollar fee is required.

2. For subjects which the student has used for entrance to the University, the student may, by satisfactory examination or by the presentation of other satisfactory evidence, be given permission to omit the elementary subject in the college course, substituting therefor credits in other subjects and taking immediately the more advanced courses in this field.

GENERAL INFORMATION

FEES	
Tuition fee, per quarter	
Residents of Minnesota	\$20.00
Nonresidents	40.00
Credit hour tuition fee (for students registered for less than full work)	
Residents of Minnesota	1.50
Nonresidents	3.00
Students in Agricultural Business Administration will pay the fees of the School of Business Administration in their junior and senior years.	
Incidental fee, per quarter	6.00
Matriculation deposit‡ (first quarter only)	
Men	15.00
Women	5.00
Special fees	
Cloquet tuition (juniors in forestry)	
Residents of Minnesota	20.00
Nonresidents	40.00
Itasca Park tuition (freshmen in forestry) prorated on basis of regular quarter tuition per quarter of 12 weeks	20.00
Physical Training for Men, per quarter course	1.00
Physical Training for Women	
All exercise courses, per quarter	1.75
Maximum fee, per quarter, \$3.50	
Vocal or instrumental music, see Bulletin of General Information for special fees	
Practice teaching laboratory, per credit hour	1.00
Examination for removal of condition	1.00
Examination for credit (after the first six weeks in residence)	5.00
Special examination	5.00
Graduation fee	7.50
Change of registration, on third day of the quarter	2.00

Laboratory fees—for individual courses. The amounts are specified in the course announcements.

LATE FEES

Late registration.—A fee of \$2 is charged for late registration or late payment of fees prior to the day classes begin, on and after which the late fee increases at the rate of \$1 per day, provided no student pay more than \$10 of late fees in any given quarter.

Change of registration.—A fee of \$2 is charged for late change of registration (if student is responsible for change and if change is made on third day of quarter). Change of registration is allowed without charge on first and second day of each quarter. No fee is charged for cancellation.

Important.—The regulations require that no student be allowed to register after the quarter opens except by special committee action.

FACULTY REGULATIONS

Students are held responsible for compliance with all faculty regulations. These regulations are published in a booklet issued to students at the time of registration.

‡ Such charges as may be incurred for lockers, library penalties, laboratory breakage, etc., will be deducted from the amount of this deposit and the balance will be refunded by mail upon graduation or after the beginning of the first quarter the student fails to return to the University. Provided that students registered for less than 5 credits shall pay a \$5 matriculation deposit.

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GRADING SYSTEM AND HONOR POINTS

There are four passing grades, A, B, C, and D, of which A is highest and D lowest. In addition there are the following nonpassing grades: E (condition), F (failure), and I (incomplete). For rules governing the nonpassing grades see the booklet of Faculty Regulations.

Honor points are awarded on the following basis: each credit hour with a grade of A counts three honor points; each credit hour with a grade of B counts two honor points; and each credit hour with a grade of C counts one honor point. A grade of D counts no honor points.

REQUIREMENTS FOR GRADUATION AND DEGREES

Candidates will be recommended for graduation after completion of the following requirements:

- A. The prescribed curriculum including all the required amount and quality of work and the required amount of elective work to make the total given below.
- B. One honor point per credit (i.e. the cumulative honor point average must be 1.0 or more). This provision does not apply to candidates in the professional curriculum in Agricultural Engineering.
- C. The English requirement for graduation (see below).
- D. A total of not less than 18 credits (inclusive of courses required in the various curricula) in social science courses including the following departments—Anthropology, Economics, Agricultural Economics, Geography, History, Political Science, Sociology, and Philosophy.

The number of elective credits required for graduation will be decreased by one for each five honor points in excess of those required to reach an honor point ratio of 1.7. This provision does not apply to candidates in the professional curriculum in Agricultural Engineering.

Course of Study	Credit Requirement	Degree Conferred
Technical Agriculture	204	Bachelor of science
Science Specialization	192	Bachelor of science
Food Technology	192	Bachelor of science
Wildlife Management	192	Bachelor of science
Agricultural Education	204	Bachelor of science
Forestry	204	Bachelor of science
Home Economics	185	Bachelor of science
Agricultural Extension	204	Bachelor of science
Agricultural Engineering (Professional).....	210	Bachelor of agricultural engineering
Agricultural Business Administration	192	Bachelor of business administration in agriculture
Agricultural Journalism	192	Bachelor of science

ENGLISH REQUIREMENT FOR GRADUATION

Every student before graduation must demonstrate an acceptable proficiency in English composition. This is comparable or equivalent to the completion of Rhetoric 51. If this is not accomplished before the end of the

sophomore year, the student must complete Rhetoric 51, three credits, in the junior or senior year.

Students, upon entering the college, are registered in Rhetoric 1 or 2 according to their tests in proficiency in English. Those students who maintain a very high standard in Rhetoric 2 and 3 and who complete suitable tests, may be exempted from the requirement of Rhetoric 51.

SCHOLARSHIP REQUIREMENTS

1. Students must present for graduation at least one honor point for each credit; i.e., the cumulative honor point average must be 1.0 or more.

2. Freshman students with an honor point average of less than 0.25 obtained in two or three quarters of work in this college and sophomore students with an honor point average of less than 0.5 obtained in six quarters in this college or of five quarters if entering in the winter quarter, shall be dropped for one year unless continued by special permission of the Students' Work Committee.

3. Classified students who have completed 90 credits with an honor point average of less than 1.0 but more than 0.5 may be permitted to take additional courses to attain the required honor point ratio of 1.0, but shall not be permitted to register for junior-senior courses without the approval of the adviser and the Students' Work Committee.

4. A student who has completed 90 credits with an honor point ratio of at least 1.0 will be classified as a junior and will be admitted to candidacy for the Bachelor's degree from this college.

Degree with distinction.—The degree of bachelor of science with distinction is granted to graduates of this college who have attained excellence in scholarship as evidenced by an average grade of two honor points per credit for the entire four-year curriculum. Transfer students with less than two years of work in this college shall not be eligible. Recommendations to the faculty for the degree with distinction shall be made through the Students' Work Committee on the basis of scholarship and other evidence of satisfactory achievement and advancement in the courses pursued.

Degree with high distinction.—The degree of bachelor of science with high distinction is granted to graduates of this college who have attained special excellence in scholarship as evidenced by an average of two and one-half honor points per credit for the entire curriculum. The same conditions for residence and recommendation apply as for the degree with distinction.

BOARD AND ROOM

Sanford Hall.—A dormitory for university women is located near the Minneapolis campus. It accommodates 225 women, about one half of whom are freshmen. Applications should be sent to the director of Sanford Hall, University of Minnesota.

College Girls' Dormitory, University Farm.—A dormitory residence for girls in the College of Agriculture, Forestry, and Home Economics is located on the University Farm campus. All applications for residence must be for

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the entire year. About fifty students may be accommodated. The dormitory is closed during vacations.

The charge per quarter is \$30 for a single room and \$24 per student for a double room. The room rent for each quarter is payable the first week of every quarter. The number of single rooms is limited. Meals are not served at the dormitory, but can be obtained at the University Farm cafeteria at reasonable rates.

Necessary bedding is provided and the bed linen laundered. Girls should provide their own couch covers.

Applications for rooms should be made early. A deposit of \$5 is made when the room is engaged. Communications regarding reservations or further information should be addressed to Cashier, University Farm, St. Paul, Minnesota.

Private houses.—For information concerning approved boarding and rooming houses, address the Housing Bureau, University of Minnesota, Minneapolis, Minnesota.

STUDENTS' BOOKSTORE

The University owns and operates the Students' Bookstore for the convenience of students and faculty.

A student agency for the sale of used or second-hand books is maintained in the office of the Y.M.C.A. in the Administration Building, at University Farm.

EXPLANATION OF TERMS AND COURSE NUMBERS

The quarters in which courses are offered are indicated by the letters f (fall), w (winter), s (spring) and su (summer) following the course number. For example: 5f,w,s indicates that Course 5 is given in the fall quarter and is repeated in the winter and again in the spring quarter; 5f-6w indicates a two-quarter course extending through the fall and winter quarters; and 5f,w-6w,s indicates that Course 5-6 is given in the fall and winter quarters and repeated through the winter and spring quarters.

All undergraduate courses are numbered from 1 through 99; 1 through 49 open to freshmen and sophomores; 50 through 99 open to juniors and seniors.

Numbers following the descriptive name of a course indicate the number of credit hours.

Course numbers in parentheses, following the number of credit hours, indicate prerequisite courses.

Descriptions of the courses listed in the following outline of the curricula, together with those of additional courses offered as electives, will be found on pages 55-100. The program of classes is printed in the Combined Class Schedule. The divisional statements are arranged alphabetically according to the names of the divisions.

One *credit hour* is equivalent to (1) one lecture or recitation period requiring two hours of preparation, (2) two periods of laboratory work

requiring one hour of preparation, or (3) three periods of laboratory work with no preparation, each week for one quarter.

Honor points.—See page 10 for definition.

A *major* is a series of courses equivalent to from 24 to 36 credit hours chosen from one of the elective groups.

A *minor* is a series of courses equivalent to 18 credit hours (12 credit hours in Science Specialization Curriculum) chosen from one of the elective groups.

A *required* course is a course required of all students for graduation irrespective of their major sequence.

A *limited elective* course is an elective which may not be chosen from the same group as the major or minor.

A *free elective* course may be chosen from any courses offered in the University for which the student has completed the prerequisites.

CURRICULA

A. ALL-COLLEGE

(See pages 18-20)

Science Specialization.—This curriculum provides for more intense specialization, particularly in the sciences basic to many fields of agriculture. Only that amount of technical training in practical agriculture is required which deals with the special science or field selected. Selection of the Science Specialization Curriculum should, in practically all cases, be followed by graduate study to at least the Master's degree. Students who do not have a high school record considerably above average should not attempt the Science Specialization Curriculum. For special scholarship requirements of this curriculum, see page 18.

B. AGRICULTURE

(See pages 21-38)

I. Technical Agriculture.—These curricula are arranged for students who plan to follow one or more of the technical or applied fields of agriculture immediately upon graduation. Students may, however, continue in graduate work for further specialization. Training is offered for all types of farming in this area, for county agent and extension work, and for technical agricultural work in agricultural industries in dairy and animal husbandry, agronomy and plant industries, horticulture, agricultural engineering, landscape gardening, farm management, agricultural economics, and business.

Students may also select the Technical Agriculture Curricula for special technical preparation in the agricultural sciences or fields represented by the various divisions of the college. After such specialization graduate work is usually advised. (For more intense and restricted specialization in the agricultural sciences, see Science Specialization Curriculum.)

For special training for teaching agriculture in high schools and for agricultural extension and county agent work, see Agricultural Education Curriculum and Agricultural Extension Curriculum.

II. Food Technology.—This curriculum provides special training in preparation for industrial fields such as meat packing; processing, storage, and distribution of fruits, vegetables, and other perishables; canning and pickling. It includes also milk products and the products of milling and related industries. While this is a normal four-year curriculum certain scientific specialties may demand graduate work.

While the employment possibilities are probably chiefly in the various food industries, additional opportunities exist in research and in teaching in connection with various federal, state, and municipal government bureaus and offices as well as in colleges and in private research institutions.

III. Wildlife Management.—The curriculum will be selected and built up with the aid of an adviser for the special vocational or professional ob-

jectives which the student has in mind. The work involves a wide range of activities including the management of upland game, big game, waterfowl, fish, and fur bearers in parks and forests, and on wildlife preserves and privately owned lands; it also includes the artificial propagation of game and fur species and the encouragement of non-game species. Students in this curriculum may prepare themselves for teaching in colleges and universities, for research and experimental work in various state and federal departments, and for management and extension work in state and federal departments concerned with utilization of our natural resources. (See also Game Management in Forestry Curriculum.)

IV. *Pre-Veterinary Medicine*.—This curriculum of one year may vary in accordance with the veterinary college to be selected by the student. In general, the requirements would follow the plan of the Science Specialization Curriculum, but special variations from this curriculum may be provided upon recommendation of the adviser. Because of the grade requirements for entrance to veterinary colleges an average grade of close to B in pre-veterinary medicine is essential.

V. *Agricultural Education*.—Designed especially for those who plan to teach agriculture in the public schools. This curriculum (given jointly with the College of Education) follows in general the technical agriculture groups and permits emphasis on majors in special technical agriculture fields, such as dairying, horticulture, farm management, etc. In addition, it offers special training in education and leads to certificates for teaching agriculture and sciences in high and elementary schools of the state.

VI. *Agricultural Extension*.—Designed for training for agricultural county agents, extension specialists, boys' and girls' club leadership, and other specialties in agricultural extension. No single curriculum is prescribed because of the numerous variations which are possible and desirable. In general, the student is advised to select a curricular pattern in Technical Agriculture or in Agricultural Education. Around the selected pattern the student, with the help of his adviser, may build the curriculum best suited to his needs. A wide range of valuable subject-matter is available in this and other colleges of the University. For a more complete discussion, see page 32.

VII. *Agricultural Engineering (Professional)*.—Offered jointly with the Institute of Technology. This is a technical engineering course leading to the degree of bachelor of agricultural engineering. The first two years are spent in work in the Institute of Technology and the last two in work in both colleges. High school mathematical preparation required for all engineering curricula is also required here. The Agricultural Engineering (Professional) Curriculum is designed to train specialists in various types of engineering fundamental to agricultural practices and industries.

Students desiring a major in agricultural engineering with special reference to the technical application and without the professional engineering training should register for a Technical Agriculture Curriculum.

VIII. *Agricultural Engineering Business Administration*.—Offered jointly with the Institute of Technology and the School of Business Administration. This is a technical engineering and business curriculum with emphasis

in the field of agriculture. The preliminary requirements are similar to those of the Professional Course in Agricultural Engineering. In addition to the required professional work in engineering a complete sequence of business courses is required together with a sequence of agricultural courses. Students completing this curriculum will receive the degrees both of bachelor of agricultural engineering and bachelor of business administration.

Students interested in this course should consult the head of the Division of Agricultural Engineering, University Farm, St. Paul, Minnesota.

IX. *Agricultural Business Administration*.—Offered jointly with the School of Business Administration. Designed for those who wish to prepare for some branch of agricultural business, such as marketing, finance, farm real estate, merchandising, and so forth. More opportunity is offered for business and economic courses than in the Technical Agriculture Curricula, where greater stress is on the agricultural subjects. In the first two years students register in the College of Agriculture, Forestry, and Home Economics; in the last two years in this college and in the School of Business Administration.

X. *Agricultural Journalism*.—Offered jointly with the Department of Journalism of the College of Science, Literature, and the Arts. Designed for those who wish to prepare especially for some field of journalism relating to agriculture. The student is offered general courses in technical agriculture, but the major part of the last three years is occupied with special preparation for technical journalism. Particular stress is also laid on economic and business courses related to agriculture.

C. FORESTRY

(See pages 39-45)

Four professional and two technological curricula are available in forestry.

A. PROFESSIONAL CURRICULA*

I. *General Forestry*.—Preparation for technical work in public and private service involving management of forests and forest crops.

II. *Range Management*.—Preparation for range and forest management work.

III. *Game Management*.—Preparation for combined forestry and game management.

IV. *Forest Sciences*.—Opportunity for specialization in the sciences basic to the various fields in forestry. This curriculum should not be selected

* Because of the increasingly rigid requirements for the practice of professional work in the several technical fields of forestry, because of the increasing range of information and training required in the fundamental, biological, and physical sciences, and in the social sciences, and also because of the increasing number of technical and professional courses in forestry, serious consideration is being given to the necessity for not less than five years of college work in the various professional curricula. Students in these curricula may be required to transfer to a five-year curriculum if they wish to obtain a professional degree in forestry. All other students who would not be affected by this change, if and when made, are urged to give serious consideration to the advantages of devoting five years to professional training. Keener competition in the future can be successfully met only by more adequate and better professional training.

unless the student has a high school record or a college freshman year record considerably above the average. It is assumed that students following this curriculum will take graduate work at least to the master of science degree.

B. TECHNOLOGICAL CURRICULA

V. *Commercial Lumbering*.—For those who wish to enter some field of lumbering.

VI. *Forest Technology*.—Preparation for manufacture of pulp, paper, and other wood products.

D. HOME ECONOMICS

(See pages 46-54)

I. *Dietetics*.—For persons expecting to become hospital dietitians. Students selecting this course should be sure of an aptitude for, and ability in, the physical and biological sciences and should have a high school record of better than average.

II. *Home Economics Education*.—Offered jointly with the College of Education. For those who wish to teach home economics in the high schools and obtain a teacher's certificate. Students should have a high school record better than average.

III. *Home Economics in Business*.—For students who wish to use their training in business where a knowledge of home economics is essential. Given with the co-operation of the School of Business Administration.

IV. *Institution Management*.—Preparation for management of such institutions as tearooms, cafeterias, dormitories, and institutional homes, etc.

V. *General Home Economics*.—A four-year program of home economics and general education courses designed for those who do not wish to fit themselves for any specialized field in home economics but are interested chiefly in preparation for homemaking.

VI. *Home Economics and Nursery School Education*.—A combination course designed for those who have ability and interest in the two fields.

VII. *Home Economics Related Science Curriculum*.—Opportunity is offered for emphasis on the sciences basic to certain fields in home economics. It is assumed that the student will take graduate work at least to the Master's degree. This curriculum should be chosen only by those who have an excellent high school record and an aptitude for science.

VIII. *Preparation for Research in (a) Textiles and Clothing or (b) Foods and Nutrition*.—An undergraduate preparation for graduate work as a basis for more intense specialization in fields of home economics research. For those who plan a scientific research career in home economics. Students who do not have a high school record or a college freshman record considerably above the average should not attempt this course. Graduate work to at least the Master's degree is assumed.

IX. *College Teaching*.—A specialized curriculum for undergraduate preparation for graduate work leading to teaching home economics at the college level. Previous teaching experience and special aptitude are essential. Graduate work is, of course, assumed.

(For Science Specialization Curriculum, see page 18.)

A. ALL-COLLEGE CURRICULA

SCIENCE SPECIALIZATION

This curriculum is designed as a preparation for teaching in colleges and universities, for research and experimental work in experiment stations, for regulatory, experimental, and extension service in the state and federal departments of agriculture, forestry, and home economics, and in the industries related to these fields. For opportunities offered in the various fields the student is advised to consult with the various divisions and with the dean of the college.

Only those students who have a high school record considerably above the average and who are capable of maintaining a high scholarship record and who desire to delve deeply into specialized science fields should attempt to follow this curriculum. In general it is assumed that students who complete this undergraduate curriculum subsequently will spend one or more years in graduate study. Success in graduate study usually is predicated upon an undergraduate scholarship record which is distinctly above the average. In order to qualify for possible graduate fellowships or assistantships it is essential that the student on completing this curriculum should have maintained an honor point average approximating 2.0 or better.

The attention of the student is called to the modern language requirement for graduate students. In most divisions either German or French is required for the Master's degree. In all divisions *both* German and French are required for the degree of doctor of philosophy. Proficiency in at least one modern language (preferably German) should be acquired during the undergraduate years. Beginning German may be taken in either the 1-2-3 (15 credits) or 24-25-26 (12 credits) sequences.

The modern trend in the physical sciences is more and more toward a mathematical interpretation. Higher mathematics including calculus has proved a very potent scientific tool in many fields. Those students who plan to major in either biochemistry or forestry should ordinarily plan to secure more mathematics than is represented in the required list of subjects, and students specializing in these fields will also be expected to include a number of physics courses in their study program.

REQUIREMENTS

(See page 10 also.)

This curriculum requires 192 credit hours for graduation and is made up of (1) freshman-sophomore required courses with such options as are indicated in the freshman and sophomore years, and (2) a major, a minor, and electives in the junior and senior years in accord with the schedule given below.

In the freshman and sophomore years a grade of C must be earned in Math. 1-6-7, Chemistry 1-2-3 (9-10), Zoology 1-2-3 (14-15 and 3 additional credits of zoology or physiology or economic entomology and zoology), in

Botany 1 plus six additional credits in Botany, Bacteriology 41, Agricultural Biochemistry 4, 5 (or 6).*

In the junior and senior year the major and minor sequence must be completed with an average honor point ratio of 1.5.*

Special attention of every student is called to the faculty requirements for classification in the junior class, pages 10-11.

FRESHMAN YEAR

1. *Noncredit courses* required for graduation in addition to the 192 credit hours.
Freshman Assembly. A course of lectures offered only in the fall quarter.
2. *General courses.*—The following courses may be registered for any quarter that they are offered except that the proper sequence of continuation courses and the prerequisites must be observed.
 - Bot. 1f,w,s,† General Botany, 4, and 6 cred. selected from the following: Bot. 2, 5, 7, 12, 13, 21, 22.
 - Inorg. Chem. 1f-2w-3s, General Inorganic Chemistry, 12. Students presenting a year of high school chemistry may omit this course and register for Inorg. Chem. 9-10.
 - Inorg. Chem. 9f,w-10w,s, General Inorganic Chemistry, 10 (1 yr. of high school chem.) Those required to take Inorg. Chem. 1-2-3 may omit this course.
 - Math. 1f,w,s,§** Higher Algebra, 5; Math. 6f,w,s, Trigonometry, 5 (Math. 1 or equiv.); and Math. 7f,w,s, College Algebra, 5 (Math. 6)
 - Modern language,§ 15 cred. or special sequence of 12.
 - P.M.&P.H. 3f,w,s,¶ Personal Health, 2.
 - Rhetoric 1f,w,s-2w,s,f-3s,f,w, Rhetoric, 9
 - Zoology 1f-2w-3s,† General Zoology, 10 or Zool. 14f-15w, General Zoology, 6 and 3 additional credits of zoology or physiology or economic entomology and zoology. (Ent. 49s, 3 cred. or 5f,w,s, 5 cred. suggested)

SOPHOMORE YEAR

1. *General courses.*—The following courses may be registered for any quarter that they are offered except that the proper sequence of continuation courses and the prerequisites must be observed.
 - Agr. Biochem. 4f,w, Introduction to Organic and Biochemistry, 5 (Inorg. Chem. 10 cred.)
 - Agr. Biochem. 5s, Plant Biochemistry, 5 (Agr. Biochem. 4, Soils 6); or Agr. Biochem. 6f, Animal Biochemistry, 5 (Agr. Biochem. 4, Soils 6)
 - Agr. Econ. 1f,w, Principles of Economics I, 3
 - Agr. Econ. 2w,s, Principles of Economics II, 5 (Agr. Econ. 1)
 - Bact. 41f,w,s, General Bacteriology, 5 (chem., zool.)
 - Bot. 1f,w,s,† General Botany, 4, and 6 cred. selected from the following: Bot. 2, 5, 7, 12, 13, 21, 22

* These regulations will become effective fall quarter, 1938-39, for all new high school and advanced standing students and for students in residence 1937-38 or before who become juniors in the fall quarter, 1938-39 or later.

† One of these two, botany or zoology, must be taken in the freshman year and the other in the sophomore year.

§ One of these two, mathematics or modern language, must be taken in the freshman year and the other in the sophomore year.

¶ Three credits in Physical Education are required for women in this curriculum.

** Students will be exempt from the required mathematics courses only in accordance with the placement tests given by the Department of Mathematics (see page 87). For any exemption the student will be required to substitute an equivalent number of credits (mathematics or electives) as approved by his adviser.

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Math. 1f,w,s,§ Higher Algebra, 5; Math. 6f,w,s, Trigonometry, 5 (Math. 1 or equiv.); and Math. 7f,w,s, College Algebra, 5 (Math. 6) if not taken in freshman year. Modern language, 15 cred. or special sequence of 12, if not taken in the freshman year.
Rhet. 11f,s, Argumentation, 3 (Rhet. 3, Rhet. 22 advised) or Rhet. 22f,w,s, Public Speaking, 3 (Rhet. 3)
Soils 6w, Soils, 5 (Agr. Biochem. 4)
Zoology 1f-2w-3s,† General Zoology, 10 or Zool. 14f-15w, General Zoology, 6 and 3 additional credits of zoology or physiology or economic entomology and zoology. (Ent. 49s, 3 cred. or 5f,w,s, 5 cred. suggested)

JUNIOR AND SENIOR YEARS

1. Rhet. 51f,w,s, Exposition, 3 (Rhet. 3)
2. A major sequence of 24 to 36 credits in one of the following fields or divisions:
 1. Agricultural Biochemistry
 2. Agricultural Economics
 3. Agronomy and Plant Genetics
 4. Animal Husbandry
 5. Animal Nutrition
 6. Dairy Husbandry
 7. Entomology and Economic Zoology
 8. Forestry
 9. Home Economics
 10. Horticulture
 11. Plant Pathology
 12. Poultry Husbandry
 13. Soils
 14. Veterinary Medicine
3. A minor sequence of 12 credits to be chosen in some division (see major), department, or field of work outside of the major.

Subject-matter courses from one division or from departments of other colleges of the University may be applied as major or minor credits in another division if they are clearly related or fundamental to the field of the major or minor specialization.

4. Electives sufficient to make a total of 192 credit hours for the four years of work of which at least 21 credit hours must be in technical agriculture, forestry, home economics, or in sciences fundamental thereto.

† One of these two, botany or zoology, must be taken in the freshman year and the other in the sophomore year.

§ Students will be exempt from the required mathematics courses only in accordance with the placement tests given by the Department of Mathematics (see page 87). For any exemption the student will be required to substitute an equivalent number of credits (mathematics or elective) as approved by his adviser.

B. CURRICULA IN AGRICULTURE

- I. Technical Agriculture, page 21.
- II. Food Technology, page 26.
- III. Wildlife Management, page 28.
- IV. Pre-Veterinary Medicine, page 31.
- V. Agricultural Education, page 31.
- VI. Agricultural Extension, page 32.
- VII. Agricultural Engineering (Professional), page 34.
- VIII. Agricultural Engineering Business Administration, page 15.
- IX. Agricultural Business Administration, page 35.
- X. Agricultural Journalism, page 37.

I. TECHNICAL AGRICULTURE

REQUIREMENTS

(See page 10 also.)

These curricula require 204 credit hours for graduation, including:

- A. Freshman-sophomore years—Required courses. Required of all students registered in Technical Agriculture, pages 21-23.
- B. Junior-senior years—Elective curricula, chosen in accordance with one of the two following methods:
 - a. "Major elective curricula," in which the student, with the help of his adviser, constructs his own curriculum, pages 23-24.
 - b. "Suggested curricula," complete and specific, arranged by faculty committees, pages 24-26.

Special attention of every student is called to faculty regulations for classification in the junior class, pages 10-11.

A. FRESHMAN-SOPHOMORE YEARS—REQUIRED COURSES

These courses are required of every student before graduation. They constitute approximately half of the curriculum and are considered fundamental and necessary to any curriculum in technical agriculture. Every student must complete these courses, if possible, before the end of the sophomore year. Modifications in the requirements may be permitted upon approval by the Students' Work Committee where students have a very definite objective in their college curriculum in which substitutions for certain of the listed freshman and sophomore required courses may profitably be made. Approval of the adviser by special letter must be presented with the petitions to the Students' Work Committee.

For some students the outline of the first two years, given below, represents more than the regular amount of work of 17 credit hours per quarter. In such cases those subjects which cannot be taken in the freshman and sophomore years must take precedence the following year. Nine credits in English are also required in the junior year. Phys. Ed. 1-2-3, Physical Education, 3 credits (credit is allowed only when the three quarters are

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completed) and Military Drill may be taken in addition to the regular schedule if desired. Care should be taken in registration to give precedence to courses offered only one quarter.

FRESHMAN YEAR

1. *Noncredit courses* required for graduation in addition to the 204 credit hours.
Freshman Assembly. A course of lectures offered only in the fall quarter.
2. *General courses.*—The following courses may be registered for any quarter that they are offered except that the proper sequence of continuation courses and the prerequisites must be observed.
Agr. Eng., 3 credits elected from the following: 3w,s, Mechanical Drawing, 3; 5w, Farm Building Construction, 3; 12s, Agricultural Machinery, 3; 13f,s, Gas Engines, 3; 28w, Land Clearing, 3; 31w,s, Principles of Drainage, 3; 37f,w, Rural Sanitation, 3. One or more of these courses are required in the junior and senior years of several of the outlined curricula. If completed in meeting this requirement some other of the above courses must be substituted in the junior or senior year.
Agron. 1f,s,* General Farm Crops, 3
An. Husb. 1f,w-2w,s,*† Market Livestock Production, 6
Bot. 1f,w,s, General Botany, 4, and 6 credits selected from the following: Bot. 2, 5, 7, 12, 13, 21, 22. Three of these credits may be selected from plant science courses given at University Farm.
Dy. Husb. 1f,s,*† Elements of Dairying, 5
Hort. 6f,* Fruit Growing, 6; or Hort. 32s, Vegetable Growing, 3 (Hort. 6 required of Agricultural Education students)
Inorg. Chem. 1f-2w-3s, General Inorganic Chemistry, 12. Students presenting a year of high school chemistry may omit this course and register for Inorg. Chem. 9-10.
Inorg. Chem. 9f,w-10w,s, General Inorganic Chemistry, 10. (1 yr. of high school chem.) Those required to take Inorg. Chem. 1-2-3 may omit this course.
Math 1,§ Higher Algebra, 5 cred., or Agr. Eng. 11w, Applied Mathematics, 5
P.M.&P.H. 3f,w,s,¶ Personal Health, 2
Rhet. 1f,w,s, Rhetoric I, 3
Rhet. 2f,w,s, Rhetoric II, 3 (Rhet. 1)
Rhet. 3f,w,s, Rhetoric III, 3 (Rhet. 2)

SOPHOMORE YEAR

1. *Freshman courses* which were not completed during the freshman year.
2. *General courses.*—The following courses may be registered for any quarter that they are offered, except that the proper sequence of continuation courses and the prerequisites must be observed.
Agr. Biochem. 4f,w,** Introduction to Organic and Biochemistry, 5 (Inorg. Chem. 10 cred.)
Agr. Biochem. 5s,** Plant Biochemistry, 5 (Agr. Biochem. 4, Soils 6); or Agr. Biochem. 6f, Animal Biochemistry, 5 (Agr. Biochem. 4, Soils 6)

* Graduates of the university schools of agriculture or students presenting high school work in any of these courses may, upon approval of their adviser and the head of the division in which the course is taught, substitute elective courses.

† Students who expect to major in a special horticultural field may substitute for these courses 11 credits approved by the chief of the Division of Horticulture.

§ Students will be exempt from Math. 1 who pass the placement test given by the Department of Mathematics requiring the equivalent of Math. 1, Higher Algebra (see page 87). For any exemption the student will be required to substitute an equivalent number of credits (mathematics or electives) as approved by his adviser.

¶ Three credits of Physical Education are required for women in this curriculum.

** Students who expect to major in agricultural education may substitute 10 credits elective for this course with the approval of the chief of the Division of Agricultural Education.

Agr. Econ. 1f,w, Principles of Economics I, 3
 Agr. Econ. 2w,s, Principles of Economics II, 5 (Agr. Econ. 1)
 Agr. Eng. 23f,s, General Physics, 5. Those presenting a year of high school physics may omit this course and substitute 5 credits elective later in their curriculum.
 Bact. 41f,w,s, General Bacteriology, 5 (chem., zool.)
 Ent. 5f,w, Economic Entomology, 5 or Ent. 49s, Introductory Entomology, 3 (Zool. 14-15 or equiv.)
 Forestry 10w, Farm Forestry, 3
 Soils 6w, Soils, 5 (Agr. Biochem. 4)
 Zool. 14f-15w, General Zoology, 6

JUNIOR YEAR

Rhet. 11f,s, Argumentation, 3 (Rhet. 3, Rhet. 22 advised) or Rhet. 24s, Advanced Public Speaking, 3 (Rhet. 22) or Rhet. 31f,w,s, Survey of English Literature I, 5 (Rhet. 3) or Rhet. 32f,s, Survey of English Literature II, 3 (Rhet. 3) or Rhet. 60w,s, Contemporary Literature, 3 (Rhet. 3)
 Rhet. 22f,w,s, Public Speaking, 3 (Rhet. 3)
 Rhet. 51f,w,s, Exposition, 3 (Rhet. 3)

B. JUNIOR-SENIOR YEARS—ELECTIVE CURRICULA

The work of the junior-senior years in Technical Agriculture must be selected from one of the two following:

- a. Major elective curricula
- b. Suggested curricula

Every student is required to file in the registrar's office by the end of his sophomore year a statement of the method and curriculum, approved by his adviser, which he plans to pursue during his junior and senior years. Such statements from each student will make it possible to provide a workable program of subject courses. The student may make, and is strongly advised to make, this statement at the end of his freshman year. In this case he would have ample opportunity to change his curriculum at the end of the sophomore year. A change from one curriculum to another after the close of the sophomore year is permitted only on approval and does not exempt the student from any of the requirements of the curriculum which he finally selects. Such changes usually involve inconvenience and sometimes loss of credit to the student. Special attention of the student is called to the faculty requirements for classification in the junior class. All students are invited to consult with the dean of the college concerning the selection of curricula.

Method A.—*Major Elective Curricula—Junior-Senior Years*

Recommended for those students who are preparing themselves for some special line of work and who have definitely in mind the relations of subjects and courses offered to this special line of work.

Under this method the student, with the approval of his adviser, may select any curriculum which complies with the following requirements:

1. A major of from 24 to 36 credit hours, to be selected from one of the main groups or subgroups listed below.
2. A minor of 18 credit hours, to be selected from a different main group from that of his major.

With the approval of the adviser and the Students' Work Committee, the major and minor may be selected from two different subgroups of one main group, and a minor may be taken in a related department of some other college of the University.

Subject-matter courses from any group or subgroup or from departments of other colleges of the University may be applied as major or minor credits in any group or subgroup if they are clearly related or fundamental to the group or subgroup of the major or minor specialization.

3. Limited electives, 18 credit hours, which must be selected outside of the groups from which the major and minor have been chosen, in order to broaden the educational base, and
4. Free electives sufficient to meet the number of credit hours required for graduation chosen from any of the courses offered in the University and approved by the adviser.

Major Elective Groups and Subgroups

- | | |
|---|---|
| 1. Agricultural Economics | 5. Science Specialization Majors (See also Science Specialization Curriculum, page 18.) |
| 2. Agricultural Education. For suggested curriculum and teacher's certificate, see page 31. | Agricultural Biochemistry |
| 3. Animal Industry | Entomology and Economic Zoology |
| Animal Husbandry | Plant Genetics |
| Dairy Husbandry | Plant Pathology and Botany |
| Poultry Husbandry | Soils |
| Veterinary Medicine | 6. Agricultural Engineering. (For Engineering (Professional) Curriculum, see page 34.) |
| 4. Plant Industry | |
| Agronomy and Plant Genetics | |
| Horticulture | |

Method B.—Suggested Curricula—Junior-Senior Years

The following curricula have been arranged and are recommended by the several departments as useful and suggestive. Changes may be made with the approval of the adviser and the Students' Work Committee. These specified curricula are offered in the hope that they will also be of value to the students in vocational guidance. Students who desire to select any of these curricula with modifications should study the changes involved to see whether or not the desired modifications admit of a possible program.

Suggested Curricula—Summary

- | | |
|---|----------------------------------|
| 1. General Agriculture, see below. | 4. Animal Husbandry, page 25. |
| 2. Agricultural Economics, page 25. | 5. Dairy Husbandry, page 25. |
| 3. Agricultural Engineering (General), page 25. | A. Dairy Production, page 26. |
| (For Engineering (Professional) Curriculum, see page 34.) | B. Dairy Products, page 26. |
| | 6. Horticulture, page 26. |
| | 7. Landscape Gardening, page 26. |

1. GENERAL AGRICULTURE

Recommended for those students who desire a general curriculum in agriculture. It is designed especially for those who aim to obtain a broad general training and for those who expect to engage in general farming.

It emphasizes two features, viz.: to include in its subject-matter the principal fields of study in agriculture and to select the essential courses necessary to an understanding of these fields. A sufficient number of electives is provided to permit the student to emphasize any special line in which he may become interested.

This curriculum is completely included in the curricula in agricultural education and agricultural extension. It is included, with only a few substitutions, in the curricula in animal husbandry, dairy husbandry, and in horticulture.

Agr. Biochem. 6	Ent. 5
Agr. Econ. 40, 102, 103, 141 or 110	Hort. 6, 32
Agr. Eng. 7, 12	Pl. Path. 1
Agron. 21, 23, 31, 132	Soc. 14
An. Husb. 3-4, 112, 113	Vet. 50-51-52
Dy. Husb. 101, 103, 104	Electives sufficient to meet the number of credit hours required for graduation

2. AGRICULTURAL ECONOMICS

Opportunities for majoring in agricultural economics are offered in various lines. The best selection and sequence of courses depend upon the particular line which the student intends to follow. Students interested in majoring in this field are requested to consult with the division in working out a program of courses suited to their needs.

3. AGRICULTURAL ENGINEERING (GENERAL)

Suggested for those who intend to prepare for general farming, with emphasis on engineering. Students desiring a curriculum in Agricultural Engineering (Professional) are referred to the outline on pages 34-35.

Agr. Econ. 40, 102, 103, 142	Ent. 5
Agr. Eng. 3, 5, 7, 12, 13, 14, 19, 24, 25, 31, 37	Pl. Path. 1
Agron. 21, 22, 31	Soc. 14
An. Husb. 3-4, 112	Electives sufficient to meet the number of credit hours required for graduation
Dy. Husb. 101, 104	

4. ANIMAL HUSBANDRY

For those who aim to make a special study of livestock as a preparation for (a) various phases of livestock farming, (b) the technical positions relating to livestock, and (c) further study in graduate work when the student desires to prepare for college, experiment station, or government research and similar positions requiring a still greater degree of specialization.

Agr. Biochem. 6	An. Husb. 3, 4, 5, 51, 52, 53, 56-57, 101, 112, 113, 115
Agr. Econ. 40, 143	Vet. 50-51-52
Agron. 23, 31	Electives sufficient to meet the number of credit hours required for graduation

5. DAIRY HUSBANDRY

Two curricula are suggested in Dairy Husbandry, namely, Dairy Production and Dairy Products.

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A. The Dairy Production Curriculum is suggested for those students interested in dairy cattle in preparation for (1) dairy farming, (2) technical and extension work pertaining to dairy cattle or dairy farming, and (3) additional graduate study in this field.

Agr. Biochem. 6	Geol. 8
Agr. Econ. 40, 80, 102, 103, 104	Pl. Path. 1
Agr. Eng. 40	Poult. Husb. 1
Agron. 21, 23, 31	Soc. 1
An. Husb. 3-4, 112, 113	Vet. 50-51-52
Dy. Husb. 2, 51, 101, 103, 104, 105, 106 116, 117	Electives sufficient to meet the number of credit hours required for graduation

B. The Dairy Products Curriculum is suggested for students interested in the manufacture or distribution of dairy products, either (1) as a plant operator, (2) in technical or extension work in this field, or (3) for graduate study in some phase relating to the dairy industry.

Agr. Biochem. 6, 101, 102, 103	Dy. Husb. 2, 3, 4, 10, 51, 101, 105, 106, 110, 111, 112, 113, 115
Agr. Econ. 25, 40, 50, 131, 140, 141	Economics 28
Agr. Eng. 24, 25, 40, 41, 70	The minor may be in Agricultural Eco- nomics or Agricultural Biochemistry

6. HORTICULTURE

Horticulture is divided into several distinct and specialized fields such as vegetable growing, fruit growing, and floriculture. Students planning to major in some branch of horticulture are requested to consult with an adviser in the division to work out the best sequence of courses suited to their needs.

7. LANDSCAPE GARDENING

Students who desire to major in landscape gardening should consult an adviser in the Division of Horticulture soon after entering the University in order to arrange a program that will include the necessary courses in drawing and design.

II. FOOD TECHNOLOGY

This curriculum provides training in preparation for industrial fields such as meat packing; processing, storage, and distribution of fruits, vegetables, and other perishables; canning and pickling. It includes also milk products and the products of milling and related industries. Specialties in these fields may involve major subject-matter specialties in chemistry, bacteriology, and other special biological fields. Students intending to enter the Food Technology Curriculum should have a fairly definite professional or vocational program and must consult the special faculty advisory committee for this curriculum (see registrar or office of the dean of the college), with whose approval a program of subject-matter courses may be selected under the limits described. The curriculum presented is intended merely to show the wide range of available subject-matter courses, especially those basic to the whole field, from which the student must select those best suited for his

particular program. While this is a normal four-year curriculum certain scientific specialties may demand graduate work.

While the employment possibilities are probably chiefly in the various food industries, additional opportunities exist in research and in teaching in connection with various federal, state, and municipal government bureaus and offices as well as in colleges and in private research institutions.

REQUIREMENTS

(See page 10 also.)

The Food Technology Curriculum requires 192 credit hours for graduation and is made up of the following:

1. *Freshman-sophomore required courses.*—The same as for the Science Specialization Curriculum, except that Quantitative Methods (Agr. Biochem. 2) is substituted for Soils (Soils 6).
2. *Junior-senior years.*—
 - a. Rhet. 51f,w,s, Exposition, 3.
 - b. Major sequence of 24 to 36 credits in one of the following fields: Agricultural Biochemistry, Animal Husbandry, Dairy Husbandry, Animal Nutrition, Foods and Nutrition. Subject-matter courses from one division or from departments of other colleges of the University may be applied as major credits in another division if they are clearly related or fundamental to the field of the major specialization.
 - c. In lieu of a minor, courses totaling at least 30 credits to be selected from the following fields: Microbiology, Chemistry, Physics. (See courses marked with an asterisk (*) in list of courses below.)
 - d. Electives sufficient to make a total of 192 credit hours. May be selected from list below or from other courses and departments.

SUGGESTED COURSES FOR FOOD TECHNOLOGY

Available for major or minor sequence and electives. Courses marked with an asterisk (*) are suggested for minor requirements (2c).

College of Agriculture, Forestry, and Home Economics

Agricultural Biochemistry: 101-102, Agricultural Quantitative Analysis*; 103, Dairy Chemistry; 108, Chemistry of Wheat and Wheat Products; 110, Flour Laboratory Methods; 113-114-115, Biochemical Laboratory Methods; 116, Advanced Animal Nutrition; 118, Laboratory Problems in Biochemistry; 119, Colloids*; 120, Proteins*; 121, Carbohydrates*; 122, Lipids and Fats*; 123, Enzymes.*

Agricultural Economics: 40, Principles of Marketing Organization; 90, Agricultural Statistics.

Agricultural Engineering: 23, General Physics or 24-25, Agricultural Physics.

Agronomy and Plant Genetics: 31, Principles of Genetics.

Animal Husbandry: 51, Meat Selection; 52, Meats; 53, Advanced Meats; 54, Utilization of Meats; 107, Meat Products.

Dairy Husbandry: 2, Dairy Bacteriology*; 110-111-112, Dairy Products; 113, Technical Control; 115, Advanced Dairy Bacteriology.*

Entomology and Economic Zoology: 5, Economic Entomology; 51, Introductory Parasitology.*

Home Economics: 40, Food Preparation; 41, Food Management and Marketing; 61, Quantity Cookery; 64, Institution Buying; 142, Experimental Cookery; 146, Special Food Problems (3 cred.) or 147, Special Food Problems (5 cred.).

Plant Pathology: 1, Plant Pathology; 105-106-107, Mycology*; 160, Plant Histochemistry; 161, Transport, Storage, Ripening of Fruits and Vegetables (may include refrigeration).

Other Colleges

Bacteriology: 114, Molds, Yeasts, and Actinomycetes*; 121-122, Physiology of Bacteria*; 123, Applied Bacteriology.*

Botany: 51, Histological Methods; 101, Biometric Principles; 118, Cytology.

Chemistry: Analytical Chemistry 1-2 or 7, Quantitative Analysis; 104, Microchemistry; 140, Water Analysis. Inorganic Chemistry 11 or 12-13, Qualitative Chemical Analysis; 17, Glass Blowing. Organic Chemistry 1-2, Elementary Organic Chemistry.

Economics: 28, Business Law.

Mathematics: 30, Analytic Geometry; 50-51-52, Calculus.

Mechanical Engineering: 166, Refrigeration (only on approval of instructor.)

Physics: 1-2-3, Introduction to Physical Science.*

Physiology: 4, Physiology; 100, Physiological Chemistry.

Political Science: 1-2, American Government and Politics

Zoology: 21, Histology.

III. WILDLIFE MANAGEMENT

(See also Game Management in Forestry Curricula)

Wildlife management has developed into an established profession, and there is an increasing demand for college training in this field. The work involves a wide range of activities including the management of upland game, big game, waterfowl, fish, and fur bearers in parks and forests, and on wildlife preserves and privately owned lands; it also includes the artificial propagation of game and fur species and the encouragement of non-game species. Within the colleges of the University many courses are available which contribute valuable information and basic principles of use to students in this field. Students desiring such specialization are advised to follow the requirements of the Wildlife Management Curriculum from the beginning of the freshman year with such substitutions as advisers may designate.

The Minnesota Agricultural Experiment Station is using every available opportunity to develop research, to collect information, and to encourage the development of this new land use industry. The following curriculum is designed to provide the student with a background of biology and farm and forest economics as well as training in the more practical phases of wildlife management. Since the specialization may vary considerably even in one field with the individual student, complete curricula are not suggested in all lines. The intention is not to offer a completely detailed curriculum to which the student must rigidly adhere. It is expected that each student will build his course by the major elective method under the guidance of an adviser and for the special vocational purpose he may have in mind. Such curricula will, in general, fall in one of the following groups: forestry, agriculture, agricultural and forestry sciences.

Students in this curriculum may prepare themselves for teaching in colleges and universities, for research and experimental work in various state and federal departments, and for management and extension work in state and federal departments concerned with utilization of our natural resources.

Wildlife management has important relations to the following government and private enterprises: United States and state forest services, national

and state park services, soil erosion programs, U. S. Biological Survey, research and teaching, and commercial wildlife management. For the opportunities offered, the student is advised to consult the Division of Entomology and Economic Zoology and other divisions or departments specially concerned and the dean of the college.

REQUIREMENTS

(See page 10 also.)

This curriculum requires 192 credit hours for graduation (in addition to noncredit courses required in the freshman-sophomore years) and is made up of (1) freshman-sophomore required courses with such options as are indicated in the freshman and sophomore years, and (2) a major and electives in the junior and senior years in accord with the schedule given below.

Special attention of every student is called to the faculty requirements for classification in the junior class, pages 10-11, and to the English Requirement for Graduation, page 10.

All students, irrespective of the special curriculum which they may select, are required to complete certain general courses before graduation. These are considered fundamental and necessary to any curriculum. For some students the outline for the first two years, given below, represents more than the regular amount of work of 17 credit hours per quarter. In such cases those subjects which cannot be taken in the freshman and sophomore years must take precedence in the following year.

RECOMMENDATIONS

General Zoology should be completed during the freshman year. Not less than 9 credits will be accepted as fulfilling the general zoology requirement.

At least one modern language should be obtained during the undergraduate work. German is recommended and may be taken in one of the two following sequences: 1-2-3 (15 cred.) or 24-25-26 (12 cred.)

FRESHMAN YEAR

1. *Noncredit courses* required for graduation in addition to the 192 credit hours.
Freshman Assembly. A course of lectures offered only in the fall quarter.
2. *General courses.*—The following courses may be registered for any quarter that they are offered except that the proper sequence of continuation courses and the prerequisites must be observed.
 - Bot. 1f,w,s, General Botany, 4
 - Bot. 7, Taxonomy of Flowering Plants, 3
 - Bot. 21, Elementary Ecology, 3
 - Inorg. Chem. 1f-2w-3s, General Inorganic Chemistry, 12. Students presenting a year of high school chemistry may elect instead Inorg. Chem. 9-10
 - Inorg. Chem. 9f,w-10w,s, General Inorganic Chemistry, 10 (1 yr. of high school chem.)
Those required to take Inorg. Chem. 1-2-3 may omit this course.
 - Math. 1f,w,s,* Higher Algebra, 5
 - Math. 6f,w,s,* Trigonometry, 5 (Math. 1 or equiv.)
 - Modern Lang., 15 or special sequence of 12

* Students will be exempt from the required mathematics courses only in accordance with the placement tests given by the Department of Mathematics (see page 87). For any exemption the student will be required to substitute an equivalent number of credits (mathematics or electives) as approved by his adviser.

P.M.&P.H. 3f,w,s,† Personal Health, 2.
 Rhet. 1f,w,s-2w,s,f-3s,f,w. Rhetoric, 9
 Zool. 1f-2w-3s, General Zoology, 10

SOPHOMORE YEAR

1. *Freshman courses* which were not completed during the freshman year.
2. *General courses*
 Agr. Biochem. 4f,w, Introduction to Organic and Biochemistry, 5 (Inorg. Chem. 10)
 Agr. Biochem. 6f, Animal Biochemistry, 5 (Agr. Biochem. 4 and Soils 6)
 Agr. Econ. 1f,w, Principles of Economics I, 3
 Agr. Econ. 2w,s, Principles of Economics II, 5 (Agr. Econ. 1)
 Bact. 41f,w,s, General Bacteriology, 5 (Inorg. Chem. and Gen. Zool.)
 Pl. Path. and Bot. 7w-8s, Weeds and Grasses, 6 (7 cred. in botany)
 Rhet. 11f,s, Argumentation, 3 (Rhet. 3, Rhet. 22 advised) or Rhet. 22f,w,s, Public Speaking, 3 (Rhet. 3)
3. *Itasca Park* (Summer Session). The second term of the Summer Session (Biological Station) should be attended after either the freshman or sophomore year. The course there should include Bot. 115su, Advanced Taxonomy of Flowering Plants, and electives selected according to the individual needs of the student. The first term of the Summer Session (Forestry Station) is also recommended but not required. (See page 40, Forestry Curricula, for courses.)

JUNIOR YEAR

1. *Sophomore courses* which were not completed during the sophomore year.
2. *General courses*
 Agr. Econ. 90f, Agricultural Statistics, 5
 Agr. Eng. 3w,s, Mechanical Drawing, 3
 Agr. Eng. 19f,s, Elementary Surveying, 3 (Math. 6)
 For. 126f, Silvics, 3
 For. 131w, Forest Policy and Administration, 5 or Ent. 62, Wildlife Conservation Principles and Administration, 3 (given at Itasca Park)
 Geol. 8, Introductory Geology, 5
 Rhet. 51f,w,s, Exposition, 3 (Rhet. 3)
 Soils 6w, Soils, 5
3. Students may elect the spring quarter of the junior year at the Cloquet Forest Experiment Station (See page 41, Forestry Curricula, for courses) upon consultation with adviser. For such students Soils 6 will not be required.

JUNIOR AND SENIOR YEARS

1. A major sequence of 30 to 36 credits which must include the following courses:
 Ent. and Econ. Zool. 64w, Economic Vertebrate Zoology, 3 (Gen. Zool. 1-2-3)
 Ent. and Econ. Zool. 165w, Game Management, 3 (Gen. Zool. 1-2-3, Ent. 62, 64, 163)
 Zool. 22w, Comparative Anatomy, 5 (Gen. Zool. 1-2-3)
 Zool. 51f, Introductory Animal Parasitology, 5 (Gen. Zool. 1-2-3)
 Zool. 53s, Faunistic Zoology, 5 (Gen. Zool. 1-2-3)
2. Electives applicable to the major or selected with a view of forming a minor field may be chosen from the following departments or divisions:

1. Agricultural Biochemistry	8. Geology
2. Agricultural Economics	9. Horticulture
3. Animal Nutrition	10. Plant Pathology and Agr. Botany
4. Bacteriology	11. Poultry Husbandry
5. Botany	12. Soils
6. Farm Management	13. Veterinary Medicine
7. Forestry	14. Zoology

† Three credits of Physical Education are required for women in this curriculum.

IV. PRE-VETERINARY MEDICINE

Curriculum to be arranged with the assistance and approval of the adviser. In general, subjects to be taken are inorganic chemistry, one year; General Zoology 14-15, and Botany 1; English composition, one year; and electives to be selected from German, mathematics, physics, or history. Because of the grade requirements for entrance to veterinary colleges an average grade of close to B in pre-veterinary medicine is essential.

V. AGRICULTURAL EDUCATION

Preparation for Teaching Agriculture

Students who have completed the required work of the freshman and sophomore years of the College of Agriculture, Forestry, and Home Economics, or equivalent, may prepare to teach agriculture in the public schools by completing the junior and senior years in a combined curriculum of the College of Education and the College of Agriculture, Forestry, and Home Economics.

Special attention of every student is called to the faculty requirements for classification in the junior class and to the qualifying examinations required before the student can register in Agr. Ed. 91, Supervised Teaching Experience.

The agriculture requirements can be fulfilled by the major, minor, and elective plan (Method A) as shown on page 23, or by completing the suggested curriculum under Method B shown below.

The education requirements can be fulfilled by completing satisfactorily 24 quarter credits in Agricultural Education courses some of which are required courses. The following courses must be included: Ed. 51, Agr. Ed. 81, 82, 83, 91.

It is recommended that electives be chosen from the courses in Agricultural Education or from such of the subject-matter courses as will best complete a well-balanced and well-distributed preparation. In addition to those found in the suggested curriculum may be mentioned Agr. Eng. 12; Agron. 124, 132; Pl. Path. 9; Poult. Husb. 1; Agr. Econ. 80. Recommended electives in education: Agr. Ed. 54, 135; Ed. 53; Ed. Ad. 133, 167.

Graduates of the University of Minnesota completing these agriculture and education requirements will be eligible for the Minnesota "high school standard special" certificate for teaching agriculture and the sciences in high schools or elementary schools of this state.

The State Department of Education requires that before certification a candidate for an agricultural high school teacher must have had at least two full years of farm experience after the age of sixteen or he shall have been born and reared on a farm until the age of sixteen.

Students desiring to obtain the teacher's certificate should consult an adviser in the Division of Agricultural Education during the freshman year to avoid difficulties that may otherwise arise in program making.

Below is found a suggested curriculum (Method B) which may serve as a guide to students desiring a well-balanced preparation for teaching agri-

culture and the sciences, for serving as county agent, or for practical farming, and will facilitate making a program that will avoid conflicts.

Agr. Econ. 40, 102, 103, 144
 Agr. Eng. 40
 Agron. 21, 23, 31
 An. Husb. 3-4, 56-57, 112
 Dy. Husb. 101
 Ed. 51, Agr. Ed. 81, 82, 83, 91

Ent. 5
 Hort. 6
 Pl. Path. 1
 Soc. 14
 Vet. 50-51-52

Electives sufficient to meet the number of credits required for graduation of which at least 3 must be chosen in Agricultural Education in the junior and senior years

VI. AGRICULTURAL EXTENSION

Experience has shown that it is not wise or feasible, because of the wide range of possible major and minor specialization, to set up a formal curriculum for training in agricultural extension. The college does, however, offer special opportunities for an adequate training in many branches of this educational field. Any student desiring such training has the privilege as well as the responsibility of formulating his own curriculum under the general curricular requirements of Technical Agriculture or Agricultural Education.

Students planning to enter some field of agricultural extension can best prepare for this by selecting some major field and by arranging for their special extension training in the selection of their minor groups or in the selection of electives with the co-operation of advisers. The major field may be agricultural education or one of the technical divisions in the field of agriculture, such as animal husbandry, dairy husbandry, agronomy, or horticulture. Other majors are also possible. The selection of a major should be determined by the type of extension work which the student plans to follow and by the plans which the student may have as to a continuation of his study and professional development after he has become engaged in extension work.

Since agricultural extension work involves educational and other methods of presenting and promoting agricultural information and practices, it must be founded primarily on a thoro knowledge of some field of technical agriculture and a general knowledge of the whole field. The extension methods must vary with different extension jobs and must be built up on a wide range of sociological subject-matter. The methods are secondary to the subject-matter and for most types of extension work an attempt to formulate a major in extension is not advised altho a considerable proportion of the subject-matter, of course, should be selected from courses that will have a distinct bearing on extension methods. A major adviser should be selected in the major subject-matter field of the student. It may also be advisable for such students to select a second adviser either from the extension staff or from some member of the resident teaching staff who is familiar with extension problems.

Since there is no single subject-matter course which can prepare the student for all of the intricate problems involved in extension methods and procedures, it becomes necessary for the student, with the help of his adviser,

to select carefully subject-matter courses from various divisions in this college and departments in the University which shall give him a background of knowledge which can be utilized in his extension work. Many of these courses will fall in the social science groups altho some may deal with subject-matter in technical agriculture. The number of technical agricultural and social science courses which would be useful are probably too numerous to be included in any one program so that the student will have to make careful selection with the aid of his advisers. For the benefit of such students and for the convenience of advisers a list of suggested courses is given below. Other courses may be advisable, or, in some cases, preferable. The list is merely suggestive. The student's special attention is called to a subject-matter course on extension work (Agricultural Education 80) which will be given co-operatively with members of the extension staff. This course deals particularly with the organization and established practices in the extension field.

It is generally recognized that "personality" is an important factor in the selection of extension workers and in the success of their subsequent vocational service. A judicious participation in student and community activities which give opportunities for the development of leadership is recommended. Students should also avail themselves of those numerous social and cultural opportunities of the University which contribute to a better understanding of how to meet and work with people. While the college offers no subject-matter courses in "personality" valuable criticism and advice may be secured from many faculty advisers.

SUGGESTED COURSES FOR AGRICULTURAL EXTENSION

Available as electives or required work in a curriculum especially suitable for those training for agricultural extension work:

College of Agriculture, Forestry, and Home Economics

Agricultural Economics: As many of these courses as would be feasible.

Agricultural Education: 51, Educational Psychology, or equivalent; 52, Vocational Education; 54, Rural Education and Community Leadership; 80, Extension Work.

Agricultural Engineering: Numerous courses from which to select.

Publications and Rural Journalism: 53, Publicity. Possibly other courses from the Department of Journalism of the College of Science, Literature, and the Arts.

Rhetoric: 22, Public Speaking; 24, Advanced Public Speaking; 28, Play Production; 59, Advanced Play Production.

Subject-matter departments such as Horticulture, Agronomy, Animal Husbandry, Dairy Husbandry, Veterinary Medicine, etc. Subjects to be selected in accordance with objectives.

College of Science, Literature, and the Arts

Political Science: 1-2-3, American Government and Politics; 31, Introduction to American Government and Administration. Other possible courses for selection.

Psychology: 1-2, General Psychology; 3, Psychology Applied to Daily Life.

Sociology and Social Work: 1, Introduction to Sociology; 6, Social Interaction; 14, Rural Sociology; 110, Rural Organization; 112, Methods of Rural Social Research; 114, Rural Social Institutions.

Business Administration: 51-52-53, Business Law.

The above is not a complete list of all of the possible electives that would be useful in a major curriculum in agricultural extension but includes a wide range and is suggestive of the additional possibilities.

VII. AGRICULTURAL ENGINEERING (PROFESSIONAL)

This curriculum leads to the degree of bachelor of agricultural engineering and is offered jointly by the College of Agriculture, Forestry, and Home Economics, and the Institute of Technology. Three distinct lines of specialization are provided, namely, Farm Buildings, Farm Machinery, and Reclamation. (See also general curriculum in Agricultural Engineering for students in agriculture who desire to major in this field, page 25.)

FRESHMAN YEAR

During the freshman year those following this curriculum will register in the Institute of Technology and follow the work of the freshman year as outlined in the bulletin of that institute.

SOPHOMORE YEAR

The following courses should be scheduled for the quarter as indicated below. For the last three years of the curriculum students are registrants both of the College of Agriculture, Forestry, and Home Economics and the Institute of Technology.

1. *Noncredit courses* required for graduation.
Agr. Eng. 91f,w,s, Seminar (Three quarters required)
2. *General courses*
Agr. Eng. 5w, Farm Building Construction, 3
Agr. Eng. 12s, Agricultural Machinery, 3
Agr. Eng. 13f,s, Gas Engines, 3
Agr. Eng. 19f, Elementary Surveying, 3 (Draw. 3 and M. & M. 12)
Agr. Eng. 22s, Agricultural Machinery Laboratory, 1 (12)
Agron. 1, General Farm Crops, 3
Hort. 6f, Fruit Growing, 3
M. & M. 24f,w,s, Differential Calculus, 5 (M. & M. 13)
M. & M. 25f,w,s, Integral Calculus, 5 (M. & M. 24)
M. & M. 84f,s, Technical Mechanics, 5 (M. & M. 25)
Phys. 7f,w,s, General Engineering Physics, 5 (M. & M. 12 or equiv.)
Phys. 8f,w,s, General Engineering Physics, 5 (Phys. 7)
Phys. 9w,s, General Engineering Physics, 5 (Phys. 8)
Soils 6w, Soils, 5

JUNIOR YEAR

SENIOR YEAR

Fall Quarter

- | | |
|---|--|
| <p>Agr. Eng. 14f,s, Tractors, 3 (Agr. Eng. 13)
Agr. Eng. 20f, Advanced Surveying, 3 (Agr. Eng. 19f)
Agr. Eng. 92f, Seminar
Econ. 8f, General Economics, 3
Geol. 5f, Engineering Geology, 3
M. & M. 128f,w,s, Strength of Materials, 5, (M. & M. 84)</p> | <p>Agr. Eng. 67f, Farm Structures Design, 3 (Agr. Eng. 7, M. & M. 128)
Agr. Eng. 71f, Design and Economics of Agricultural Machinery, 3 (Agr. Eng. 12, 13, 22; M.E. 27)
Agr. Eng. 93f, Seminar
Electives to complete program</p> |
|---|--|

JUNIOR YEAR

SENIOR YEAR

Winter Quarter

Agr. Econ. 102w, Farm Organization, 3 (Econ. 9 or equiv. or reg. in 9)	M.E. 26f,w,s, Mechanism and Kinematics, 3 (Draw. 27, M. & M. 24)
Agr. Eng. 51w, Land Reclamation, 5 (19, Soils 6, M. & M. 143, or Soils 108)	Agr. Eng. 37f,w, Rural Sanitation, 3
Agr. Eng. 92w, Seminar	Agr. Eng. 93w, Seminar
Econ. 9w, General Economics, 3 (Econ. 8)	C.E. 146f,w, Plain Concrete, 3
M. & M. 86w, Hydraulics, 2 (M. & M. 84)	G.E. 101w, Contracts and Specifications, 3
M. & M. 143f,w,s, Hydraulics Laboratory 1 (M. & M. 84)	Rhet. 22f,w,s, Public Speaking, 3 (Rhet. 3)
	Soils 108w, Physical Properties of Soils, 3 (Soils 6) or Agr. Eng. 51
	Electives to complete program

Spring Quarter

Agr. Econ. 103s, Farm Operation, 3 (Agr. Econ. 102)	Agr. Eng. 70s, Steam Boilers and Engines, 3 (Phys. 23, 24)
Agr. Eng. 7s, Farm Structures 3 (Drawing 3 or equiv.)	Agr. Eng. 72s, Applied Electricity, 3 (prereq. 25) or C.E. 37
Agr. Eng. 43s, Mechanical Laboratory, 3	Agr. Eng. 93s, Seminar, 1
Agr. Eng. 72f,s, Applied Electricity, 3 (Phys. 9, 44 or equiv.) or C.E. 37	An. Husb. 50s, Fundamentals of Livestock Production, 3 or
Agr. Eng. 92s, Seminar, 1	Dy. Husb. 52s, Elements of Dairying, 3
An. Husb. 50s, Fundamentals of Livestock Production, 3 or	C.E. 37s, Structural Engineering, 3 (M. & M. 84) or Agr. Eng. 72
Dy. Husb. 52s, Elements of Dairying, 3	G.E. 193s, Engineering Practice, 2 (sr.)
M. E. 27s, Machine Design, 3 (M.E. 26)	Electives to complete program
Electives to complete program	

RECOMMENDED ELECTIVES

1. *Farm Structures*
Agr. Eng. 44, 111-112-113; Arch. 57, 58, 59; For. 10; G.E. 81; Hort. 74.
2. *Farm Machinery and Power*
Agr. Eng. 121-122-123, 126; E.E. 43-44-45; M.E. 17, 31-32, 121, 150, Metal. 156
3. *Land Reclamation and Development*
Agr. Eng. 28, 101-102-103; C.E. 18, 161; M. & M. 130, 193.

VIII. AGRICULTURAL ENGINEERING BUSINESS
ADMINISTRATION CURRICULUM

(See statement on page 15.)

IX. AGRICULTURAL BUSINESS ADMINISTRATION

This curriculum offers an opportunity for those who wish to prepare specifically for some branch of agricultural business, such as the marketing of farm products, farm finance, farm implements, farm real estate, country merchandising, and the like. The first two years are prescribed and include introductory courses in agriculture, economics, and the fundamental sciences necessary for further work in agriculture and economics. During the freshman and sophomore years, students will register in the College of Agriculture, Forestry, and Home Economics. In the junior and senior years the student will register in both the School of Business Administration and the College of Agriculture, Forestry, and Home Economics. At least 90 credits and honor points equal to the number of credits are required for admission

to the junior class. For definition of "honor points" see page 10. Approximately one third of the last two years is elective and may include approved courses in any college as well as advanced courses in agriculture and economics. The fees for the first two years are those of the College of Agriculture, Forestry, and Home Economics. For the last two years the fees are those of the School of Business Administration.

FRESHMAN YEAR

The freshman year consists of the regular freshman courses outlined on pages 21-22, except that students are advised to take Math. 8 rather than Agr. Eng. 11; or Math. 1 if they do not have the prerequisites for Math. 8. If any course of the freshman year is deferred to the sophomore year it should be An. Husb. 1-2. (See page 10 also.)

SOPHOMORE YEAR

The following courses should be scheduled for the quarter as indicated.

1. *Noncredit courses required for graduation.*
2. *Freshman courses which were not completed during the freshman year.*
3. *General courses*
 - Agr. Econ. 1f,w, Principles of Economics I, 3
 - Agr. Econ. 2w,s, Principles of Economics II, 5 (Agr. Econ. 1)
 - Agr. Econ. 8s, Rural Economics, 3 (Agr. Econ. 2 or 3)
 - Agr. Econ. 50f, Farm Finance, 5 (Agr. Econ. 2)
 - Econ. 20f,w,s,* Elements of Accounting, 3
 - Econ. 25f,w-26w,s, Principles of Accounting, 6
 - Ent. 5f,w, Economic Entomology, 5 (Zool. 14-15 or equiv.)
 - Psy. 1f-2w, General Psychology, 6
 - Zool. 14f-15w, General Zoology, 6
4. *Electives.*—Enough elective credits should be selected to make with the required work of the freshman and sophomore years a total of 101 credit hours.

JUNIOR YEAR

1. *General requirements*
 - Bus. Adm. 51f-52w-53s, Business Law, 9 (10 cred. in econ. incl. Agr. Econ. 1 and 2)
 - Bus. Adm. 87f,w,s, Report Writing, 1
 - Bus. Adm. 142f,w,s, Advanced Money and Banking, 3 (Econ. 3 and either 4 or 6-7)
2. *Special requirements*
 - Agr. Econ. 30f, Agricultural Prices, 3 (Agr. Econ. 2)
 - Agr. Econ. 40f,s, Principles of Marketing Organization, 3 (Agr. Econ. 2)
 - Agr. Econ. 90f, Agricultural Statistics, 5
 - Agr. Econ. 110f-111w, Economics of Agricultural Production, 6 (Agr. Econ. 2)
 - Agr. Econ. 131w, Market Prices, 3 (Agr. Econ. 30, 40)
 - Agr. Econ. 141w, Marketing Organization: Dairy and Poultry Products, 3 (Agr. Econ. 40)
 - Rhet. 51f,w,s, Exposition, 3 (Rhet. 3)

SENIOR YEAR

1. *General requirements*
 - Bus. Adm. 58f,w,s, Elements of Public Finance, 3 (Econ. 4 or 6-7)
 - Bus. Adm. 71f,w,s, Transportation: Services and Charges I, 3 (Econ. 4 or 6-7)
 - Bus. Adm. 101f,w-102w,s, Advanced General Economics, 6 (Econ. 4 or 6-7)

* Students who have had a high school course or experience in bookkeeping may be exempted from this course and admitted to Econ. 25-26 by passing a placement test.

- Bus. Adm. 139f,w,s, Advanced General Accounting, 3 (Econ. 25-26)
 Econ. 149f,w,s, Business Cycles, 3 (Econ. 141 or Bus. Adm. 142)
2. *Special requirements*
 Agr. Econ. 135s, Methods of Price Analysis, 3 (Agr. Econ. 30, 191)
 Agr. Econ. 150s, Advanced Farm Finance, 3 (Agr. Econ. 50 or equiv.)
 Agr. Econ. 170s, Land Economics, 3 (Agr. Econ. 110)
 Agr. Econ. 191w, Advanced Agricultural Statistics, 3 (Agr. Econ. 90)

X. AGRICULTURAL JOURNALISM

This curriculum is intended for those who wish to prepare for some branch of journalism which relates to agriculture: such as staff positions on agricultural magazines, writing on agricultural questions, editing of bulletins for state and federal departments of agricultural and experiment stations, editing of special farm pages or departments for newspapers, and editing of publications for farm organizations. The first two years are prescribed and include introductory courses in agriculture, journalism, and economics. During the freshman and sophomore years, students will register in the College of Agriculture, Forestry, and Home Economics, and during the junior and senior years, will become registrants in both the College of Agriculture, Forestry, and Home Economics and the College of Science, Literature, and the Arts. Special attention of every student is called to the faculty requirements for classification in the junior class, pages 10-11.

FRESHMAN YEAR

The freshman year consists of the regular freshman courses outlined on pages 21-22 except that English A-B-C should be substituted for Rhetoric 1-2-3. (See page 10 also.)

SOPHOMORE YEAR

- Agr. Econ. 1f,w-2w,s, Principles of Economics I, II, 8
 Agr. Econ. 8s, Rural Economics, 8 (Agr. Econ. 2 or 3)
 Comp. 27f,w,s-28w,s, Advanced Writing, 6 (A-B-C, or 4-5-6 or exemption from requirement)
 Jour. 13f, Introduction to Reporting, 3 (Eng. A-B-C, Comp. 4-5-6 or exemption)
 Jour. 14w-15s, Newspaper Reporting, 6 (Average of C in 13 or 12 or consent of instructor and Comp. 27-28. Comp. 27-28 may be taken parallel)
 Psy. 1f-2w, General Psychology, 6
 Zool. 14f-15w, General Zoology, 6

JUNIOR YEAR

- Agr. Econ. 40f,s, Principles of Marketing Organization, 3 (Agr. Econ. 2)
 Agr. Econ. 90f, Agricultural Statistics, 5
 Agr. Econ. 110f-111w, Economics of Agricultural Production, 6 (Agr. Econ. 2)
 Jour. 51f-52w, News Editing, 6 (Jour. 15)
 Jour. 55f,w,s, Advertising and Newspaper Typography, 3 (Jour. 15)
 Jour. 69s, Newspaper and Magazine Articles, 3 (Jour. 15 or 41)
 Rhet. 51f,w,s, Exposition, 3 (Rhet. 3)
 Soc. 1f,w,s, Introduction to Sociology, 5
 Soc. 14f,w,s, Rural Sociology, 3 (Soc. 1)

SENIOR YEAR

- Agr. Econ. 30f, Agricultural Prices, 3 (Agr. Econ. 2)
 Agr. Econ. 135s, Methods of Price Analysis, 3 (Agr. Econ. 30, 191)

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Econ. 149f,w,s, Business Cycles, 3 (Econ. 141 or B.A. 142)

Jour. 60f-61w-62s, The Weekly Newspaper, 9 (Jour. 15)

Psy. 56w, Psychology of Advertising, 3 (Psy. 1-2 and Agr. Econ. 1-2)

Pub. and Rur. Jour. 50f-51w-52s, Agricultural Journalism, 9 (Jour. 13-14-15, 51-52)

RECOMMENDED ELECTIVES

Agr. Econ. 25, 126, 170; Ed. 51; For. 1; Geog. 11; Jour. 70; Pol. Sci. 1, 2, 3; Soc.
110, 114

MINOR IN JOURNALISM

For students in the various divisions of the College of Agriculture, Forestry, and Home Economics wishing a short course in journalistic writing, elections from the following program are recommended.

Comp. 27-28; Jour. 13, 41, 69, 70.

(See also Science Specialization Curriculum, page 18.)

C. CURRICULA IN FORESTRY

Four professional and two technological curricula are offered students with majors in forestry. These are:

Professional Curricula*

- I. General Forestry, page 41.
- II. Range Management (Professional), page 42.
- III. Game Management (Professional), page 42.
- IV. Forest Sciences (Professional), page 42.

Technological Curricula

- V. Commercial Lumbering, page 43.
- VI. Forest Technology, page 44.

Each curriculum is made up of 204 credit hours of work.

PROFESSIONAL CURRICULA*

GENERAL REQUIREMENTS

(See page 10 also.)

All students, irrespective of the professional curriculum which they may select, are required to complete certain general courses before graduation. These are considered fundamental and necessary to any professional curriculum in forestry. For some students the outline for the first two years, given below, represents more than the regular amount of work of 17 credits per quarter. In such cases those subjects which cannot be taken in the freshman and sophomore years must take precedence the following year. Phys. Ed. 1-2-3, Physical Education, 3 credits (credit is allowed only when the three quarters are completed) and Military Drill may be taken in addition to the regular schedule if desired. Care should be taken in registration to give precedence to courses offered in only one quarter.

During the first two years the work in all the professional curricula is essentially the same, and is devoted to the study of general courses. Preferably at the beginning of the sophomore year, and not later than the junior year, each student must decide upon the professional curriculum he wishes to follow. Special attention of every student is called to the faculty requirements for classification in the junior class, page 11.

* Because of the increasingly rigid requirements for the practice of professional work in the several technical fields of forestry, because of the increasing range of information and training required in the fundamental, biological, and physical sciences, and in the social sciences, and also because of the increasing number of technical and professional courses in forestry, serious consideration is being given to the necessity for not less than five years of college work in the various professional curricula. Students in these curricula may be required later to transfer to a five-year curriculum if they wish to obtain a professional degree in forestry. All other students who would not be affected by this change, if and when made, are urged to give serious consideration to the advantages of devoting five years to professional training. Keener competition in the future can be successfully met only by more adequate and better professional training.

FRESHMAN YEAR

1. *Noncredit courses* required for graduation in addition to the 204 credit hours. Freshman Assembly. A course of lectures offered only in the fall quarter.
2. *General courses*.—The following courses may be registered for any quarter that they are offered except that the proper sequence of continuation courses and the prerequisites must be observed.
 - Agr. Eng. 3f,w,s, Mechanical Drawing, 3
 - Bot. 1f,w,s, General Botany, 4
 - Bot. 21f,w,s, Elementary Ecology, 3
 - Bot. 22f,w,s, Elementary Plant Physiology, 3
 - For. 1f, General Forestry, 3
 - For. 3w, Dendrology, 3
 - For. 4s, Dendrology, 4
 - Inorg. Chem. 1f-2w-3s, General Inorganic Chemistry, 12. Students presenting a year of high school chemistry may omit this course and register for Inorg. Chem. 9-10.
 - Inorg. Chem. 9f,w-10w,s, General Inorganic Chemistry, 10 (1 yr. of high school chem.). Those required to take Chem. 1-2-3 are exempt.
 - Math. 1f,w,s,* Higher Algebra, 5
 - Math. 6f,w,s,* Trigonometry, 5 (Math. 1 or equiv.)
 - P.M.&P.H. 3f,w,s,† Personal Health, 2
 - Rhet. 1f,w,s, Rhetoric I, 3
 - Rhet. 2f,w,s, Rhetoric II, 3 (Rhet. 1)
 - Rhet. 3f,w,s, Rhetoric III, 3 (Rhet. 2)

Lake Itasca Forest and Biological Station

(First term, Summer Session)

Transfer students who enter the University as juniors may substitute electives for this requirement. All others must complete the Itasca Park work before the beginning of the sophomore year unless given permission on petition to defer it one year. A satisfactory scholastic average must be maintained during the preceding year. In no case will such students be permitted to register for junior work before completing the summer camp requirement.

Bot. 3su, Forest Botany, 1	For. 5su, Field Silviculture, 2
Ent. 13su, Field Zoology, 1	For. 6su, Field Mensuration, 1
For. 2su, Field Dendrology, 1	For. 9su, Camp Management, 1

SOPHOMORE YEAR

1. *Freshman courses* which were not completed during the freshman year.
2. *General courses*.—The following courses may be registered for any quarter that they are offered except that the proper sequence of continuation courses and the prerequisites must be observed.
 - Agr. Biochem. 4f,w, Introduction to Organic and Biochemistry, 5 (Inorg. Chem. 10 cred.)
 - Agr. Biochem. 5s, Plant Biochemistry, 5 (Agr. Biochem. 4, Soils 6)
 - Agr. Eng. 19f,s, 20f,s, Elementary Surveying, 6 (Math. 6)
 - For. 7f-8w-11s, Forest Mensuration, 10 (For. 6)
 - Geol. 1f,w,s, General Geology (Dynamic) 3, Geol. 1A, General Geology Lab. (Dynamic) 2

* Students will be exempt from the required mathematics courses only in accordance with the placement tests given by the Department of Mathematics (see page 87). For any exemption the student will be required to substitute an equivalent number of credits (mathematics or electives) as approved by his adviser.

† Three credits in Physical Education are required for women in this curriculum.

Pl. Path. 10w,s, Forest Pathology, 5 (Bot. 10 cred.)
 Rhet. 11f,s, Argumentation, 3 (Rhet. 3, and 22 recommended) or Rhet. 22f,w,s,
 Public Speaking, 3 (Rhet. 3) or Rhet. 31f,w,s, Survey of English Literature I,
 5 (Rhet. 3) or Rhet. 32f,s, Survey of English Literature II, 3 (Rhet. 3) or
 Rhet. 60w,s, Contemporary Literature, 3 (Rhet. 3)
 Zool. 1f-2w-3s, General Zoology, 9

JUNIOR YEAR

1. *Sophomore courses* which were not completed during the sophomore year.
2. *General courses*.—The following courses may be registered for any quarter that they are offered, except that the proper sequence of continuation courses and the prerequisites must be observed.
 - Agr. Econ. 1f,w, Principles of Economics I, 3
 - Agr. Econ. 2w,s, Principles of Economics II, 5 (Agr. Econ. 1)
 - Agr. Eng. 24f-25w, Agricultural Physics, 8 (Math. 1 or equiv.)
 - Ent. 56w,s, Forest Entomology, 3 (Zool. 14-15 or equiv.)
 - For. 53f-54w, Wood Structure and Identification, 6 (For. 3-4)
 - For. 126f, Silvics, 3
 - For. 127w, Silviculture, 3
 - For. 130f, Forest Valuation, 5
 - For. 131w, Forest Policy and Administration, 5
 - Rhet. 51, Exposition, 3 (Rhet. 3)

Students majoring in professional forestry curricula are required to spend the spring quarter of the junior* year in the field at the Cloquet Forest Experiment Station pursuing the following courses:

- Ent. 61s, Forest Zoology, 3 (Zool. 14-15 or equiv.)
 - For. 128s, Silviculture Laboratory, 6 (For. 127)
 - For. 132s, Forest Regulation Laboratory, 6 (For. 130)
 - Soils 50s, Forest Soils, 2 (Agr. Biochem. 4)
3. *Special courses* selected from one of the major groups (pages 41 to 45) and electives to make from 15 to 18 credit hours per quarter. Full work for the year consists of 51 credit hours.

SENIOR

1. *Junior courses* which were not completed during the junior year.
2. *General courses*.—The following courses may be registered for any quarter that they are offered, except that the proper sequence of continuation courses and the prerequisites must be observed.
 - For. 62f-63w, Forest Problems, 4 (sr. class.)

I. GENERAL FORESTRY

Suggested for those who are preparing themselves for technical forest work, such as positions in the federal or state services, or foresters for paper companies, lumber companies or other large timber owners, involving the growth, management, and harvesting of forest crops.

The course of study must also include the following:

- For. 129f,w,s, American Silvicultural Practice, 3
- For. 140f, Forest Working Plans, 3
- For. 151f,w,s, Logging, 3
- For. 155w, Forest Protection, 3

A sufficient number of courses to be selected in consultation with, and with the approval of, the adviser to make a total of 204 credits.

* Students who transfer to the Forestry Course after completing two years of work in some other college of this University or in some other institution are required to delay the field work at Cloquet until the spring quarter of the senior year.

II. RANGE MANAGEMENT (PROFESSIONAL)

Suggested for those who wish to prepare themselves for range and management work. It is important that these men should be well prepared in plant physiology, systematic botany, plant ecology, as well as in the underlying principles of forestry. In addition, they should have some knowledge of the feeding and breeding of livestock. The course of study must include the following courses:

- Agr. Econ. 90f, Agricultural Statistics, 5
- Agr. Eng. 19f,s-20f,s, Surveying, 6 (Math. 6)
- Bot. 7f,s, Taxonomy of Flowering Plants, 3
- Bot. 113f-114w-115s, Advanced Taxonomy of Flowering Plants, 9
- Bot. 134s, Research Methods in Ecology, 5
- Bot. 140w, General Plant Physiology, 3
- For. 20w, Grazing, 3
- Pl. Path. 7w,8s, Weeds and Grasses, 6

Not less than 9 credits in Animal Husbandry to be selected in consultation with, and with the approval of, the adviser.

A sufficient number of courses to be selected in consultation with, and with the approval of, the adviser to make a total of 204 credits.

III. GAME MANAGEMENT (PROFESSIONAL)

(See also Wildlife Management Curriculum, page 28.)

Suggested for those who wish to prepare themselves for a combination of forestry and game management work. It is important that these men be acquainted with the general forestry practices in addition to having a thorough knowledge of biology.

- For. 140f, Forest Working Plans, 3

Not less than 24 to 30 credits in addition to the required course in Economic Entomology and Zoology, to be selected in consultation with, and with the approval of, the adviser and the chief of the Division of Entomology and Economic Zoology.

A sufficient number of courses to be selected in consultation with, and with the approval of, the adviser to make a total of 204 credits.

IV. FOREST SCIENCES (PROFESSIONAL)

Suggested for those who wish to specialize in the various branches of forestry or the forest sciences and who at the end of the sophomore year have an honor point ratio of 1.7. It is assumed that students who follow this curriculum will spend one or more years in graduate study. Attention is therefore called to the language requirement for advanced degrees. Only those students who have maintained high scholarship records and who appreciate the true spirit of research should contemplate following this specialization. (See also Science Specialization Curriculum, page 18.)

The major course of study must include not less than 30 credits in one of the following fields:

- | | |
|---------------------------------|-----------------|
| Botany | Genetics |
| Chemistry | Plant Pathology |
| Economics | Soils |
| Entomology and Economic Zoology | |

German or French 15 credits. Not less than 15 credits in forestry in addition to required courses.

A sufficient number of courses to be selected in consultation with, and with the approval of, the adviser and the head of the science department concerned to make a total of 204 credits.

TECHNOLOGICAL CURRICULA

Two four-year technological curricula, Commercial Lumbering and Forest Technology, are offered. These curricula are not suitable for training for the professional practice of forestry. They have common freshman year course requirements.

GENERAL REQUIREMENTS

(See pages 10 and 39.)

FRESHMAN YEAR

1. *Noncredit courses* required for graduation in addition to the 204 credit hours. Freshman Assembly. A course of lectures offered only in the fall quarter.
2. *General courses.*—
 - Agr. Eng. 3f,w,s, Mechanical Drawing, 3
 - Bot. 1f,w,s, General Botany, 4
 - Bot. 21f,w,s, Elementary Ecology, 3
 - Bot. 22f,w,s, Elementary Plant Physiology, 3
 - For. 1f, General Forestry, 3
 - For. 3w, Dendrology, 3
 - For. 4s, Dendrology, 4
 - Inorg. Chem. 1f-2w-3s, General Inorganic Chemistry, 12. Students presenting a year of high school chemistry may omit this course and register for Inorg. Chem. 9-10.
 - Inorg. Chem. 9f,w-10w,s, General Inorganic Chemistry, 10 (1 yr. of high school chem.) Those required to take Chem. 1-2-3 are exempt.
 - Math. 1f,w,s,* Higher Algebra, 5
 - Math. 6f,w,s,* Trigonometry, 5 (Math. 1 or equiv.)
 - Math. 7s, College Algebra, 5 (Math. 6)
 - P.M.&P.H. 3f,w,s,† Personal Health, 2

V. COMMERCIAL LUMBERING

Suggested for those who wish to enter any branch of the lumber business. Includes fundamental business courses and a thoro training in the structure, handling, and uses of wood. The course of study must include the following courses:

SOPHOMORE YEAR

1. *Noncredit courses* required for graduation in addition to the 204 credit hours.
2. *Freshman courses* which were not completed during the freshman year.
3. *Special courses.*—The following courses may be registered for any quarter that they are offered except that the proper sequence of continuation courses and the prerequisites must be observed.
 - Agr. Eng. 24f-25w, Agricultural Physics, 8 (Math. 1 or equiv.)
 - Econ. 3s, Elements of Money and Banking, 5

* Students will be exempt from the required mathematics courses only in accordance with the placement tests given by the Department of Mathematics (see page 87). For any exemption the student will be required to substitute an equivalent number of credits (mathematics or electives) as approved by his adviser.

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Econ. 6w-7s, Principles of Economics, 10
Econ. 20f, Elements of Accounting, 3
Pl. Path. 10w,s, Forest Pathology, 5
Psy. 1f-2w, General Psychology, 6
Rhet. 1f-2w-3s, Rhetoric 9
Zool. 14f-15w, General Zoology, 6

JUNIOR YEAR

1. *Sophomore courses* which were not completed during the sophomore year.
2. *Special courses.*—The following general courses may be registered for any quarter that they are offered, except that the proper sequence of continuation courses and the prerequisites must be observed.
Bus. Adm. 51f-52w-53s, Business Law: Contracts, 9
Bus. Adm. 71f,w,s, Transportation: Services and Charges, 3
Bus. Adm. 77f,w,s Survey in Marketing, 3
Bus. Adm. 89f,w,s, Production Management, 3
Econ. 25f,w,s-26f,w,s, Principles of Accounting, 6
Econ. 161f,w,s, Labor Problems and Trade Unionism, 3
Ent. 56w,s, Forest Entomology, 3
For. 48s, Forest Products, 3
For. 53f-54w, Wood Structure and Identification, 6
For. 136f, Forest Economics. 3
Rhet. 22f,w,s, Public Speaking, 3
Rhet. 51f,w,s, Exposition, 3

SENIOR YEAR

1. *Junior courses* which were not completed during the junior year.
2. *Special courses.*—The following courses may be registered for any quarter that they are offered, except that the proper sequence of continuation courses and the prerequisites must be observed.
Agr. Econ. 90f, Agricultural Statistics, 5
Bus. Adm. 88w,s,f, Advertising, 3
For. 29f, Sawmill and Woodworking Machinery, 3
For. 57f, Wood Utilization, 3
For. 58w, Lumber Merchandising and Grading, 3
For. 113f, Wood Pulp and Paper, 3
For. 114f-115w-116s, Mechanical and Physical Properties of Wood, 9
For. 125s, Wood Preservation, 3
For. 151f,w,s, Logging, 3
For. 152s, Wood Seasoning, 3
M.E. 3, Wood Finishing, 3
Psy. 56w, Psychology of Advertising, 3
A sufficient number of courses to be selected in consultation with, and with the approval of, the adviser to make a total of 204 credits.

VI. FOREST TECHNOLOGY

Suggested for those who wish to enter the field of pulp and paper manufacture, wood preservation, or those industries using wood as a raw material. Includes a series of courses in chemistry and mathematics and a thoro training in the structure and properties of wood. The course of study must include the following courses:

SOPHOMORE YEAR

1. *Noncredit courses* required for graduation in addition to the 204 credit hours.
2. *Freshman courses* which were not completed during the freshman year.
3. *Special courses.*—The following courses may be registered for any quarter that they are offered except that the proper sequence of continuation courses and the prerequisites must be observed.

Agr. Econ. 1f,w-2w,s, Principles of Economics, 8
 Anal. Chem. 1w, Quantitative Analysis, 5
 Bot. 2f,w,s, Elementary General Morphology of Plants, 3
 Chem. 11f,s, Qualitative Chemical Analysis, 4
 Math. 30f,w,s, Analytic Geometry, 5
 Math. 50f,w, Calculus I, 5
 Rhet. 1f-2w-3s, Rhetoric, 9

JUNIOR YEAR

1. *Sophomore courses* which were not completed during the sophomore year.
2. *Special courses*.—The following courses may be registered for any quarter that they are offered, except that the proper sequence of continuation courses and the prerequisites must be observed.
 - Bact. 41f,w,s, General Bacteriology, 5
 - For. 29f, Sawmill and Woodworking Machinery, 3
 - For. 48s, Forest Products, 3
 - For. 52s, Wood Seasoning, 3
 - For. 53f-54w, Wood Structure and Identification, 6
 - For. 142s, Wood Chemistry, 3
 - Org. Chem. 51f-52w-53s, Organic Chemistry, 15
 - Physics 7f,w-8w,s-9s,f, General Physics, 15
 - Rhet. 22f,w,s, Public Speaking, 3
 - Rhet. 51f,w,s, Exposition, 3

SENIOR YEAR

1. *Junior courses* which were not completed during the junior year.
2. *Special courses*.—The following courses may be registered for any quarter that they are offered, except that the proper sequence of continuation courses and the prerequisites must be observed.
 - For. 57f, Wood Utilization, 3
 - For. 58w, Lumber Merchandising and Grading, 3
 - For. 113f, Wood Pulp and Paper, 3
 - For. 114f-115w-116s, Mechanical and Physical Properties of Wood, 9
 - For. 119s, Advanced Wood Structure, 4
 - For. 125s, Wood Preservation, 3
 - Phys. Chem. 101f-102w-103s, Physical Chemistry, 9-15
 - Pl. Path. 10w,s, Forest Pathology, 5

A sufficient number of courses to be selected in consultation with, and with the approval of, the adviser to make a total of 204 credits.

(For Science Specialization Curriculum, see page 18.)

D. CURRICULA IN HOME ECONOMICS

- I. Dietetics, page 47.
- II. Home Economics Education, page 48.
- III. Home Economics in Business, page 49.
- IV. Institution Management, page 52.
- V. General Home Economics, page 52.
- VI. Home Economics and Nursery School Education, page 53.
- VII. Home Economics Related Science, page 53.
- VIII. Preparation for Research in (a) Textiles and Clothing and
(b) Foods and Nutrition, page 54.
- IX. College Teaching, page 54.

Specialization in any of the fields of home economics involves two types of training for each student. Throughout the training period there is a core of courses required for homemaking purposes, and, in addition, courses are required depending upon the student's vocational interest and choice. The four-year period includes a study of the physical, biological, and social sciences, English, and art, with opportunities for electives in many other fields. Home economics students have an excellent opportunity to share in the provisions which the University makes for orientation, and general education and advisory service is available for all. Special attention is given to those persons whose only interest is securing training for homemaking purposes. Reasonable modifications of requirements may be made depending upon the student's ability, interests, and needs subject to the approval of the chief of the Division of Home Economics.

The requirements and suggested electives for each field of specialization will be found under appropriate headings, e.g., those interested in Related Art should see the curricula under Business and Teaching; those interested in Foods and Nutrition should see the curricula for Dietetics and for Business and Research; those interested in Textiles and Clothing should see the curricula for Business, Teaching, and Research.

A total of 185 credits is required for the B.S. degree. (See statement regarding adjustment of credits on page 10.)

Clothing.—Home experience in the construction of garments is required of all students who have completed H.E. 3 as a prerequisite to H.E. 4. The character and amount of home experience will be determined by a member of the faculty of the Textiles and Clothing section.

Foods.—Home experience in meal preparation and preservation of fruits and vegetables following H.E. 41, is a prerequisite for H.E. Ed. 93 and H.E. 79 and is required of all whose specialization is Home Economics in Business—Foods and Nutrition and Dietetics. A conference with a member of the faculty of the Foods and Nutrition section should precede this work. An examination covering this work must be passed. For the schedule of these examinations consult the office.

Placement tests.—Students who have had previous courses in home economics in high school or elsewhere are urged to take placement tests. Those who make sufficiently high scores will be permitted to substitute electives for a part of the required elementary courses in Home Economics.

SPECIALIZATION IN THE FIELDS OF HOME ECONOMICS

See Combined Class Schedule Bulletin for numbers of the courses, quarters offered, names of courses, credits, prerequisites, class hours, buildings, and room numbers. In making out quarter programs, schedule for the freshman year those courses which are classified as for freshmen, for the sophomore year those classified as for sophomores, etc., and be sure that provision is made for the proper sequence of continuation courses. Fifteen or sixteen credits should be scheduled for each quarter. Special attention of every student is called to faculty requirements for classification in the junior class, pages 10-11.

All students majoring in home economics will be required to take at least 3 credits in Physical Education. The courses chosen must be approved by the major adviser in the Department of Physical Education for Women.

I. DIETETICS*

This curriculum is planned for women expecting to supervise a dietary department in a general hospital. Students who plan ultimately to hold more highly specialized positions such as those of a therapeutic dietitian or an administrative dietitian or a dietitian in a food clinic should choose their electives carefully in consultation with an adviser familiar with the field selected. Home Experience in Meal Preparation is now required in this specialization.

Freshman Assembly: A course of lectures offered only in the fall quarter.

Home Economics: H.E. 1, 10, 15, 20, 24 (or 21, 22, 55, 180) 31, 33, 40, 41, 50, 61, 62, 64, 75, 79, 85, 86, 142, 163, 170, 171, 173, 175, 176 (or 177), 178, 179, 185.

English: Rhet. 1, 2, 3, 22 (or 11), 31 (or 32 or 60), 34, 51.

Biological Science: Bact. 41, Physiol. 4 (or 51), P.M.&P.H. 52, Zool. 14-15.

Physical Science: Inorg. Chem. 1-2 (or 9-10† or 6-7). Agr. Biochem. 2, 4, Agr. Eng. 23‡.

Social Science: Agr. Econ. 3, 25 (or Econ. 20), Soc. 1, and additional credits chosen from Anthropology, Economics, Geography, History, Political Science, Sociology, or Philosophy to total 18 credits in Social Science.

Psychology: Psy. 1-2.

Home Economics Education 90 (or C.W. 40).

Physical Education, 3 credits.

Electives: Enough additional elective credits to make a total of 185 credits.

* For the Dietetics specialization a grade of at least C is required for the following courses: Agr. Biochem. 4, H.E. 31, 40, 41, 61, 170, 171, Physiol. 4 (or 51) and Soc. 1. A "C" average is required in the following group of courses: H.E. 33, 62, 75, 79, 163, 173, 175, and 178.

† Open only to students with one year of high school chemistry.

‡ Students having one year of high school physics may be exempted from Agricultural Engineering 23.

Suggested electives: Agr. Econ. 126, Agr. Eng. 34, 35, An. Husb. 54, Anthrop. 41, Astron. 11, Bus. Adm. 167, C.W. 80, 82, 90, 170, Econ. 161, 185, Geog. 11, G.C. 1, 29, 30, 31, 73, 74, 75, Geol. 8, H.E. 3, 42, 102, 120, 146, 186, 195, Hist. 1, 2, Philos. 1, 3, Pol. Sci. 1, 2, 3, P.M.&P.H. 57, 61, Psy. 3, 130, 160, Soc. 6, 49, 90.

II. HOME ECONOMICS EDUCATION

The College of Agriculture, Forestry, and Home Economics and the College of Education co-operate in the preparation of teachers of home economics. Satisfactory completion of the following curricula will lead to the B.S. degree and will provide the necessary training for qualification for the Minnesota "high school standard special certificate" for teaching home economics in the secondary school. The teachers' curricula are arranged in accordance with the provisions of the Vocational Education Act.

When the student has acquired a minimum of 90 credits and at least one honor point per credit (junior classification) and indicated her specialization as the teachers' or the extension teachers' curriculum, she becomes a registrant also in the College of Education. At the beginning of the junior year, the student is required to take the psychological examination given in the College of Education.

Prior to registration for Supervised Teaching, the student must have completed the following requirements:

The qualifying examination required of all those graduating from the College of Education.

Home experience in meal preparation and clothing.

Certain home economics courses with at least a grade of C.

In order to be recommended for graduation from the teaching specialization the student must have (1) $1\frac{1}{2}$ honor points per credit in all home economics courses required in the curriculum for General Home Economics Teaching not including home economics education courses, (2) an average of 1 honor point per credit in all other courses pursued during the junior and senior years.

By a proper selection of courses, students qualifying for the degree of bachelor of science may qualify for teaching in more than one field. This is desirable since most beginning teachers in public schools are often expected to teach an academic subject in addition to home economics.

GENERAL HOME ECONOMICS TEACHING*

The following courses are required of those preparing for teaching general home economics:

Freshman Assembly: A course of lectures offered only in the fall quarter.

Home Economics: H.E. 1, 3, 4, 10, 15, 20, 21, 22, 31, 34 (or 170-171), 40, 41, 50, 53, 55, 85, 86, 180, 185.

English: Rhet. 1, 2, 3, 22 (or 11), 31 (or 32 or 60), 34, 51.¶

* For the General Home Economics Teaching specialization a grade of at least C is required for the following courses: H.E. 1, 3, 4, 20, 21, 22, 31, 34 (or 170), 40, 41, 55.

¶ Unless exempt.

Biological Science: Zool. 14-15 and Physiol. 4 (or 51) or G.C. 101, 102; Bact. 41; P.M.&P.H. 52.
 Physical Science: Chem. 1-2 (or 9-10†, or 6-7) and Agr. Eng. 23§ (or 35) or G.C. 88-89; Agr. Biochem. 4.
 Social Science: Agr. Econ. 3 (or Econ. 6-7), 126, Soc. 1, and additional credits chosen from Anthropology, Economics, Geography, History, Political Science, Sociology, or Philosophy to total 18 credits in Social Science.
 Psychology: Psy. 1-2.
 Home Economics Education: H.E. Ed. 90 (or C.W. 40), Ed. 51A, 51C, H.E. Ed. 91, 92, 93-94, 192.
 Physical Education, 3 credits.

Those whose interests lead them into further specialization in the teaching field may choose one of the following groups. The student should plan her program early in her college course to be certain that she has the necessary prerequisites.

Textiles and Clothing: To the above requirements in general teaching add: H.E. 54, 102, 115, 120, Bot. 1.
 Foods: H.E. 61, 142, 146 or 147, Agr. Biochem. 2.
 Nutrition: Omit H.E. 3, 4, 21, 22, 52 (or 53), 55 and 180 and G.C. courses and Agr. Econ. 126. To the above requirements in general teaching add: H.E. 24, 75, 173, 179, 142.
 Home Economics Extension: Those who wish to go into home economics extension teaching should fulfill the requirements of the general teachers' curriculum and add H.E. 98.
 Related Art:* Substitute for the requirements in general teaching the following list of required courses:
 Home Economics: H.E. 1, 3, 4, 10, 15, 20, 21, 22, 23, 25 (or 26), 31, 34, 40, 50, 55, 85, 86, 120, 121, 122, 125, 180, 185.
 English: Rhet. 1, 2, 3, 22 (or 11), 31 (or 32 or 60), 34, 51.
 Biological Science: G.C. 101, 102, P.M.&P.H. 3, 4.
 Physical Science: G.C. 89, 88** (or Agr. Eng. 23).
 Social Science: Agr. Econ. 3, Soc. 1, G.C. 28 or Hist. 1-2, and additional credits chosen from Anthropology, Economics, Geography, History, Political Science, Sociology, or Philosophy to total 18 credits in Social Science.
 Psychology: Psy. 1-2.
 Home Economics Education: H.E. Ed. 90 (or C.W. 40), 91, 92, 93, 94, 192, 197.
 Education: Ed. 51A, 51C.
 Physical Education, 3 credits.
 Art Education: 6 credits freehand drawing as Arch. D.P.-If,w,s; or Art. Ed. 6, 8, 29-30.
 Fine Arts: Any course.

In order to fulfill the requirements for teaching general home economics in addition to related art, the course listed below should be included.

Home Economics: H.E. 41.

III. HOME ECONOMICS IN BUSINESS

Students planning to use home economics training in business may choose one of the following fields in which to specialize.

* For the Related Art Teaching specialization a grade of at least C is required for the following courses: H.E. 1, 20, 21, 22, 23, 25, 26, 55, 122, 125, 180.

† Open to students having one year of high school chemistry.

§ Students having one year of high school physics may be exempted from Agr. Eng. 23 or G.C. 88 and substitute Agr. Eng. 35.

** Students having one year of high school physics may be exempted from Agr. Eng. 23 or G.C. 88 or physics courses.

1. FOODS AND NUTRITION§

Those who wish to specialize in the general field of Foods and Nutrition are required to take the following courses:

Freshman Assembly: A course of lectures offered only in the fall quarter.

Home Economics: H.E. 1, 10, 15, 20, 24 (or 21, 22, 55, 180), 31, 40, 41, 42, 50, 61, 62, 85, 86, 120, 142, 146 (or 147), 170, 171, 179, 185.

English: Rhet. 1, 2, 3, 22 (or 11), 31 (or 32 or 60), 34, 51.

Biological Science; Zool. 14-15, Physiol. 4 (or 51), P.M.&P.H. 52, Bact. 41.

Physical Science: Chem. 1-2 (or 6-7 or 9-10†), Agr. Biochem. 4, Agr. Eng. 23†† (or 35).

Social Science: Agr. Econ. 3; Bus. Adm. 88; Econ. 185 (or Bus. Adm. 167 or Econ. 161 or Agr. Econ. 126); Soc. 1, 6 (or G.C. 28 or 29 or 30 or 38 or 39 or Hist. 1-2), and additional credits chosen from Anthropology, Economics, Geography, History, Political Science, Sociology, or Philosophy to total 18 credits in Social Science.

Psychology: Psy. 1-2, 56 or 130, 160.

Home Economics Education: 90 (or C.W. 40).

Physical Education, 3 credits.

Journalism: Jour. 13, 41, 69 or 70.

Electives should be chosen with the aid of an adviser to make a total of 185 credits necessary for graduation.

2. RELATED ART*

For those who wish to specialize in the general field of Related Art and Business the following courses are required:

Home Economics: H.E. 1, 10, 15, 20, 21, 22, 23 (or 25 or 26) 31, 34, 40, 50, 55, 85, 86, 120, 121, 122, 125, 180, 185.

English: Rhet. 1, 2, 3, 22 (or 11), 31 (or 32 or 60), 34, 51.

Biological Science: G.C. 101, 102, P.M.&P.H. 3, 4.

Physical Science: G.C. 89, 88** (or Agr. Eng. 23).

Social Science: Agr. Econ. 3, 25 (or Econ. 20), 126, Soc. 1, G.C. 28 or Hist. 1-2, and additional credits chosen from Anthropology, Economics, Geography, History, Political Science, Sociology, or Philosophy to total 18 credits in Social Science.

Psychology: Psy. 1-2, 56 (or Bus. Adm. 88).

Home Economics Education 90 (or C.W. 40).

Physical Education, 3 credits.

Art Education, 6 credits freehand drawing from the following courses Art Ed. 6, 8, 29-30, Arch. D.P.-If,w,s.

Fine Arts: Any course.

Business Administration 69.

Journalism, 5 or 6 credits or additional English.

* For the Related Art in Business specialization a grade of at least C is required for the following courses: H.E. 1, 20, 21, 22, 55, 180, 122, 125.

† Open to those having had one year of high school chemistry.

§ For the Foods and Nutrition in Business specialization a grade of at least C is required for the following courses: H.E. 31, 40, 41, 170, 142, Rhet. 22, Jour. 69 or 70.

** Students having had one year of high school physics may be exempted from Agr. Eng. 23 or G.C. 88 or physics courses.

†† Students having had high school physics may be exempt from Agr. Eng. 23 but must take Agr. Eng. 35. Students who have not had high school physics will take only Agr. Eng. 23.

For those who are interested in special aspects of Related Art in the field of business, the following courses are listed:

Interior Furnishing: To the general courses listed under Related Art add:

Arch. D.P.-If,w,s and Art Ed. 6.

Omit H.E. 125 and Art Ed. 8, 29-30.

Costume Design: To the general courses listed under Related Art add:

H.E. 3, 4, 115.

Omit H.E. 122, Arch. D.P.-If,w,s.

Journalism: To the general courses listed under Related Art add:

Bus. Adm. 88, Jour. 13 or 12 or 14-15, 41, or 78, 69 or 73-74, 70, and Psy. 56.

Omit Art Ed. 6, 8, Arch. D.P.-I, Agr. Econ. 25 (or Econ. 20).

For the specialization in Related Art and Journalism a grade of C is required in courses in English and Journalism in addition to the C grade requirements in Related Art.

3. TEXTILES AND CLOTHING*

For those who wish to build up a background in the field of Textiles and Clothing in Business the following courses are required:

Home Economics: H.E. 1, 10, 15, 20, 31, 3, 4,† 21, 22, 34, 40, 50, 55, 85, 86, 115, 120, 121, 185, 180.

English: Rhet: 1, 2, 3, 22 (or 11), 31 (or 32 or 60), 34, 51.

Physical Science: Chem. 1, 2, (or 6-7 or 9-10§ or G.C. 89) and Agr. Eng. 23 (or G.C. 88).¶

Biological Science: Zool. 14, 15 and Physiol. 4 (or 51) or G.C. 101-102; P.M.&P.H. 52; Bact. 41.

Social Science: Agr. Econ. 3 (or Econ. 6-7), 25 (or Econ. 20), 126; Bus. Adm. 69, 88; Soc. 1, 6 (or 14 or 49 or 55 or 119 or G.C. 50-51).

Psychology: Psy. 1-2.

Home Economics Education 90 (or C.W. 40).

Physical Education, 3 credits.

In addition, the student will choose the phase of Textiles and Clothing in Business in which she is interested and for which special requirements are listed below:

Work with a store or other commercial enterprise:

Home Economics: H.E. 53.

Social Science: Bus. Adm. 77.

Modern Language: French, 10 credits, or reading knowledge of French.

Psychology: Psy. 3, 56.

Journalism:

Home Economics: H.E. 53.

Journalism: Jour. 13, 41, 69.

Psychology: Psy. 3, 56.

Fine Arts: 1, 2, 3.

Textile Testing:

Home Economics: H.E. 102, 107.

Biological Science: Omit group with G.C. 101, 102; add Bot. 1, Biostatistics 101.

Physical Science: Omit group with G.C. 89; add Agr. Biochem. 2, 4.

* For the Textiles and Clothing in Business specialization a grade of at least C is required in the following courses: H.E. 1, 50, 21, 22, 3, 4, 102, 107, 115.

† Garments suitable for remodeling must be provided by the student.

§ Open to students having one year of high school chemistry.

¶ Anyone having had high school physics may be exempted from Agr. Eng. 23 and G.C. 88.

Electives suggested for any of the above groups:

- Home Economics: H.E. 54, 102, 125.
- Biochemistry 4.
- History: Hist. 1-2 or G.C. 28.
- Fine Arts 1, 2, 3.

IV. INSTITUTION MANAGEMENT**

For those who wish to specialize in Institution Management the following courses are required:

- Freshman Assembly: A course of lectures offered only in the fall quarter.
- Home Economics: H.E. 1, 10, 15, 20, 24 (or 21, 22, 55, 180), 31, 40, 41, 42, 50, 61, 62, 63, 64, 75 (or 173), 85, 86, 142, 185, 163, 170, 171.
- English: Rhet. 1, 2, 3, 22 (or 11), 31 (or 32 or 60), 34, 51.
- Biological Science: Zool. 14-15, Physiol. 4 (or 51), P.M.&P.H. 52, Bact. 41.
- Physical Science: Chem. 1-2 or 9-10,† Agr. Eng. 23 (or G.C. 88)§ Agr. Biochem. 4.
- Social Science: Agr. Econ. 3 (or Econ. 6-7), 25 (or Econ. 20), 126, Bus. Adm. 77 (or Econ. 185), Bus. Adm. 167¶ (or Econ. 161 or Psy. 160), Soc. 1, 6 (or 14 or 49 or 55 or 119).
- Psychology: Psy. 1-2.
- Home Economics Education 90 (or C.W. 40).
- Physical Education, 3 credits.
- Animal Husbandry 54.

For those who are interested in special aspects of the field of Institution Management, the following electives are suggested:

- Institution Food Service: H.E. 33, 120, 146 (or 147).
- Institution Equipment
- Physics 3, 4 or 23, 24 or 43, 44.

V. GENERAL HOME ECONOMICS*

This curriculum is designed to satisfy the needs and interests of those persons who wish to prepare themselves for homemaking. The prescribed courses offer a broad background in home economics. Opportunity is offered also for a rather wide choice of electives.

- Freshman Assembly: A course of lectures offered only in the fall quarter.
- Home Economics: H.E. 1, 3, 4, 10, 15.
and (20, 24, 120) or (20, 21, 22, 55, 180)
and 37, 40, 41
and (34, 75) or (170, 171)
and 50, 85, 86, 185.
- English: Rhet. 1, 2, 3, 22 (or 11), 31 (or 32 or 60), 34, 51.
- Biological Science: G.C. 101, 102; P.M.&P.H. 52, or the following group
Zool. 14-15, Physiol. 4 or 51, P.M.&P.H. 52, Bact. 41.

* For the General Home Economics specialization a grade of at least C is required for the following courses: H.E. 3, 4, 24 (or 180), 34, 40, 41, 50, 185.

† Open only to students with one year of high school chemistry.

§ Students having had high school physics may be exempted from Agr. Eng. 23 or G.C. 88.

¶ By petition.

** For the Institution Management specialization a grade of at least C is required for the following courses: H.E. 31, 40, 41, 61, 62, 63, 64, 163, 170.

Physical Science: G.C. 89, 90, 88 (or Agr. Eng. 23) or the following group

Chem. 1-2 or 9-10,† Agr. Biochem. 4, G.C. 88§ (or Agr. Eng. 23).

Social Science: Agr. Econ. 3, Soc. 1, 6 (or 14 or 49 or 55 or 119), and additional credits chosen from Anthropology, Economics, Geography, History, Political Science, Sociology, or Philosophy to total 18 credits in Social Science.

Psychology: Psy. 1-2.

Home Economics Education 90 (or C.W. 40).

Physical Education, 3 credits.

VI. HOME ECONOMICS AND NURSERY SCHOOL EDUCATION

A few promising students can be encouraged to pursue this combination. The student and her program must be approved by the director of the Nursery School and the chief of the Division of Home Economics. In addition to the General Home Economics program the following courses offered by the Institute of Child Welfare will be required. These courses are open to juniors.

Ed.T.55 Principles of Early Childhood Education, 3 credits.

Ed.T.56 Permanent Play Materials, 2 credits.

Ed.T.57 Plastic Materials, 3 credits.

Ed.T.58 Rhythms, Games, and Music for the Young Child, 2 credits.

Ed.T.59 Story Telling for Young Children, 2 credits.

Ed.T.75 Methods and Observation in Nursery School, 3 credits.

VII. HOME ECONOMICS RELATED SCIENCE

Opportunity is offered for emphasis on the sciences basic to certain fields in home economics. It is assumed that the student will take graduate work at least to the Master's degree. This curriculum should be chosen only by those who have an excellent high school record and an aptitude for science.

English: Composition and public speaking, 15 credits (including Rhet. 51).

Biological Science: 20 to 25 credits from three or more of the following fields: bacteriology, botany, physiology, preventive medicine and public health, and zoology.

Physical Science: 20 to 25 credits from two or more of the following fields: chemistry, biochemistry, and physics.

Social Science: 18 to 20 credits from one or more of the following fields: anthropology, economics, geography, history, political science, sociology, or philosophy.

Psychology and Child Welfare: 9 credits.

Mathematics, Statistics or combination: 9 to 15 credits.

A major sequence of 24-36 credits in a field such as foods and nutrition, home management, or textiles and clothing.

A minor sequence of 12 credits to be chosen in some field of work outside of the major and not to include any of the courses specifically used to meet the above requirements. (Subject-matter courses from any department or college in the University may be applied as major or minor credits if they are clearly related or fundamental to the field of the major or minor specialization.)

Electives sufficient to make a total of 185 credits of which at least 25 shall be in courses outside the major which will contribute to the recognition and solution of the problems of personal and family living.

Total 185 credits required.

† Open only to students with one year of high school chemistry.

§ Students having had high school physics may be exempted from Agr. Eng. 23 or G.C. 88.

VIII. PREPARATION FOR RESEARCH IN (a) TEXTILES AND CLOTHING AND (b) FOODS AND NUTRITION

These curricula are planned for superior students who wish to be prepared to pursue graduate work with the expectation of filling a research position after receiving an advanced degree. The options and electives offered should be selected in consultation with a major adviser of the Graduate School faculty. An average honor point ratio of 1.5 must be maintained for the major and minor sequences. Courses required for all students taking these curricula:

Freshman Assembly: A course of lectures offered only in the fall quarter.

English: Rhet. 1, 2, 3, 22 (or 11), 31 (or 32 or 60), 34, 51.

Biological Science: Bact. 41, Bot. 1, Physiol. 4 (or 51), P.M.&P.H. 52, Zool. 14-15.

Physical Science: Inorg. Chem. 1-2 (or 9-10 or 6-7), Agr. Biochem. 2, 4 (or Org. Chem. 1-2), Agr. Eng. 23* (or 35 or Physics 3, 4 and 23, 24 or 43, 44).

Social Science: Agr. Econ. 3 (or Bus. Adm. 6, 7), Soc. 1, 6 (or 14 or 19 or 55 or 119), and additional credits chosen from Anthropology, Economics, Geography, History, Political Science, Sociology, or Philosophy to total 18 credits in Social Science.

Psychology: Psy. 1-2.

Home Economics Education 90 (or C. W. 40).

Physical Education, 3 credits.

Mathematics, 10 credits.

Modern Language, 10 credits.

(a) Majors in Textiles and Clothing

General Home Economics: H.E. 10, 15, 20, 34 (or 170 and 171), 40, 31, 85, 86, 185.

A major sequence in the field of textiles and clothing to make a total of 24 to 36 credits and to include the following courses: H.E. 1 (or 5), 3, 24 (or 180), 50, 102.

A minor sequence of 12 credits to be chosen outside the field of textiles and clothing, e.g., biochemistry, botany, economics, physics, and not to include any of the courses required for all. Additional elective credits to make a total of 185 credits.

(b) Majors in Foods and Nutrition

General Home Economics: H.E. 1 (or 5), 10, 15, 20, 24 (or 180), 50, 85, 86, 185.

A major sequence in the field of foods and nutrition to make a total of 24 to 36 credits and to include the following courses: H.E. 31, 24 (or 170 and 171), 40, 41, 75, 142 (or 143).

A minor sequence of 12 credits to be chosen outside the field of foods and nutrition, e.g., biochemistry, physiology, physics, bacteriology, and not to include any of the courses required for all. Additional elective credits to make a total of 185 credits.

IX. COLLEGE TEACHING

Those persons with several years of satisfactory teaching experience and who hold no degree may wish to do further undergraduate and graduate work with the expectation of teaching home economics at the collegiate level. Such persons should be advised by a member of the graduate teaching faculty from the time they enter in order to insure that they take the courses that will best prepare them to pursue graduate work.

(For Science Specialization Curriculum, see page 18.)

* Students having had high school physics may be exempt from Agr. Eng. 23 but take Agr. Eng. 35 or the following group: Phys. 3, 4 and 23, 24 (or 43, 44). Students who have not had high school physics will take only Agr. Eng. 23.

DESCRIPTION OF COURSES

AGRICULTURAL BIOCHEMISTRY

Freshman and Sophomore Courses

This division offers two types of work, namely courses in those phases of chemistry which have special application in agriculture or home economics for students whose major work is in other divisions; and courses designed to train chemists for research or instruction in the special field of agricultural biochemistry.

2. Quantitative Methods. Principles of quantitative analysis, including stoichiometric problems, practice in the use of the balance and in typical gravimetric and volumetric manipulations. (5 cred.; soph., jr., sr.; prereq. Inorg. Chem. 10 cred.)
4. Introduction to Organic and Biochemistry. An introduction to the chemistry of carbon compounds directed toward an understanding of the principles underlying the classification, structure, and general properties of those which are of biological importance. (5 cred.; soph., jr., sr.; prereq. Inorg. Chem. 10 cred.*)
5. Plant Biochemistry. An introduction to the chemistry, metabolism, and nutrition of plants based on the organic and inorganic compounds which are characteristic of plants and plant products, and their reactions and interactions. (5 cred.; soph., jr., sr.; prereq. 4, Soils 6 advised)
6. Animal Biochemistry. An introduction to the chemistry, metabolism, and nutrition of animals based on the organic and inorganic compounds which are characteristic of animals and animal products and their reactions and interactions. (5 cred.; soph., jr., sr.; prereq. 4, Soils 6 advised)

Junior and Senior Courses

- 101-102. Agricultural Quantitative Analysis. The estimation of inorganic and organic constituents of biological products, the proximate analysis of foods and feeding stuffs, the use of the polariscope, immersion, refractometer, colorimeter and nephelometer, viscosimeter, and other special apparatus. (6 cred.; jr., sr.; prereq. 2)
103. Dairy Chemistry. Lectures and laboratory work on the physical, colloidal, and chemical properties of milk and dairy products, the chemistry of the various constituents of milk and of the processes involved by the manufacture of dairy products. (5 cred.; jr., sr.; prereq. 2, 6)
108. Chemistry of Wheat and Wheat Products. A lecture course, with collateral library reference work, on the chemical technology of the production and milling of wheat and the conversion of its products into human food. (3 cred.; jr., sr.; prereq. 5)

* By special permission of the students' adviser, General College Courses 88, 89, 90 will be acceptable as prerequisites.

110. Flour Laboratory Methods. A laboratory course in methods of analysis of wheat and its products; milling tests of wheat, baking, and special tests of flour. Designed to train students for research and control work in the cereal industry. (3 to 5 cred.; jr., sr.; prereq. 101-102 or equiv.)
- 113-114-115. Biochemical Laboratory Methods. A laboratory course paralleling the lectures in 119-123, using recent methods for the investigation of biologically important compounds. (6 cred.; sr.; prereq. quant. anal., parallel 119-123)
116. Advanced Animal Nutrition. Recent developments in animal nutrition, covering the field of proteins, mineral metabolism, and vitamins. (3 cred.; jr., sr.; prereq. 6 or Physiol. Chem. 120 advised)
117. Laboratory Problems in Animal Nutrition. A laboratory course on methods used in nutrition studies. (3 cred.; jr., sr.; prereq. 116, instructor's permission)
118. Laboratory Problems in Biochemistry. Special laboratory work in the preparation and isolation of pure compounds which occur in living cells, the study of biochemical reactions, and special methods of identification or determination of biochemical products. (3 or 5 cred.; sr.; prereq. 113-114, 119; or 103 or 110)
119. Colloids. Lectures and assigned readings dealing with the colloidal state of matter, the preparation and properties of colloidal systems, and the relation of these to biochemical processes. (3 cred.; sr.; prereq. Zool. or Bot. 9 cred., and 5 cred. in Org. Chem. 51-52-153)
120. Proteins. Lectures and assigned readings on composition, structure, chemical and physical properties, and the functions of proteins and amino acids. (3 cred.; sr.; prereq. 119)
121. Carbohydrates. Lectures and assigned readings on the composition, structure, chemical and physical properties, and the functions of the carbohydrates. (3 cred.; sr.; prereq. 119)
122. The Lipids and Fats. Lectures and assigned readings on the composition, structure, chemical and physical properties, and the functions of the fats and fatlike compounds. (3 cred.; sr.; prereq. 119)
123. Enzymes. Lectures and assigned readings on enzyme action, including the methods of preparation and investigation of enzymes and their function in biological and industrial processes. (3 cred.; sr.; prereq. 119)

AGRICULTURAL ECONOMICS

Freshman and Sophomore Courses

1. Principles of Economics I. For students in agriculture and forestry. (3 cred.; soph., jr., sr.; no prereq.)
2. Principles of Economics II. For students in agriculture and forestry. (5 cred.; soph., jr., sr.; prereq. 1)
3. Principles of Economics. For students in home economics. (5 cred.; soph., jr., sr.; no prereq.)
7. Natural Resources. A study of the natural resources of the United States and other countries in their relation to agriculture. Attention is given to

- the importance of these resources and to their wise utilization. Lectures, reference work, and discussions. (3 cred.; soph., jr., sr.; no prereq.)
8. Rural Economics. An analysis of a number of the important economic problems of agriculture, including organization of the agricultural industry, tenancy, farm incomes, rural population and standards of living, tariff, taxation, and agricultural policy. (3 cred.; soph., jr., sr.; prereq. 2 or 3)
 25. Principles of Accounting. (4 cred.; soph., jr., sr. in agr., for., and home econ. only)
 30. Agricultural Prices. Factors determining prices and trend in prices of agricultural commodities. Adjustment of production to price changes. Foreign competition. Price stabilization. Price policies. (3 cred.; soph., jr., sr.; prereq. 2)
 40. Principles of Marketing Organization. The principles of the organization of the market and of marketing enterprises, both proprietary and co-operative. (3 cred.; soph., jr., sr.; prereq. 2)
 47. Marketing Accounting. (4 cred.; soph., jr., sr.; prereq. 25)

Junior and Senior Courses

- 50.* Farm Finance. The mechanism of exchange with special reference to the financing of the production and marketing of farm products. (5 cred.; jr., sr. in agr. or for. only; prereq. 2)
80. Farm Management. Farm records—simple farm accounting and the forms and methods employed in making cost of production studies and farm management surveys. Practice in record keeping and accounting. (3 cred.; jr., sr.)
- 90.* Agricultural Statistics. Statistical method applied to the analysis of agricultural data; collection, tabulation, and graphical presentation; averages; measures of dispersion; index numbers; sampling; time series. (5 cred.; jr., sr.)
102. Farm Organization. The business side of farming is emphasized. Attention is given to principles underlying farm organization and factors affecting returns. Analysis of farm business statements. (3 cred.; jr., sr.; prereq. 2)
103. Farm Operation. Selection and adjustment of crop and livestock enterprises. Utilization of labor, power, and equipment. Physical and productive reorganization of the farm business. Problems encountered by farmers in the operation of their business. (3 cred.; jr., sr.; prereq. 102)
104. Types of Farming. A study of types of farming and of prevailing farm practices in the principal agricultural production areas. (3 cred.; jr., sr.; prereq. 2)
- 110-111. Economics of Agricultural Production I and II. The principles of production economics applied to agriculture, special emphasis being placed upon profitable combinations of factors of production, comparative advantage, and localization of production. (6 cred.; jr., sr.; prereq. 2)

* Open to sophomores on petition.

126. Economics of Consumption. Nature of human wants; standards of living; costs of living; income, administration of income; nature of demand; demand and price; relation of consumption to the population problem. (3 cred.; jr., sr.; prereq. 2 or 3)
131. Market Prices. Manner in which prices are determined in the market place. Local, wholesale, and retail prices. Price fluctuation and speculation. Prices and market grades. Market quotations. (3 cred.; jr., sr.; prereq. 30, 40)
135. Methods of Price Analysis. Statistical methods for the study of the forces determining prices, forecasting price changes, and determining "established prices." Survey of research work in the field. (3 cred.; sr.; prereq. 30, 191)
140. Marketing Organization: Staples. Principles of production economics applied to the organization of markets and marketing organization for the grains, tobacco, cotton, and wool. Special attention to grain marketing. (3 cred.; jr., sr.; prereq. 40)
141. Marketing Organization: Dairy and Poultry Products. (3 cred.; jr., sr.; prereq. 40)
142. Marketing Organization: Fruits and Vegetables. (2 cred.; jr., sr.; prereq. 40)
143. Marketing Organization: Livestock and Meats. (3 cred.; jr., sr.; prereq. 40)
144. Co-operative Organization. Development of co-operation in agriculture in the United States and foreign countries. Analysis of economic problems peculiar to co-operative organization, especially of marketing agencies. (3 cred.; jr., sr.; prereq. 40)
150. Advanced Farm Finance. A consideration of credit problems of farmers with special attention to institutions financing farmers. (3 cred.; jr., sr.; prereq. 50 or equiv.)
170. Land Economics. Land as a factor of production; rural and urban utilization; rents and land values; land classification; land exchange. (3 cred.; jr., sr.; prereq. 110)
191. Advanced Agricultural Statistics. Analysis of agricultural data by methods of correlation, partial and multiple correlation. (3 cred.; jr., sr.; prereq. 90)

See also courses in Economics and Business Administration.

AGRICULTURAL EDUCATION

COLLEGE OF EDUCATION

Junior and Senior Courses

52. Vocational Education. A short history of vocational education; present status in Europe and the United States; manual training and home arts in an educational system; place of agriculture in the public schools with special reference to Minnesota. (3 cred.; jr., sr.; no prereq.)
54. Rural Education and Community Leadership. The school as a com-

- munity center; organizing educational, social, and recreational activities, clubs, festivals, fairs, and other desirable features of rural community life, such as Future Farmers of America. (3 cred.; jr., sr.; prereq. 51)
80. Extension Work. Federal, state, and local extension aims, organization. Assembling and use of extension data and equipment. Development of extension methods especially as applied to the work of Minnesota. (3 cred.; jr., sr.; prereq. 6 cred. in farm management, 6 cred. in farm crops, 15 cred. in animal industry, 3 cred. in agr. ed.)
 81. Teaching Agriculture. Introduction to the setup for teaching agriculture in the high school. Observations of class work, apprentice teaching, curriculum organization, supervised farm practice, and use of the farm and community for teaching purposes. (5 cred.; jr., sr.; prereq. 51)
 82. Teaching Agriculture. Special methods' course dealing with conducting a high school agriculture department. Fundamentals of method in teaching as related to teaching agriculture in high school. Organizing subject-matter. Selection and manipulation of devices. (Same as 81)
 83. Teaching Agriculture. Organization and administration of agriculture in secondary schools including all-day, part-time, and evening school instruction. Special emphasis on equipment, text and reference books, extension work, and organizations. (Same as 81)
 - 91.*‡ Supervised Teaching Experience. Preparation of lesson plans and actual teaching of classes under careful supervision in recitation and laboratory; criticism and discussion of plans, methods, and results of student teaching. Review and discussion of assigned professional readings. (3 cred.; sr.; prereq. 82)
 135. The Curriculum in Vocational Agriculture. A study of curriculum organization, determination of subject-matter, organization of subject-matter, job analysis, course construction, instructions on individual basis, texts, and references. (3 cred.; sr.; prereq. 10 cred. in ed.)
 141. Supervised Practice in Vocational Agriculture. A special methods course dealing with the selection, planning, supervising, and summarizing of the practical work in agriculture. Special emphasis on the problem method of teaching, and the use of the farm and community for teaching purposes. (3 cred.; sr.; prereq. 10 cred. in ed.)
 161. Vocational Education in Agriculture. A study of the principles developed and established in agricultural education. The principles developed in other vocational education and their relation to agricultural education. Opportunities for emphasis on current problems in teaching agriculture. (3 cred.; jr., sr.; prereq. 15 cred. in ed.)
 171. Problems in Procedure. For agriculture teachers. Emphasizes working out problems in detail in order that the processes as formulated can be used in teaching the following year by those enrolled. Discussions, readings, papers, laboratory. (3 cred.; sr.; prereq. 82, 91, or equiv. teaching experience)

* Passing the qualifying examination is prerequisite to this course.

‡ A special fee of \$1 per credit is charged for this course.

AGRICULTURAL ENGINEERING

Freshman and Sophomore Courses

3. Mechanical Drawing. Materials, instruments, and their uses. Lettering, scale reading, conventional symbols, and blue printing. Orthographic projection, pictorial drawing, and farm buildings (Agriculture); or records and plats of surveys, contour, profile, and map tracing (Forestry). (3 cred.; no prereq.)
4. General Woodworking. Instruction and practice in bench and machine woodworking, sharpening edge tools, saws, etc. Painting, wood finishing, and glazing. Projects selected to meet the ability of the student. (3 cred.; no prereq.)
5. Farm Building Construction. Instruction and practice in design and construction of farm buildings. Building materials and estimates. (3 cred.; prereq. 4 or equiv.)
7. Farm Structures. The arrangement, planning, and designing of farm buildings with special attention to their convenience, economy, and durability. (3 cred.; prereq. 3)
11. Applied Mathematics. Rules of practical mathematics with special attention to formulas and problems directly related to agricultural and forestry work; e.g., areas, volumes, progressions, statistics, averages, proportions, variations, investments, cost problems. (5 cred.; no prereq.)
12. Agricultural Machinery. Machinery as a factor in agricultural production, development, construction, and operation. (3 cred.; no prereq.)
13. Gas Engines. Theory, operation, care, and repair of gasoline engines. (3 cred.; no prereq.)
14. Tractors. Lecture and laboratory course dealing with the construction, operation, care, adjustment, testing, and use of the tractor. (3 cred.; prereq. 13)
19. Elementary Surveying. Use of tape, level, transit, and traverse board in agricultural and forestry field problems, e.g., mensuration surveys, traverses, differential and profile leveling; plotting and mapping. Care and adjustment of instruments. (3 cred.; prereq. 3, 11 or trigonometry, or Draw. 3 and M.&M. 12)
20. Advanced Surveying. Topographic surveys by stadia and other methods, running simple curves, cross sectioning, plotting the survey, profile building, grade determination, and figuring of quantities in earthwork. (3 cred.; prereq. 19)
22. Agricultural Machinery Laboratory. Construction and adjustment of machines; measurement of drawbar horse-power; hitches. (1 cred.; prereq. 12 or parallel)
23. General Physics. The elements of physics for those who have not had physics in high school. Mechanics, heat, light, and electricity with laboratory work. (5 cred.; no prereq.)
24. Agricultural Physics I. An applied course involving lectures and laboratory work in mechanics and heat. (4 cred.; prereq. Math. 4 or equiv.)

25. Agricultural Physics II. A practical lecture, recitation, and laboratory course on electricity and light, including electric generating plants, batteries, motors, lighting systems, and light and radiant energy as applied to farm problems. (4 cred.; prereq. 24)
28. Land Clearing. Land clearing methods, machinery, and care and use of explosives. (3 cred.; no prereq.) (Offered only in even numbered years)
31. Principles of Drainage. Elementary principles and practice of soil erosion control and of drainage in relation to plant growth, crop and land values, and farm operation and development. (3 cred.; no prereq.)
32. Elements of Supplemental Irrigation. A study of the place and purpose of supplemental irrigation in humid regions. Systems and methods, plans of layouts, costs and return therefrom. (3 cred.; no prereq.) (Offered only in odd numbered years)
34. Household Mechanics. Lectures, recitations, demonstrations, and laboratory work on the construction, care, maintenance, and repair of household appliances, fixtures, and furniture. (3 cred.; home econ. students only; prereq. 23 or equiv. or G.C. 88)
35. Household Physics. Lectures and laboratory work on the physical principles underlying the operation of the common household devices and appliances. Home heating; air conditioning and ventilation, artificial lighting, illumination. (3 cred.; prereq. 23 or equiv. or G.C. 88)
37. Rural Sanitation. Wells, pumps, and water supply. Methods of securing sanitary water systems for farmsteads and rural institutions. Sanitary sewage disposal methods for homes, creameries, etc. (3 cred.; no prereq.)
40. Mechanical Training. Instruction and laboratory practice in mechanical trades embracing rope work, belt lacing and pulleys, cement work, soldering, electric wiring, harness repair, etc. (3 cred.; no prereq.)
41. Metal Work. Instruction and laboratory practice in mechanical trades embracing cold metal work, pipe fitting, forge work, oxyacetylene welding, brazing and cutting, and electric arc welding. Students may select any of the above and concentrate on those of special interest. Special attention given to practical applications and features of special interest to teachers. (3 cred.; no prereq.)
43. Mechanical Laboratory. Instruction and laboratory practice in mechanical work embracing rope work, belt lacing and pulleys, cement work, soldering, welding, pipe fitting, electric wiring, etc. (3 cred.; prof. agr. eng. only; no prereq.)
44. Advanced Drawing. Plans and pictorial drawings, including perspective, charts, graphs, and co-ordinate plotting on various scales. Mapping. Illustrations for publication. (2 cred.; prereq. 3 or equiv.)

Junior and Senior Courses

51. Land Reclamation. Principles and practices of soil erosion control, land drainage, and irrigation in relation to plant growth, farm operation, land development, and community interest. (5 cred.; jr. and sr. prof.

62 AGRICULTURE, FORESTRY, AND HOME ECONOMICS

- agr. eng. only; prereq. 19 or parallel, Soils 6, M.&M. 143) (Offered only in even numbered years)
67. Farm Structures Design. Planning, estimating, and designing of farm structures. Study of materials, and equipment commonly used. (3 cred.; jr., sr.; prereq. 7, M.&M. 128)
 68. Drainage Engineering and Works. Design, location, and construction of public and private drainage systems and works; construction estimates, drainage engineering, and public records. (3 cred.; jr., sr.; prereq. 51)
 69. Irrigation Engineering and Works. Design, location, and construction of irrigation works; reservoir and transmission losses; general irrigation law; irrigation engineering and public records. (3 cred.; jr., sr.; prereq. 51)
 70. Steam Boilers and Engines. Construction, operation, and care of simple steam engines and boilers. (3 cred.; jr., sr.; prereq. Phys. 23, 24)
 71. Design and Economics of Agricultural Machinery. Machine and power costs of farm operations; operating principles and design problems. (3 cred.; jr., sr.; prereq. 12, 13, 22, M.E. 27)
 72. Applied Electricity. Laboratory work in direct and alternating current machines as used on farms, including generators, motors, storage batteries, transformers, and complete isolated electric and hydroelectric plants. (3 cred.; jr., sr.; prereq. 25)
 - 91, 92, 93. Seminar. General agricultural engineering seminar. Junior and senior students will give reports of their investigations on certain assigned problems for research. (1 cred. each for 92 and 93; prof. agr. eng. only)
 - 101-102-103. Advanced Drainage Problems. Special drainage problems including surface run-off, soil permeability, relation of soil and crop type to drainage, shape and regulation of water table in relation to root growth, etc. (3 to 6 cred. per qtr.; sr.; prereq. 51)
 - 111-112-113. Farm Building Problems. Investigations in the utility and durability of building materials. Methods of construction, costs, and efficiency of farm buildings. (3 to 6 cred. per qtr.; sr.; prereq. 67)
 - 121-122-123. Farm Power and Machinery Problems. Special studies of farm machinery and mechanical power for the farm. Tests, design, and adaptability to various farm conditions. (3 to 6 cred. per qtr.; jr., sr.; prereq. 126)
 126. Selection and Management of Agricultural Machinery. Special problems in economical power and machine combinations and their application to the farm. (3 cred.; jr., sr.; prereq. 14, 71, Agr. Econ. 103)

AGRONOMY AND PLANT GENETICS

Freshman and Sophomore Courses

1. General Farm Crops. A study of the important field crops of the United States. (3 cred.; no prereq.)
21. Grain Crops. Structure, function, culture, improvement, and uses of corn, wheat, oats, barley, rye, flax, and buckwheat. (4 cred.; soph, jr., sr.; prereq. 1)

22. Grain and Hay Grading. Development of grades, study of grading methods, and actual practice in grading grain and hay samples according to federal standards. Training in judging grain and hay on quality basis. (3 cred.; soph., jr., sr.; prereq. 1)
23. Forage Crops. Methods of obtaining stands, stage of maturity of cutting or grazing in relation to continued productivity, yields and quality of product. Hay and silage makings and storage. (4 cred.; soph., jr., sr.; prereq. 1)
31. Principles of Genetics. Fundamental principles of breeding, heredity, variation, biometry, and evolution. (4 cred.; soph., jr., sr.)

Junior and Senior Courses

124. Problems in Farm Crops. Through the use of the problem method, the student is given opportunity to deal with important phases of agronomy. (3 cred.; jr., sr.; prereq. 1, 31, and at least two courses from groups 21, 23, 132, 134. Seniors and special students may register in the course with approval of instructor)
126. Crop Judging. Identification of crops, weeds, and diseases in relation to judging and grading farm crops. (3 cred.; jr., sr.; prereq. 22)
132. Farm Crops Plant Breeding. Applied genetics. Methods of breeding each of the important agricultural crops. (4 cred.; jr., sr.; prereq. 31)
133. Pasture Crops and Management. Characteristics, economic value, and distribution of pasture plants. Methods of obtaining stands. Management of temporary and permanent pastures to maintain and improve production. (3 cred.; jr., sr.; prereq. 23)
134. Seminar in Agronomy. Critical studies of problems in agronomy. (2 cred.; sr.; prereq. Agron. 9 cred.)

ANALYTICAL CHEMISTRY

INSTITUTE OF TECHNOLOGY

SCHOOL OF CHEMISTRY

Freshman and Sophomore Courses

- 1-2. Quantitative Analysis. (10 cred.; soph., jr., sr.; prereq. Inorg. Chem. 13)

For additional courses and course descriptions see the Bulletin of the Institute of Technology.

ANIMAL AND POULTRY HUSBANDRY

ANIMAL HUSBANDRY

Freshman and Sophomore Courses

- 1-2. Market Livestock Production. Opportunities and problems in livestock production. Livestock markets and marketing methods. The market classes and grades of horses, cattle, sheep, and swine. Practice in classifying, grading, and appraising livestock. (6 cred.; no prereq.)

- 3-4. Breeds of Livestock. The origin, history, characteristics, and economic importance of the breeds of livestock. Factors for consideration in the selection of breeding animals and practice in judging purebred livestock. (6 cred.; soph., jr., sr.; prereq. 1-2)
- 5. Livestock Judging. Practice in judging horses, cattle, sheep, and hogs from the market and breed standpoint. (3 cred.; soph., jr., sr.; prereq. 3-4)

Junior and Senior Courses

- 50. Fundamentals of Livestock Production. Basic principles involved in the breeding, feeding, and management of livestock. (3 cred.; jr., sr. in forestry or prof. agr. eng. only; no prereq.)
- 51. Meat Selection. Lectures on the characteristics and peculiarities of meats from different animals. Meat classification, grading, and utilization; the physical and chemical composition of meat. (3 cred.; jr., sr.; prereq. 1-2)
- 52. Meats. Slaughter of animals and the cutting of carcasses. Lectures, demonstrations, and laboratory; meat judging practice. (3 cred.; jr., sr.; prereq. 1-2, 51)
- 53. Advanced Meats. The relation of animal form to carcass yield. The commercial wholesale and retail meat cuts. Factors affecting the quality of meat. (3 cred.; jr., sr.; prereq. 52)
- 54. Utilization of Meats. A study of the different cuts of pork, beef, veal, mutton, and lamb with reference to prices, relative economy, uses, nutritive value, chemical composition, ripening, curing, palatability. (3 cred.; jr., sr. home econ. students; no prereq.)
- 56-57. Livestock Feeding. A study of the nutritional requirements of farm animals and the composition and characteristics of livestock feeds. The values of separate feeds and of combinations of feeds for beef cattle, sheep, horses, and swine. (6 cred.; jr., sr.; prereq. 1-2)
- 101. Advanced Stock Judging. Competitive judging of all types, breeds, and classes of livestock supplemented by visits to nearby stock farms. (3 cred.; jr., sr.; prereq. 5)
- 107. Meat Problems. The wholesale cuts and grades of meat; the packing industry and the utilization of by-products. Special problems and trips to packing establishments. (3 cred.; jr., sr.; prereq. 53)
- 108. Seminar. Special problems and research assignments on investigations pertaining to the livestock industry. (3 cred.; jr., sr.; prereq. 3-4)
- 112. Animal Breeding. The application of the principles of genetics to the breeding of livestock; a review of the master-breeders' methods and consideration of the practical breeders' problems. (3 cred.; jr., sr.; prereq. Agron. 31)
- 113. Livestock Management. Management problems in market stock and in purebred livestock production. A study of the essential management principles involved in each of the several types of specialization in livestock production. A general course covering horses, beef cattle, sheep, and hogs. (3 cred.; jr., sr.; prereq. 3-4)

115. The Marketing of Livestock. A study of livestock marketing methods; transportation problems; sanitary regulations; meat processing and distribution; visits to the South St. Paul market; selling purebred livestock. (3 cred.; jr., sr.; prereq. 3-4)

POULTRY HUSBANDRY

Freshman and Sophomore Courses

1. Poultry Production. An introduction to the poultry industry, housing, feeding, market classes, and management. (3 cred.; soph.; no prereq.)
2. Poultry Judging. The origin, standard requirements, and common defects of the leading commercial standard breeds and varieties and determination of standard values by the score card and comparison methods. (3 cred.; prereq. 1 or parallel)

Junior and Senior Courses

50. Poultry Problems. Special problems and research in the field of poultry industry. (2 to 6 cred.; jr., sr.; prereq. 6 cred. in poultry husbandry)
51. Incubating, Brooding, and Breeding. Instruction and practice in incubation and brooding, selection of breeding stock and eggs for hatching, and feeding young chicks. Of practical value to teachers of agriculture and poultry raisers. (4 cred.; jr., sr.; prereq. 1, Agron. 31)
52. Advanced Poultry Judging. Practice in close selection for high egg production; for standard values of different color patterns and principal standard types; mating to produce high standard quality. (3 cred.; jr., sr.; prereq. 2)
103. Poultry Feeding and Management. A study of principles of poultry nutrition and systems of feeding and management. (3 cred.; jr., sr.; prereq. 2, Agr. Biochem. 6)

ANTHROPOLOGY

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Freshman and Sophomore Courses

41. Introduction to Anthropology. (5 cred.; soph., jr., sr.; prereq. 10 cred. in sci. or soc. sci.)

Junior and Senior Courses

54. Cultural Anthropology: Social Organization. (3 cred.; jr., sr.; prereq. 41)
62. Ethnology of Polynesia. (3 cred.; jr., sr.; prereq. 41)
106. European Prehistory. (3 cred.; jr., sr., grad.; prereq. 41)
110. Physical Anthropology. (3 cred.; jr., sr., grad.; prereq. 41 or one course in human anat. or zool.)
112. Growth and Biological Techniques. (3 cred.; jr., sr., grad.; prereq. 110 or permission of instructor)

66 AGRICULTURE, FORESTRY, AND HOME ECONOMICS

- 115. The American Indian. (3 cred.; jr., sr., grad.; prereq. 41)
- 116. Indians of the Southwest. (3 cred.; jr., sr., grad.; prereq. 41)
- 161. Primitive Religion. (3 cred.; jr., sr., grad.; prereq. 41)

For additional courses and course descriptions see the Bulletin of the College of Science, Literature, and the Arts.

ARCHITECTURE

INSTITUTE OF TECHNOLOGY

COLLEGE OF ENGINEERING AND ARCHITECTURE

Junior and Senior Courses

- 51-52-53. History of Architecture. (6 cred.; jr., sr.; prereq. consent of instructor)
- 54-55-56. History of Architecture (continued). (6 cred.; prereq. 53)
- D.P.-I‡ Drawing and Painting, Grade I. (6 cred.; no prereq.)
- D.P.-II.‡ Drawing and Painting, Grade II. (6 cred.; prereq. D.P.-I)
- D.P.-III.‡ Drawing and Painting, Grade III. (6 cred.; prereq. D.P.-II)
- A.D.-I.‡‡ Architectural Design, Grade I. (15 cred.; no prereq.)
- A.D.-II.‡‡ Architectural Design, Grade II. (18 cred.; prereq. A.D.-I)
- S.D.-I. Stage Design. (4 cred.; no prereq.)
- 4-5-6. Graphic Representation. Projections, shades and shadows, perspective, etc. (6 cred.; no prereq.)

For additional courses and course descriptions see the Bulletin of the Institute of Technology.

ART EDUCATION

COLLEGE OF EDUCATION

Freshman and Sophomore Courses

- 1-2-3. Fundamental Experiences in Design. (9 cred.; all; prereq. high school art or 14-15-16)
- 6. Sketch from Pose. (2 cred.; all; no prereq.)
- 8. Drawing. Continuation of 4, 6. (2 cred.)
- 10-11-12. Experiences with Rhythm and Color. (Not offered as a separate course in 1938-39)
- 20-21-22. Fundamental Experiences in Design (continued). With especial emphasis upon light and color. (9 cred.; soph.; prereq. 1-2-3)
- 23-24-26-28. Drawing from Still Life and Pose. (2 cred. each)
- 29-30. Rhythmic Sketch (action and blackboard drawing). (1 cred. each qtr.; no prereq.)

For additional courses and course descriptions see the Bulletin of the College of Education.

‡ A fee of \$1 per quarter is charged for this course.

‡‡ A fee of \$2 per quarter is charged for this course.

BACTERIOLOGY AND IMMUNOLOGY

MEDICAL SCHOOL

Freshman and Sophomore Courses

- 41.‡‡ General Bacteriology. (5 cred.; soph., jr., sr.; prereq. 10 cred. in chem. and 4 cred. in botany or zoology)

Junior and Senior Courses

103. Soil Microbiology. Studies of the microscopic inhabitants of the soil, their interrelationships and rôle in the transformations of soil constituents with particular emphasis on the cycles of carbon, nitrogen, and sulphur in nature. (5 cred.; jr., sr., grad.; prereq. 41, and 15 cred. in chem.)
114. Molds, Yeasts, and Actinomycetes. (4 cred.; jr., sr., grad.; prereq. 41 or 101)
- 121-122.† Physiology of Bacteria. (6 cred.; jr., sr., grad.; prereq. Bact. 41 and 8 cred. in org. chem. or biochem.)

BOTANY

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Freshman and Sophomore Courses

1. General Botany. (4 cred.; all; no prereq.)
- 2.‡ Elementary General Morphology of Plants. (3 cred.; all; prereq. 1)
3. Forest Botany. (1 cred.; students in agr. and for.; no prereq. Given at Itasca Park)
- 5.‡ Elementary Plant Histology. (3 cred.; all; prereq. 1)
- 7.‡ Taxonomy of Flowering Plants. (3 cred.; all; prereq. 1)
- 21.‡ Elementary Ecology. (3 cred.; all; prereq. 1)
- 22.‡ Elementary Plant Physiology. (3 cred.; all; prereq. 1 and high school or college chem. or registration in college chem.)

Junior and Senior Courses

- 61.‡ Thallophytes. (3 cred.; jr., sr.; prereq. 10 cred. incl. 2)
- 62.‡ Bryophytes and Pteridophytes. (3 cred.; jr., sr.; prereq. 10 cred. incl. 2)
- 63.‡ Gymnosperms and Angiosperms. (3 cred.; jr., sr.; prereq. 7 and either 2 or 62)
108. Pteridophytes. (5 cred.; sr., grad.; prereq. 18 cred. incl. 7 and 62) (Not offered in 1938-39)
110. Gymnosperms. (5 cred.; sr., grad.; prereq. 18 cred. incl. 7 and 63)
- 113-114-115.* Advanced Taxonomy of Flowering Plants. (9 cred.; jr., sr., grad.; prereq. 10 cred. incl. 7)

* Any quarter may be taken separately, except 115, which requires either 113 or 114 as a prerequisite.

† A fee of \$1 is charged for this course.

‡‡ Microscope required. Use of microscope may be obtained by purchasing \$1.50 microscope card from bursar, Main campus.

- 118.‡ Cytology I—Cytoplasmic Phenomena. (3 cred.; jr., sr., grad.; prereq. 15 cred. in biol. incl. Bot. 5 and an elem. course in chem.)
- 119.‡ Cytology II—Nuclear Phenomena. (3 cred.; jr., sr., grad.; prereq. same as for 118)
- 120.‡ Research Methods in Histology and Cytology. (3 or 5 cred.; jr., sr., grad.; prereq. 118 and 119)
127. Anatomy of Vascular Plants. (5 cred.; jr., sr., grad.; prereq. 18 cred. incl. 5)
131. Field Ecology. (5 cred.; jr., sr., grad.; prereq. 10 cred. incl. 21)
- 132.‡ Ecological Anatomy. (5 cred.; jr., sr., grad.; prereq. 10 cred. incl. 5 and 21)
133. Plant Geography of North America. (5 cred.; jr., sr., grad.; prereq. 10 cred. incl. 21)
- 134.‡ Research Methods in Ecology. (5 cred.; jr., sr., grad.; prereq. 18 cred. incl. 21) (Not offered in 1938-39)
136. Physiology of the Cell. (3 cred.; jr., sr., grad.; prereq. 20 cred. in physics, chem., or biochem. and permission of instructor)
140. General Plant Physiology. (3 cred.; jr., sr., grad.; prereq. 22, elem. inorg. chem.)
- 141.‡ Physicochemical Principles and Measurements in Plant Physiology. (3 or 5 cred.; jr., sr., grad.; prereq. 20 cred. in chem. or biochem.)
- 142.‡ Photosynthesis and Other Effects of Radiation. (3 or 5 cred.; jr., sr., grad.; prereq. same as for 141)
- 143.‡ Plant Metabolism. (3 or 5 cred.; jr., sr., grad.; prereq. same as for 141)
- 144.‡ Applied Spectroscopy in Biology. (3 to 5 cred.; jr., sr., grad.; prereq. 20 cred. in chem. or biochem.)
- 145.‡ Advanced Spectroscopy in Biology. (3 cred.; jr., sr., grad.; prereq. 144)
- 197-198-199. Problems. (3 to 5 cred.; jr., sr., grad.; prereq. 20 cred. and consent of instructor)

CHILD WELFARE

Freshman and Sophomore Courses

10. Introduction to Child Study. To orient student with reference to modern movement for nursery schools, parent education, and the study of child development. Some consideration of the kindergarten, Montessori, and mental hygiene movements. (2 cred.; 3rd qtr. fr. and soph.; no prereq.)
40. Child Training. Survey of child development followed by a discussion of the practical aspects of the training of young children. Observations in the Nursery School, lectures, and reports. Students cannot receive credit for both 40 and 90. (3 cred.; soph., jr., sr.; prereq. Psy. 1-2)

‡ A fee of \$1 is charged for this course. No fee is charged for Botany 141, 142, or 143, 3 credits, lectures only.

Junior and Senior Courses

80. Child Psychology. A survey of child development with special reference to nursery school and kindergarten education. (3 cred.; jr., sr.; prereq. Psy. 1-2)
82. Later Childhood and Adolescence. Growth, social adjustment, emotional, mental, and personality development. Training and guidance, leisure time activities. (3 cred.; prereq. 40 or 80 or equiv.)
130. Motor, Linguistic, and Intellectual Development of the Child. Lectures, readings, and reports. (3 cred.; sr., grad.; prereq. 12 cred. in psy. or equiv.)
131. Personality, Emotional, and Social Development of the Child. Lectures, readings, and reports. (3 cred.; sr., grad.; prereq. 12 cred. in psy. or equiv.)
- 133-134.† Measurement of Child Personality. The various methods and techniques such as growth records, mental tests, ratings, controlled observations, experiments, etc., used in the study of the young child. Practical exercises on institute records and data. (4 cred.; sr., grad.; prereq. 10 cred. in psy. or ed. psy., and Ed. Psy. 60, or Biom. 101, and permission of instructor)
140. Behavior Problems. Nature and origin of behavior difficulties. Emphasis upon young children and the relation between early behavior trends and later maladjustment. (2 cred.; sr., grad.; prereq. 12 cred. in psy., ed. psy., or soc.)
- 141-142. Practicum in Behavior Problems. Clinic and field work in the study and treatment of behavior problems. (Cred. ar.; sr., grad.; prereq. 140 and permission of instructor)
170. Parent Education. History and survey of present programs in parent education and adult education. Analysis of child development and training literature in relation to the preparation of materials for study groups. Lectures, discussions, and reports. (2 cred.; sr., grad.; prereq. 15 cred. in child welfare or home econ., or ed., or psy., or soc., or prev. med.)
190. Principles of Mental Measurement of Young Children. Mental test methods and their interpretation. Lectures, demonstrations, readings, and reports. (3 cred.; sr., grad.; prereq. 12 cred. in psy., ed. psy., or soc.)

DAIRY HUSBANDRY

Freshman and Sophomore Courses

1. Elements of Dairying. Lectures and demonstrations with opportunity for laboratory practice. The history and development of the dairy industry. The origin and classification of domesticated cattle. History and characteristics of the dairy breeds of cattle. Milk, its composition, food value, chemical and physical properties with relation to the handling of milk and the manufacture of milk products. Dairy arithmetic. (5 cred.; prereq. entrance cred. in chem. or Inorg. Chem. 1 or 9)

† To receive credit for any part of this course a student must complete the parts preceding the dagger.

2. Dairy Bacteriology. Lectures and laboratory exercises. Types of milk organisms; the contamination of milk and how prevented; relation of milk to the public health; the bacteriology of dairy products. (3 or 5 cred.; 3 cred. for lect., 2 cred. for lab.; soph., jr., sr.; prereq. Bact. 41) (Lecture taken separately only on permission of instructor)
3. Testing Dairy Products. The use of the Babcock test and other tests common to dairy products plants. (4 cred.; prereq. 1)
4. Dairy Products Practice. A study of factory methods. Includes a minimum of one month's practical experience in a plant handling dairy products in a factory way. Reports and records of work done required. (3 cred.; soph., jr., sr.; prereq. 1)
9. Dairy Cattle Judging. A study of the type and breed characteristics of dairy animals and the relation of form to function in the dairy cow. (1 cred.; soph., jr., sr.; no prereq.)
10. Dairy Products Judging. Laboratory practice in the grading of milk and milk products including cream, ice cream, cheese, butter, and concentrated milks. (1 cred.; soph., jr., sr.; prereq. 1, 2)

Junior and Senior Courses

51. Market Milk. Lectures and laboratory work. Classes of market milk; transportation and distribution; sanitary inspection; equipment and operation of plants; problems of public control. (3 cred.; jr., sr.; prereq. 1, 2)
101. Milk Production. Problems of the dairy farmer, such as characteristics and adaptations of dairy breeds; selection and management of dairy herd and sire; calf raising, dairy barns. (5 cred.; jr., sr.; prereq. 1)
103. Dairy Stock Feeding. Application of principles of nutrition to feeding the dairy cow and growing young animals. Feeding standards; characteristics of various feeding stuffs; formulation of rations. (3 cred.; sr.; prereq. 101, Agr. Biochem. 6) (Only 2 credits allowed to those who have completed An. Husb. 56-57)
104. Dairy Stock Selection. Selection by type, pedigree, and production records. (2 cred.; jr., sr.; prereq. 9, 101 or parallel)
105. Seminar I. Special investigation and study of selected topics. Each student presents papers and reports on assigned subjects and reviews recent scientific investigations in dairy husbandry. (1 cred.; sr.; prereq. 3 courses in dairy husbandry)
106. Seminar II. Continuation of 105. (1 cred.; sr.; prereq. 105)
110. Dairy Products III. The manufacture of ice cream with special reference to the chemical and physical processes involved. Organization, construction, equipment, and operation of such factories. Laboratory exercises and lectures. (3 cred.; jr., sr.; prereq. 1, 3)
111. Dairy Products I. The manufacture of butter with special reference to the chemical and bacteriological processes involved. Organization, construction, equipment, and operation in such factories. Laboratory exercises to illustrate these processes. (3 cred.; jr., sr.; prereq. 1, 2, 3)
112. Dairy Products II. The manufacture of cheese, condensed and pow-

- dered milks with special reference to the chemical, bacteriological, and physical processes involved. Organization, construction, equipment, operation of such factories. Laboratory exercises and lectures. (3 cred.; jr., sr.; prereq. 1, 2, 3)
113. Technical Control. Lectures and laboratory. Chemical and bacteriological laboratory methods used in technical control of milk and its products. Use of Monjonnier tester, cryoscope, and bacteriological control methods. (3 cred.; sr.; prereq. 2, 111 or 112)
115. Advanced Dairy Bacteriology. Investigations of specific problems on the bacteriology and mycology of milk and dairy products. (3 cred.; sr.; prereq. 2, 111 or 112)
116. Milk Secretion. Lecture assignments covering the anatomy and physiology of milk secretion and factors influencing the quality and quantity of milk. (3 cred.; sr.; prereq. Physiol. 9 cred. and Agr. Biochem. 103)
117. Dairy Cattle Breeding. Application of the principles of genetics to the improvement of dairy cattle. Evaluation of breeding animals and formulation of breeding plans. (3 cred.; jr., sr.; prereq. 101, 104, Agron. 31)
- (For courses in Dairy Chemistry see Agricultural Biochemistry 103, page 55.)

ECONOMICS

SCHOOL OF BUSINESS ADMINISTRATION

For courses and course descriptions see the Bulletin of the School of Business Administration.

See also courses in Agricultural Economics.

EDUCATIONAL ADMINISTRATION AND SUPERVISION

COLLEGE OF EDUCATION

For courses and course descriptions see the Bulletin of the College of Education.

EDUCATIONAL PSYCHOLOGY

COLLEGE OF EDUCATION

For courses and course descriptions see the Bulletin of the College of Education.

ENGLISH

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Freshman and Sophomore Courses

- 21-22-23. Introduction to Literature. (15 cred.; all; prereq. Rhet. 1, 2, 3)
 31-32.† The English Novel. (6 cred.; all; prereq. Rhet. 1, 2, 3)
 33. The Later English Novel. (3 cred.; soph., jr., sr.; prereq. Rhet. 1, 2, 3)

For additional courses and course descriptions see the Bulletin of the College of Science, Literature, and the Arts.

† To receive credit for any part of this course a student must complete the parts preceding the dagger.

ENTOMOLOGY AND ECONOMIC ZOOLOGY

Courses in this department are closely correlated with those offered by the Department of Zoology of the College of Science, Literature, and the Arts. Courses 117-118-119, 120, 125-126-127, 139-140, 144-145-146, and 197 of this division are also offered under these numbers by the Department of Zoology.

Freshman and Sophomore Courses

5. (Formerly Course 65.) Economic Entomology. The life histories, habits, and methods of control of the insects pests of orchard, field, and garden. Laboratory work in the determination of the more important forms. (5 cred.; soph., jr., sr.; prereq. Zool. 14-15 or equiv.)
13. Field Zoology. For forestry freshmen at Itasca Park. (1 cred.; no prereq.)
- 14-15-16. Principles of Beekeeping. History of beekeeping industry. Life history, morphology, physiology, and reproduction of the honey bee. Colony development. Races of bees. Bee equipment. Apiary and shop management. Wintering, disease control. Grading and marketing bee products. (2 to 6 cred.; no prereq.)
- 17-18-19. Beekeeping Practice. Laboratory, shop, and apiary work. External and internal anatomy of honey bee. Assembling equipment. Installing package bees, requeening, making increase. Preparation of combs and extracted honey for market. (1 to 3 cred.; prereq. 14-15 or parallel)
20. Advanced Beekeeping. Special work for students specializing in beekeeping, adapted to the needs of the individual student. (2 to 6 cred.; prereq. 14 to 19 and 5 cred. in ent.)
49. Introductory Entomology. General characters, classification, and habits of insects. (3 cred.; fr., soph.; prereq. Zool. 14-15 or equiv.)

Junior and Senior Courses

- 51.*† Introductory Parasitology. An elementary course dealing with parasitic Protozoa, worms, and arthropods and their relation to diseases of man and animals. (5 cred.; jr., sr.; prereq. Zool. 14-15 or equiv.)
- 52.*† Introductory Entomology. General morphology, life histories, habits, and classification of insects. (5 cred.; jr., sr.; prereq. Zool. 14-15 or equiv.)
56. Forest Entomology. Lectures and laboratory work dealing with the principles of controlling insects that attack trees and forest products, together with a consideration of the life history and habits of important representative species. (3 cred.; jr., sr.; prereq. Zool. 14-15 or equiv.)
61. (Formerly Course 68.) Forest Zoology. Lectures, laboratory, and field work. Habits and life histories of forest vertebrates. Relations of vertebrates to forest environments and their effects on these environments. Collection and care of specimens. (3 cred.; jr., sr.; prereq. Zool. 14-15 or equiv. Given at Cloquet)

* Offered on the Minneapolis campus.

† Open to sophomores on petition.

62. (Formerly Course 69.) Wildlife Conservation Principles and Administration. A general course dealing with principles and practical problems met in administering the wildlife resources, and with the state and federal agencies which are involved. Public attitudes toward this resource, and legislation are considered. (3 cred.; jr., sr.; prereq. Zool. 1-2-3 or equiv. Given at Itasca Park.)
64. Economic Vertebrate Zoology. Lectures and library work. Deals with the various vertebrates of Minnesota, their habits and economic status, and means by which their numbers may be controlled. (3 cred.; jr., sr.; prereq. Zool. 1-2-3 or equiv.)
114. Apiculture. Problems of bee management, disease control, wintering, bee breeding, processing and marketing bee products. Given in the form of seminar discussion and laboratory and field practice. (3 cred.; jr., sr.; prereq. 9 cred. in beekeeping, 9 cred. in entomology)
- 117-118-119. General Ecology. General ecology with special reference to the insects of Minnesota. Frequent field trips. Lectures, laboratory, and field work. (9 cred.; jr., sr.; prereq. 15 cred. in zool. or ent.)
120. General Ecology of Insects. Ecology with special reference to insects, their distribution, natural control, and related problems. Lectures, laboratory, and field work. (3 cred.; jr., sr.; alternative to 119, or both may be taken; prereq. 117-118)
- 125-126-127.* Advanced General Entomology. Advanced work in the lines of morphology and classification of insects with lectures on the history of entomology. Lectures and laboratory. (9 cred.; jr., sr.; prereq. 15 cred. in zool. or ent.)
- 139-140. Histology and Development of Insects. Lectures and laboratory work on the histology, embryonic and postembryonic development of insects. Individual work along these lines is available to properly qualified students in Course 197. (9 cred.; jr., sr.; prereq. 125-126-127 or equiv.)
- 141-142. Insects in Relation to Plant Diseases. 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 diseases, the methods of rearing and handling the carriers. Of interest to students in entomology, plant pathology, horticulture, forestry, and agronomy. (6 cred.; jr., sr.; prereq. 8 cred. in ent. or plant path.)
- 144-145-146.* Animal Parasites and Parasitism. Lectures and laboratory work. Origin and biological significance of parasitism; structure, life history, and economic relations of representative parasites. Second term devoted primarily to the relation of insects to diseases of man and animals. (3 to 9 cred.; jr., sr.; prereq. Zool. 9 cred.)
150. Introduction to Aphidology. The biology and taxonomy of Aphidae. (3 cred.) (Given in alternate years. Offered in 1938-39).
161. Waterfowl and Upland Game Birds. Life histories, habits, environmental requirements and management of the North American species of

* Offered on the Minneapolis campus.

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- game birds. Lectures, laboratory and field work. (3 cred.; jr., sr.; prereq. Zool. 46-47 or equiv.)
163. (Formerly Course 63.) Mammalogy. Distinguishing characters and life histories of the various mammal groups, particularly those represented in the state. Consideration is given to the possibilities of fur farming in case of certain species. (3 cred.; jr., sr.; prereq. Zool. 22)
165. (Formerly Course 66.) Game Management. Theory and practice of game management, including a consideration of its history and mechanism; the properties of game populations; the factors that make up game environments; methods of recognizing and measuring these properties and factors; and management measures for the various species. (3 cred.; jr., sr.; prereq. 62, 64, 163)
166. Methods in Field Zoology. Lectures and laboratory work. Frequent field trips. Use of field data, range mapping, censuses, surveys, preparation of indices and life equation tables, field investigation techniques. (3 cred.; jr., sr.; prereq. 163, 165)
175. Insecticides and Their Action. A study of the chemical composition, the physical properties, and the physiological action of standard, of little known, and of new insecticides. (4 cred.; sr.; prereq. inorg. and org. chem.)
- 176-177. Advanced Economic Entomology. A critical consideration of the principles of insect control and the history of their development. (6 cred.; sr.; prereq. 5 or 56, Zool. 117-118-119 or equiv.)
197. Introduction to Research. Preparation for investigational work in lines of entomology, parasitology, ecology, economic zoology, or bee-keeping. Advanced laboratory, field, and library work; training in preparation of bibliographies and manuscripts; special problems. Summer work should be planned when possible. (5 or more cred.; sr.; prereq. work as prescribed by the division)

FORESTRY

Freshman and Sophomore Courses

1. General Forestry. A brief history of the development of forestry in Europe and America; its bearing on the forestry problems of the United States; description of the United States forests. Lectures and collateral reading. (3 cred.; no prereq.)
2. Field Dendrology. Trees and shrubs found in Itasca Park, with special reference to identification by means of gross characters. (1 cred.; no prereq.)
- 3,4. Dendrology. The forest trees of the United States; their classification, characteristics, and range, with special attention to prominent and constant characteristics. Lectures, assigned reading, laboratory. (3 cred. for Course 3 and 4 cred. for Course 4; no prereq.)
5. Field Silviculture. Largely field work designed to give the student a working knowledge of the forest. Includes silvicultural study of the

- species found in the north woods and the general principles underlying silvicultural reconnaissance. (2 cred.; no prereq. Given at Itasca Park)
6. Field Mensuration. Largely field work. Includes elementary work in timber cruising, valuation surveys, stem analysis, and the study of the measurements of stand, volume, and yield; use of compass, pacing and mapping. (1 cred.; no prereq. Given at Itasca Park)
- 7-8-11. Forest Mensuration. The basic principles underlying the measurement of forest products. Measurement of standing and felled timber. Special attention is given to log rules, preparation and use of volume and yield tables, and growth of trees and stands. (9 cred.; all; prereq. 6, Math. 1 and 6)
9. Camp Management. Instruction and experience in camp management. Each student shall be placed in charge of the summer camp under faculty supervision for a short period of time. (1 cred.; no prereq. Given at Itasca Park)
10. Farm Forestry. The place of forestry in land use planning. The economic status of the farm woodlot. The establishment and care of woodlots and windbreaks. Forest influences with special reference to soil erosion control. The use of wood on the farm. (3 cred.; no prereq.) (Not open to students majoring in forestry)
20. Grazing. History of grazing in the West. Kind of stock used. Forage plants. Regulations and methods of handling stock. Range management and protection. Lectures, recitations, and reading. (3 cred.; soph., jr., sr.; no prereq.)
29. Sawmill and Woodworking Machinery. Sawmills, woodworking machinery, and the processes in the primary manufacture of lumber products. (3 cred.; soph., jr., sr.)
48. Forest Products. An introductory survey of the products of forests other than lumber such as naval stores, tannins, wood pulp, paper, etc. Lectures, reading, reports. (3 cred.; no prereq.)
49. House and Furniture Woods. The woods used in house construction and finish, furniture, etc. Their identification and properties. Lectures and laboratory. (2 cred.; soph., jr., sr.; no prereq.) (Not open to students majoring in forestry)

Junior and Senior Courses

- 53-54. Wood Structure and Identification. Structure, classification, and identification of the domestic commercial woods. Lectures, reading, laboratory. (6 cred.; jr., sr.; prereq. 3, 4)
57. Wood Utilization. The economic hard and soft woods, both foreign and domestic from standpoint of production, distribution, qualities, amounts, and prices in relation to the wood using industries. Lectures, reading, reports. (3 cred.; sr.; prereq. 53-54)
58. Lumber Merchandising and Grading. A study of the lumber industry, lumber associations, lumber grades, lumber prices, and distribution. (3 cred.; sr.; prereq. 53-54)

- 62-63. Forest Problems. The preparation of a report on some phase of forestry work. This report may include the results of some original investigation, or it may consist in collecting and arranging facts and the drawing of proper conclusions from these facts. (4 cred.; sr. classification)
101. Advanced Dendrology. A continuation of Course 3, 4 with special studies in classification and distribution of the timber species of the world. (3 cred.; jr., sr.; prereq. 3, 4)
111. Advanced Forest Mensuration. Continuation of Course 11 with special emphasis on the construction of alignment charts, and correlation as applied to problems in forest mensuration. (3 cred.; sr.; prereq. 11)
113. Wood Pulp and Paper. Cellulose and its properties. Methods of production of wood pulp and paper products. Lectures, reading, reports. (3 cred.; jr., sr.; prereq. 53-54, Chem. 3 or 10)
114. Mechanical and Physical Properties of Wood. Derivation and application of the formulas used in determining stresses in wood. Laboratory methods in timber physics. Lectures, laboratory, reading, and reports. (3 cred.; jr., sr.; prereq. 53-54, Math. 7)
- 115-116. Mechanical and Physical Properties of Wood. Study of the physical properties of wood. Shrinkage, relation of strength to moisture content, etc., and their bearing on wood utilization. Laboratory reading and reports. (6 cred.; sr.; prereq. 114)
119. Advanced Wood Structure I. The microtechnique of woody tissues. Lectures, reading, and laboratory work. (4 cred.; sr.; prereq. 53-54)
125. Wood Preservation. Lectures and collateral reading upon the history, development, and methods of wood preservation. Different systems now in use and preservatives used. (3 cred.; jr., sr.; prereq. 53-54)
126. Silvics. The fundamentals forming the basis of silviculture with special attention to the silvics of the important tree species. Lectures, readings, and required papers. (3 cred.; jr., sr.; no prereq.)
127. Silviculture. A study of the general principles underlying the art of silviculture, and a brief study of European methods as applied to American conditions. (3 cred.; jr., sr.; prereq. 126)
128. Silviculture Laboratory. Nursery practice and field planting. Preparation of a silvicultural plan for a small tract of timber and the application of that plan. (6 cred.; jr., sr.; prereq. 127)
129. American Silvicultural Practice. A study of the silvicultural methods now being employed in the United States and the probable results of the application of other European methods. Lectures, references, and discussion. (3 cred.; jr., sr.; prereq. 127)
130. Forest Valuation. The business of forest management. A study of the different factors entering into the valuation of forest property. (5 cred.; jr., sr.)
131. Forest Policy and Administration. Policy of the United States and the states toward the utilization of the public forest resources. Policy of other owners toward forest resources controlled by them. Administration of the national and state forests. (5 cred.; jr., sr.)

132. Forest Regulation Laboratory. Field work. The collection of the data necessary to working up a forest working plan. Includes the making of the timber estimates, growth studies, and maps necessary to a forest working plan. (6 cred.; jr., sr.; prereq. 130. Given at Cloquet)
136. Forest Economics. The place of the forest in the productive utilization of land; past and present markets and source of supply of timber and timber products, particularly with reference to the present situation in North America. (3 cred.; jr., sr.; prereq. 130, Agr. Econ. 2)
137. Seeding and Planting. A study of the principles of seeding and planting and the various methods used in the different regions of the United States. (3 cred.; jr., sr.; prereq. 126 or 127)
140. Forest Working Plans. A study of methods of regulating and allotting the cut from a forest under management. Preparation of a working plan. Lectures and reports. (3 cred.; sr.; prereq. 128, 132)
141. Principles of Silvics. A study of the principles underlying the silvical characteristics of trees and the reactions of trees to their environments. (3 cred.; jr., sr.; prereq. 126)
142. Wood Chemistry. Wood composition, the constitution of wood components, the reactions of wood components and derivatives, and the analysis and chemical technology of wood and wood products. (3 cred.; jr., sr.; prereq. Org. Chem. 52, For. 54)
143. Forest Recreation. The recreational use of the forest from an economic, sociological, and technical point of view. Administrative and technical problems arising from recreational use. (3 cred.; jr., sr.)
151. (Formerly Course 51.) Logging. The principles and general methods of operation in the United States, and the modifications required by forest management. (3 cred.; jr., sr.)
152. (Formerly Course 52.) Wood Seasoning. The theory and practice of air seasoning and kiln drying of wood. (3 cred.; jr., sr.; prereq. 53-54)
155. (Formerly Course 55.) Forest Protection. The protection of forest from fire—fire prevention and fire suppression. The causes of forest fires and their elimination, climate and fires, fire fighting and fire legislation. (3 cred.; jr., sr.; prereq. 127)
- 220-221-222. Major Report. Independent study and the preparation of a comprehensive report on some phase of general forestry, range management, or game management. (2 cred. per qtr.; grad.)
- 223-224-225. Literature Seminar. Assigned topics with special reference to current forestry problems. Critical and historical review of current forestry literature. (1 cred. per qtr.; grad.)

GENERAL COLLEGE

28. Europe Today and Yesterday. Class meets twice a week.
29. The Functions and Problems of Government. Class meets three times a week.
30. The American Citizen and His Government. Class meets three times a week.

31. International Relations. Class meets three times a week.
 32-33. Minnesota: Its History and People. Class meets twice a week.
 Part A. The Pioneer Commonwealth of Minnesota.
 Part B. The Modern Commonwealth of Minnesota.
 49-50-51. Social Trends and Problems. Class meets three times a week.
 73-74-75. Current Affairs I. Class meets twice a week.
 88,89,90. Physical Science Studies. Class meets five times a week each quarter.
 88—Part A. Energy and Matter.
 89—Part B. The Nature of Chemistry.
 90—Part C. Technology, Astronomy, and Sound.
 101-102-103. Human Biology. Class meets three times a week each quarter.

GEOLOGY AND MINERALOGY

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Freshman and Sophomore Courses

- 1-2.† General Geology (Dynamic and Historical). (6 cred.; all; no prereq.)
 A-B.‡ General Geology Laboratory (Dynamic and Historical). (4 cred.; all; with or after 1-2)
 1-3.† General Geology (Dynamic and Economic). (6 cred.; all; no prereq.)
 A-C.‡ General Geology Laboratory (Dynamic and Economic). (4 cred.; all; with or after 1-3)
 8. Introductory Geology. (5 cred.; all; no prereq.)
 23-24.†† Elements of Mineralogy. (8 cred.; soph., jr., sr.; prereq. a course in chem.)

For additional courses and course descriptions see the Bulletin of the College of Science, Literature, and the Arts.

GERMAN

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Freshman and Sophomore Courses

1. Beginning German A. (5 cred.; all; no prereq.)
 2. Beginning German B. (5 cred.; all; prereq. 1 or one year of high school German)
 3. Beginning German C. (5 cred.; all; prereq. 2 or two years of high school German)
 4. Intermediate German. (5 cred.; all; prereq. 3 or three years of high school German)
 24-25-26.† Chemical German. (12 cred.; no prereq.)
 30-31-32. Medical German. (9 cred.; prereq. 3)

† To receive credit for any part of this course a student must complete the parts preceding the dagger.

‡ A fee of \$1 per quarter is charged for this course.

Two options are permitted for requirements in Science Specialization Curriculum: 1-2 (15 cred.) or 24-25-26 (12 cred.)

For additional courses and course descriptions see the Bulletin of the College of Science, Literature, and the Arts.

HISTORY AND PHILOSOPHY OF EDUCATION

COLLEGE OF EDUCATION

For courses and course descriptions see the Bulletin of the College of Education.

HOME ECONOMICS

Freshman and Sophomore Courses

1. Choice and Care of Clothing. A consideration of the problems involved in the selection and buying of clothing. A study will be made of the characteristics of certain textile materials, and their suitability for various uses. (4 cred.; fr.; no prereq.)
2. Introduction to Textiles. A study of textile fibers and their properties as related to fabric properties; yarn and fabric structure and design; problems in the selection of textile materials for clothing and household furnishings. Laboratory work with representative fabrics. (3 cred.; all; no prereq.) (For S.L.A., Bus. Adm., and Art Ed.)
3. Clothing Construction A. Laboratory practice in designing and planning, cutting, fitting, and applying the suitable techniques in making garments of cotton and silk or rayon fabrics; care and use of sewing machines; interpretation and adaptation of commercial patterns. Construction problems will include a child's garment. (3 cred.; soph.; prereq. 1)
4. Clothing Construction B. Laboratory practice in costume modeling; preparation of dress form; application of tailored technique to silk, rayon, or wool fabrics; garments constructed will include a remodeling problem. (3 cred.; soph., jr.; prereq. 3, 21, and home practice in clothing construction)
10. Introduction to Home Economics. A study of the environment of the new student, emphasizing the educational and vocational problems involved. (2 cred.; 1st qtr. fr. only; no prereq.)
15. Personal Relationships. This course is concerned with a study of human relationships. Practical situations involved in everyday living will be discussed. (2 cred.; fr.; no prereq.)
20. Introduction to Related Art. A study of the art problems which are involved in the everyday life of the student. (4 cred.; fr.; no prereq.)
- 21-22. Color and Design I, II. The principles of color and design related to such problems as selecting and designing costumes and selecting, arranging, and designing house furnishings. (3 cred. for each course; prereq. 20 for 21, 21 for 22)
23. Advanced Design. An intensive study of design and its applications. The aim is facility in designing. (3 cred.; soph., jr.; prereq. 22)

24. Problems in Home Planning and Furnishing. Exteriors and interiors studied for their design and suitability. An analysis of typical floor plans. Problems in selecting and arranging household furnishings. (5 cred.; soph.; prereq. 20)
25. Design Applied to Crafts. Principles of design and color harmony applied in various crafts. Articles are planned to relate to definite dress and home furnishing problems. (3 cred.; prereq. 22)
26. Decorative Needlework and Other Crafts. Applied design in needlework the major interest. Other crafts are given consideration. (3 cred.; prereq. 22)
- 30.* Introduction to Nutrition. A course designed for students wishing a discussion of the application of the principles of nutrition to the selection of food. (2 cred.; no prereq.) (Not open to home econ. students)
31. Introduction to Nutrition. The application of nutrition principles to food selection. Includes typical student problems such as buying meals, the regulation of weight through diet, the relation of food to health, and the nutritive needs of college students. (3 cred.; fr.; no prereq.)
33. Nutrition I. (1) The nature and properties of groups of compounds occurring in the cell and in food, (2) digestion, and (3) absorption. (4 cred.; soph., jr., sr.; prereq. Agr. Biochem. 4, Physiol. 4 or 51)
34. Nutrition Problems. A consideration of the nutrition problems most commonly met by adults and children in typical families. (4 cred.; 3rd qtr. soph., jr., sr.; prereq. 31, 40, physiol. or human biol.)
40. Food Preparation. The development of technique and the application of fundamental science principles to cookery processes. The establishment of good standards for food products. (5 cred.; prereq. 2 qtrs. chem.)
41. Food Management and Marketing. Determination and study of the management factors involved in the food problems of the homemaker and consumer. A study of the quality and cost of foods on the market. Laboratory and field work. (5 cred.; soph., jr., sr.; prereq. 31, 40)
42. Demonstrations. The aim shall be to familiarize the student with the purposes and techniques of demonstrations on the various fields of home economics with special reference to their application in the field of business. (1 cred.; open only to sr.)
43. Food Service for Special Occasions. Attention will be given to those occasions requiring special menus and special types of service. (1 cred.; open only to sr.)
44. Camp Cookery. Simple cookery processes with adaptations to out-of-door cookery. Laboratory and field work. Not open to home economics students. For prospective foresters, engineers, and others. (Given in alternate years.)

Junior and Senior Courses

50. Textiles. A lecture and laboratory course dealing intensively with textile materials—fibers and fabrics, with special emphasis upon the selection of household fabrics; textile problems of the consumer-buyer. (3 cred.; jr., sr.; prereq. 1)

* Offered on the Minneapolis campus.

53. Advanced Clothing. Laboratory course in the designing, modeling, and construction of silk or wool costume, including millinery; one problem to test acquired speed. (3 cred.; jr., sr.; prereq. 4, 22, 50)
54. (Formerly Course 52.) Problems in Clothing Construction. Laboratory work will deal with alteration of ready-made garments, fitting, pattern modification, and other construction processes. (3 cred.; jr., sr.; prereq. 53 or permission of instructor)
55. Related Art Problems. Problems worked out relating to costume and house furnishing design. (3 cred.; jr., sr.; prereq. 22 or 56)
- 56A-56B. Applications of Color and Design. The principles of design and color applied to the selection, cost, and arrangement in the fields of costume, dress, and household fabrics and household furnishings. (3 cred. each; no prereq.; courses must be taken in the sequence indicated; not open to home econ. students. Written permission must be obtained from the Junior College office, 106 Folwell Hall)
61. Quantity Cookery. Application of the principles of cookery to large quantity preparation; planning of meals for dining hall, cafeteria, and tearoom; a study of standardized formulae and production costs. (4 cred.; jr., sr.; prereq. 40, 41)
62. Institution Experience A. Experience in the minor problems of cafeteria, dining hall, and tearoom administration. (3 cred.; jr., sr.; prereq. 40, 41)
63. Institution Experience B. Additional experience in preparation of food for large groups, and individual problems in organization and administration. (3 cred.; jr., sr.; prereq. 61, 62) (For institution management majors only)
64. Institution Buying. Problems involved in the purchasing and use of foods and equipment for the institution. (4 cred.; jr., sr.; prereq. 61 or parallel, 62 or parallel)
70. Advanced Food Preparation. This course involves an intensive study (with laboratory work) of one of the following problems: cooking meat or fish and poultry; preservation of fruits and vegetables or meats and poultry; cakes; bread. (3 cred.; prereq. Agr. Biochem. 4, H.E. 40)
75. Dietetics Laboratory. (1) Food values, (2) problems relating to the selection of food under conditions of health and under such pathological conditions as are treated by diet. (2 cred.; jr., sr.; prereq. 34 or 170)
- 76.* Nutrition. The application of the principles of nutrition as applied to special groups. (3 cred.; not open to home economics students; permission of instructor)
79. Selected Problems for Dietitians. A selected group of problems related to the work of the dietitian involving discussions, assigned readings, and field trips. (3 cred.; jr., sr.; prereq. 170 or equiv. The student must have completed Home Experience in Meal Preparation)
84. Junior-Senior Problems. Independent work will be required on a problem selected under guidance. Open only to those persons who are taking Home Management Laboratory *in the same quarter*. (2 cred.; permission of instructor under whom the student wishes to work)

* Offered on the Minneapolis campus.

85. Home Management: Operation and Maintenance, Lectures. Discussion of the managerial aspects of homemaking with special emphasis upon problems involved in the use of time, energy, and money. (3 cred.; jr., sr.; prereq. 40, H.E. Ed. 90 or C.W. 40 or parallel)
86. Home Management: Operation and Maintenance, Laboratory. Actual experience in a home management house with various household management problems including the care and development of a child of pre-school age. (4 cred.; jr., sr.; prereq. 85 or parallel, 40, 185 parallel, H.E. Ed. 90 or C.W. 40)
- 89.* Home Management with Special Reference to Low Income Families. The management of the home in relation to the economic and social status of the family, special consideration being given to the dependent family. (3 cred.; jr., sr.) (Not open to home economic students)
98. Home Economics Extension. Study of the objectives, organization, and functioning of home economics extension service in Minnesota and elsewhere. Observation of work in the Twin Cities. Discussion and conferences. (3 cred.; sr.; prereq. H.E. Ed. 91 or parallel)
102. Advanced Textiles. An intensive study of textile materials with special reference to the following: nature of the raw materials; economic, chemical, and physical applications involved in their manufacture and use; methods and significance of physical testing. (3 cred.; jr., sr.; prereq. 50, Agr. Biochem. 4, Agr. Econ. 3 or parallel)
107. Textile Analysis. Problems and application of quantitative methods in textile analysis with special reference to establishing standards for fabrics. (3 cred.; jr., sr.; prereq. 102, Agr. Biochem. 2)
115. Clothing Economics. A study of the economic aspects of clothing which directly or indirectly affect the consumer. (2 cred.; jr., sr.; prereq. 50, Agr. Econ. 3)
120. Art History and Appreciation. The historical development of painting, sculpture, architecture, decoration, furniture, and costumes, studied with special emphasis on design and influence upon modern styles. (3 cred.; Senior College and grad. only)
121. Textile Design. A study of historic and modern textile designs with special reference to the technique and materials employed in their production and to their adaptations for present-day use in the home and in dress. (3 cred.; jr., sr.; prereq. 50, 55, 120)
122. Advanced Interior Design. Special problems of small house interiors involving execution of elevation drawings. Studies and reports on topics of practical and historical interest. Actual materials will be used as far as possible. (3 cred.; jr., sr.; prereq. 180, 120 or permission of instructor)
125. Advanced Costume Design. Relation of color and texture to dress design. Study of figure construction. Studies and reports on assigned topics. Laboratory work with fabrics. Designs in pencil and water colors. (3 cred.; jr., sr.; prereq. 4, or permission of instructor, 22; 26 recommended)

* Offered on the Minneapolis campus.

142. Experimental Cookery. An intensive study of problems in foods and food preparation with individual laboratory problems. (3 cred.; jr., sr.; prereq. 40, Agr. Biochem. 4)
146. Special Food Problems. Individual problems in foods and food preparation. (3 cred.; sr.; prereq. 142)
147. Special Food Problems. The same as Course 146 with additional problems. (5 cred.; sr.; prereq. 142)
163. Institution Management Problems. Problems affecting the efficient administration of the institution; departmental organization, operation, maintenance; employment problems; business policies. Field trips to various types of institutions. (3 cred.; sr.; prereq. 61, 62, 64 or parallel)
170. Nutrition of the Family. The fundamental principles of human nutrition as applied to the feeding of individuals and groups under conditions of health. (3 cred.; jr., sr.; prereq. 31, 40, Agr. Biochem. 4, Physiol. 3 cred.)
171. Child Nutrition. Lectures, discussions, and field work dealing with the principles of child nutrition and with the formation of desired food habits. (3 cred.; jr., sr.; prereq. 170, H.E. Ed. 90 or C.W. 40)
173. Nutrition in Disease. A study of the fundamental principles involved in using diet in the treatment of certain diseases. (3 cred.; jr., sr.; prereq. 170, 175 also advised)
175. Nutrition II. A study of tissues and tissue metabolism as well as work on blood, milk, and urine. (4 cred.; jr., sr.; prereq. 33)
176. Advanced Nutrition. Selected quantitative methods applicable to investigations relating to digestion and metabolism. (4 cred.; jr., sr.; prereq. 33, 175 or parallel, Agr. Biochem. 2)
177. Digestion and Metabolism. An intensive study of problems relating to digestion and metabolism involving lectures, readings, demonstrations, and laboratory work. (3 cred.; jr., sr.; prereq. 175)
178. Clinical Problems in Nutrition. The application of nutrition information to problems in health and disease involving assigned readings, discussions, and experience in a clinic. (2 cred.; jr., sr.; prereq. 75 or parallel, 170, 175 or parallel)
179. Readings in Nutrition. A course designed to give intensive experience in the use of nutrition books and periodicals, involving assigned readings, oral and written reports. (2 cred.; jr., sr.; prereq. 170)
180. Home Planning and Furnishing. A study for the homemaker who aims at more intelligent planning and furnishing of the home. House plans and the selection and arrangement of equipment and furnishings from the point of view of beauty and good home management. (5 cred.; jr., sr.; prereq. 55; 120 recommended)
185. Family Relationships. A consideration of the factors that promote security, stability, and satisfaction in the immediate family group; and the responsibilities of the family in its relationship to community life. (2 cred.; jr., sr.; prereq. 86 or parallel, H.E. Ed. 90, or C.W. 40)

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186. Problems in Income Management. An intensive study of problems relating to individual and family budgets. Readings, discussions, and field work. (3 cred.; prereq. 85 or parallel, 86, 170 or equiv., Agr. Econ. 126 or parallel)
195. Development of Home Economics. A discussion of the development of home economics with special emphasis upon current problems. (2 cred.; sr.; permission of instructor)

HOME ECONOMICS EDUCATION

COLLEGE OF EDUCATION

Junior and Senior Courses

90. Child Training. A brief study of the physical and mental development of the child is followed by a discussion of the problems of training small children. Emphasis is placed on the preschool child. Lectures, observations in the Nursery School, and reports. (3 cred.; jr., sr.; prereq. Psy. 1-2)
- 91.† Observation, Materials, Teaching in Home Economics. The psychological bases for teaching; investigation and collection of facts on teaching situations through observation and participation in school activities; study of teaching materials and method. (5 cred.; jr., sr.; prereq. H.E. 4, 34 (or 170), 41, 50, 55; Psy. 1-2; Ed. 51A, 51C; Parallel H.E.Ed. 93)
92. Teaching Problems in Home Economics. Reports, discussion, conferences on the planning of units, teaching procedures, illustrative materials, and equipment. (2 cred.; sr.; prereq. H.E. Ed. 91, 93 parallel; H.E. Ed. 94 and 192)
- 93.† Supervised Teaching in Home Economics. Observation, participation, and actual teaching experience under supervision in different home economics situations and on different age levels. (3 cred.; jr., sr.; prereq. H.E. 4, 34 (or 170), 41, 50, 55; Psy. 1-2; Ed. 51A, 51C; parallel H.E. Ed. 91. Students must have received a grade of C or higher in H.E. 1, 3, 4, 20, 21, 22, 31, 34 (or 170), 40, 41, 55, and must have completed home experience in meal preparation and clothing, and must have passed the qualifying examination)
- 94.† Supervised Teaching in Home Economics. A continuation of H.E. Ed. 93. (3 cred.; sr.; prereq. H.E. Ed. 91, 93; parallel H.E. Ed. 92, 192) To receive credit for this course student must have completed H.E. Ed. 93.
192. Educational Measurement in Home Economics. Study of the techniques of measurement applicable in home economics, construction and evaluation of objective devices; review of published tests and scales. (2 cred.; sr.; prereq. 91, 93 parallel; H.E. Ed. 92 and 94)
193. Home Economics Curriculum. The objectives of home economics at various educational levels; evaluation of present curriculum practices; techniques employed in curriculum planning and reconstruction. (3 cred.; sr.; prereq. or parallel 94 or permission of instructor)

† A fee of \$1 per credit is charged for this course.

- 194a. Adult Education Problems. Development of unit outlines in the various fields of home economics. Discussion of teaching methods. This course is planned for high school and extension teachers and supervisors of home economics classes. (3 cred.; prereq. 91, 93)
- 194b. Adult Education Problems. Development of unit outlines, illustrative material, and bibliography for use in adult classes. Course is planned for teachers and supervisors of local leader groups or adult classes. (3 cred.; prereq. 91, 93)
197. Organization and Methods for Related Art Teaching. Organization of a related art course and methods of teaching art as applied to familiar objects and processes. (3 cred.; sr.; prereq. 91, 180 or parallel)
199. Methods of Investigation and Research. Study of methods used in collecting data on various types of educational problems; tabulations; organization; appropriate statistical treatment of data; writing reports of investigations made. (2 cred.; sr.; prereq. 192 or permission of instructor)

HORTICULTURE

Freshman and Sophomore Courses

6. Fruit Growing. The fundamental principles of fruit growing. Sites, soils, nursery stock, planting and planting plans, tillage, fertilization, cover crops, pollination, frost avoidance, pruning, and thinning. Lectures, recitations, and references. (3 cred.; no prereq.)
10. Home Floriculture. Designed for the student who does not take any other courses in floriculture. Gives the student a working knowledge of the propagation, culture, and uses of common garden flowers and house plants. Lectures, reference reading, and laboratory. (3 cred.; not open to students who have credit in Hort. 11 or 56; no prereq.)
11. Garden Flowers. A study of the common annuals, biennials, and perennial flowers, with special emphasis on their uses in landscape planting. Lectures, reference reading, laboratory, and field trips. (3 cred.; [2 cred. if Course 10 has been taken] prereq. Bot. 10 cred. or equiv.) (Offered only in odd numbered years.)
12. Commercial Floriculture, Fall Crops. A study of the culture of the principal florists' crops with major emphasis on chrysanthemums, carnations, and cut flowers and potted plants, especially adapted to Christmas sales. Lectures, reference reading, laboratory, and field trips to greenhouses and flower stores. (3 cred.; prereq. Bot. 1 or equiv.)
12. Commercial Floriculture, Fall Crops. A study of the culture of the principal florists' crops with major emphasis on roses, bulbous plants, the minor cut flower crops, and bedding plants. Lectures, reference reading, laboratory, and field trips to greenhouses and flower stores. (3 cred.; prereq. Bot. 1 or equiv.) (Offered only in even numbered years.)
21. Plant Materials, Fall and Winter Aspects. A study of the trees, shrubs, and evergreens used in landscape planting, with special emphasis on their fall and winter characters, their identification and uses in landscape design. Lectures, outdoor and indoor laboratories, field trips. (3 cred.; prereq. Bot. 10 cred. or equiv.)

22. Plant Materials, Spring and Summer Aspects. A study of trees, shrubs, and evergreens used in landscape planting, with special emphasis on their spring and summer characters, particularly that of blooming habit. Lectures, outdoor and indoor laboratories, field trips. (3 cred.; prereq. Bot. 10 cred. or equiv.)
24. (Formerly Course 74.) Principles of Landscape Design. The composition of the various elements used in landscape gardening, methods of presentation. Lectures and problems. (3 cred.; prereq. 21 or 22, Draw. and Des. Geom. 41 or Agr. Eng. 3)
32. Vegetable Growing. The fundamental principles of vegetable growing. Scope of the industry and its place in agriculture. Varieties, seed production, regional adaptation, soils, fertilizers, equipment, storage, systems of production and marketing. (3 cred.; no prereq.)
40. Horticultural Laboratory. Laboratory exercises in practical horticulture formerly given in connection with Courses 6 and 32. Lectures and practice in plant culture, spraying, planting, pruning, and grafting. (2 cred.; prereq. Hort. 3 cred.)
41. Judging Horticultural Crops. The principles and practice of judging and exhibiting fruits, vegetables, and flowers. (2 cred.; soph., jr., sr.; prereq. 6 or 32) (Offered only in even numbered years)

Junior and Senior Courses

56. Plant Propagation. Methods of propagating plants by seed, cuttings, layers, and grafting. Practical work in management of nursery stock, bulbs, and plants. Lectures, reference reading, and field trips. (3 cred.; [2 cred. if Course 10 has been taken] jr., sr.; prereq. Bot. 7 cred. or equiv.) (Offered only in even numbered years)
107. Orchard Management. A detailed study of the various operations in orchards and berry fields. Operating costs and profits. Lectures, laboratory, and individual problems. (3 cred.; jr., sr.; prereq. 6) (Offered only in even numbered years)
110. Horticultural Crop Breeding. Applied genetics are emphasized. The method of breeding each of the important horticultural crops with special attention to experiment station investigations and to the methods used by plant breeders. (3 cred.; jr., sr.; prereq. Agron. 31)
111. Systematic Pomology. Fruit varieties. Classification, description, identification, and elements of judging. Lectures, laboratory, and a survey of the literature. (3 cred.; jr., sr.; prereq. 6, Bot. 10 cred. or equiv.) (Offered only in odd numbered years)
121. Small Fruit Culture. Cultural practices for each of the small fruits. Brief consideration is given to their botanical relationships and the history of their commercial development. Lectures, problems, and survey of literature. (3 cred.; jr., sr.; prereq. 6 or 32, Bot. 10 cred. or equiv.)
135. Potatoes. Culture, handling, storage, seed maintenance, varieties, improvement, and physiology of the potato plant. (3 cred.; jr., sr.; prereq. 32, Bot. 10 cred. or equiv.)

137. Vegetable Crops. Lectures and survey of literature relating to vegetable crop production. Assigned readings include the classification, culture, improvement, and physiology of leading vegetable crops. (3 cred.; jr., sr.; prereq. 32, Bot. 10 cred. or equiv.)
153. Conservatory Plants and Florists' Flowers. A systematic study of the plants adapted to growing in conservatories and homes, and also of florists' cut flowers and potted plants. Lectures, laboratory, and field trips to greenhouses. (3 cred.; jr., sr.; prereq. Bot. 10 cred. or equiv.) (Offered only in odd numbered years)
176. Landscape Construction. Construction and maintenance of turf for lawns, golf courses, and other play areas; garden architecture, grading, planting and care, costs of construction. Lectures, field trips, and reports. (3 cred.; sr.; prereq. 24) (Offered only in odd numbered years)
- 190-191-192. Special Problems. Problems based upon the work given in the preceding courses. (2 to 4 cred. per qtr.; jr., sr.; prereq. instructor's permission)
- 193-194. Horticultural Seminar. Reports and discussions of problems and investigational work. (1 cred. per qtr.; jr., sr.; prereq. Hort. 9 cred.)

INORGANIC CHEMISTRY

INSTITUTE OF TECHNOLOGY

SCHOOL OF CHEMISTRY

Freshman and Sophomore Courses

- 1-2-3. General Inorganic Chemistry. (12 cred.; all; no prereq.)
- 9-10. General Inorganic Chemistry. (10 cred.; all; prereq. entrance cred. in chem.)
11. Qualitative Chemical Analysis. (4 cred.; prereq. 3 or 5)

For additional courses and course descriptions see the Bulletin of the Institute of Technology.

MATHEMATICS

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Placement tests.—In each of Courses 1 and 6, a placement test will be given during the first two weeks of the quarter. Students who fail in this test will be advised to take a more elementary course. In particular, any student who offers less than one year of high school advanced algebra as a substitute for Course 1 and who fails to pass the placement test in Course 6, will be required to take Course 1 before taking more advanced mathematics. A student who has had a complete year of elementary algebra and a corresponding course in advanced high school algebra for one-half year, should be able to pass the placement test in Course 6. The first class meeting in each course is of particular importance.

Freshman and Sophomore Courses

1. Higher Algebra. (5 cred.; all; prereq. 1 yr. elementary algebra; open for credit to any student offering less than one year of high school higher algebra for entrance)

6. Trigonometry. (5 cred.; all; prereq. 1 or high school higher algebra; open for credit to students offering high school trigonometry for entrance)
7. College Algebra. (5 cred.; all; prereq. 6 or high school trigonometry if approved by department chairman)

For additional courses and course descriptions see the Bulletin of the College of Science, Literature, and the Arts.

MILITARY SCIENCE AND TACTICS

Students who have completed the Basic Course, R.O.T.C., may be selected for advanced work by the professor of military science and tactics. Those who pursue the Advanced Course are required to sign an agreement with the government to continue the two years' course to completion. This includes attendance at a training camp, held normally during the summer following the first year's advanced work. The camp is conducted free of cost to the student, and in addition, while actually in camp, the student receives the pay prescribed for the seventh grade in the army. Students pursuing the Advanced Course are also furnished a special uniform and receive a fixed allowance per day. The total government compensation for the two years' advanced work amounts to about \$150. Students who satisfactorily complete the Advanced Course will be commissioned in the Officers' Reserve Corps of the United States Army. The University allows 18 credits for the two years' advanced R.O.T.C. work.

- 1,2,3. First Year Basic Course R.O.T.C. Coast Artillery Corps. Leadership, rifle marksmanship, ammunition, weapons and materiel, hygiene and sanitation, military courtesy and discipline, national defense, military history and policy, army organization, obligations of citizenship, map reading, motor transportation, national situation. (1 cred. each qtr.; prereq. higher algebra, geometry, and trigonometry.) Students who do not possess these prerequisites at the time of registration may be accepted by the commandant if they agree to complete these studies prior to the gunnery courses.
- 4,5,6. Second Year Basic Course R.O.T.C. Coast Artillery Corps. Leadership, fire control and position finding for seacoast and anti-aircraft artillery, identification of aircraft, characteristics of naval targets, chemical warfare defense, signal communication. (1 cred. each qtr.; prereq. 1, 2, 3, higher algebra and trigonometry)
- 151-152,153. First Year Advanced Course R.O.T.C. Coast Artillery Corps. Leadership, position finding, conduct of fire, gunnery for heavy artillery, gunnery for anti-aircraft artillery, combat orders. (3 cred. each qtr.; prereq. 4, 5, 6)
- 154,155,156. Second Year Advanced Course R.O.T.C. Coast Artillery Corps. Military law, military history, administration and supply, field engineering, leadership, artillery materiel, artillery tactics, orientation. (3 cred. each qtr.)

MUSIC

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Credit is offered to students in the College of Agriculture, Forestry, and Home Economics who may wish to elect work in the Department of Music.

Freshman and Sophomore Courses

1. Ear Training. (2 cred.; all) (No student should register for this course until after he has made arrangements for a placement test in the office of the Department of Music)
- 4-5-6. Harmony. (9 cred.; all; prereq. 1)
11. Piano‡
12. Voice.‡
13. Violin.‡
- 14-26. Other Orchestral Instruments.‡
27. Organ.‡
- 40-41-42. Orchestra. (3 cred.; all; prereq. consent of director)
- 43-44-45. University Chorus. (3 cred.; all; prereq. consent of director)

For additional courses and course descriptions see the Bulletin of the College of Science, Literature, and the Arts.

ORGANIC CHEMISTRY

INSTITUTE OF TECHNOLOGY

SCHOOL OF CHEMISTRY

- 51-52†-153. Organic Chemistry. (10 or 15 cred.; jr., sr.; prereq. 15 cred. in college chem.)

For additional courses and course descriptions see the Bulletin of the Institute of Technology.

PHYSICAL CHEMISTRY

INSTITUTE OF TECHNOLOGY

SCHOOL OF CHEMISTRY

- 101-102-103. Physical Chemistry. (9, 12, or 15 cred.; jr., sr., grad.; prereq. 2 yrs. college chem., 1 yr. college phys.) (A knowledge of calculus is advisable.)

For additional courses and course descriptions see the Bulletin of the Institute of Technology.

† To receive credit for any part of this course a student must complete the parts preceding the dagger.

‡ For special and practice fees for these courses see Bulletin of General Information.

PHYSICAL EDUCATION FOR MEN‡

The Physical Education Department offers men the opportunity to elect instruction and participation in sports of a recreational nature which men may play during their college career and in later life.

Not more than nine credits in courses in physical activities may be counted toward graduation.

1,2,3. Sports Education. (3 cred.; all; no prereq. All three quarters must be taken in order to receive credit)

6A,B,C. Intramural Sports. (1 cred. per quarter; all)

A towel and locker fee of \$1.25 per quarter is charged all students taking exercise courses. The University furnishes uniforms to students for class work or recreational play for \$1 per quarter.

For additional courses and course descriptions and for special four-year professional course in physical education for majors and minors see the Bulletin of the College of Education.

PHYSICAL EDUCATION FOR WOMEN

The General Course in Physical Education offered by the Department of Physical Education for Women provides a wide program of sports and other activities to meet the varying interests and needs of all the women students. The program offers an opportunity to take courses in body building and conditioning and for the acquisition of personal and recreational skills.

All women students will be required to take at least 3 credits in physical education. The courses chosen must be approved by the major adviser in the Department of Physical Education for Women.

Nine credits is the maximum number that can be gained toward the degree by taking courses in physical education activities.

For a special four-year professional course designed to prepare graduates for the responsible direction of physical education activities see the Bulletin of the College of Education.

Statement of fees.—A physical education fee of \$1.75 per quarter is charged for all courses except Phys. Ed. 7, Lectures in Physical Education and Health, and Phys. Ed. 8, Horseback Riding. Maximum fee per student, \$3.50 per quarter.

Phys.Ed.1-2-3-4-5-6-8. (1 cred. for each quarter) (Phys.Ed. 7, 2 cred.)

GROUP I. AQUATICS

Canoe Paddling

Swimming, Beginning

Swimming, Elementary

Swimming, Intermediate

Swimming, Advanced

Diving

Lifesaving

Recreational Swimming and
Water Games

‡ For all exercise courses, \$1 per quarter. Maximum fee, \$1 per quarter.

GROUP II. THE DANCE

Folk Dancing	Tap Dancing, Elementary
Modern Dance, Elementary	Tap Dancing, Intermediate
Modern Dance, Advanced	Recreational Rhythms

GROUP III. INDIVIDUAL SPORTS AND ACTIVITIES

Archery, Elementary	Individual Body Building
Archery, Intermediate	(formerly Orthopedics)
Badminton	Skating, plain, figure, and racing
Golf, Elementary	Classes meet at the Hippodrome
Golf, Intermediate	Tennis, Elementary†
Horseback Riding	Tennis, Intermediate‡
	Tournament Tennis‡

GROUP IV. TEAM SPORTS AND ACTIVITIES

Baseball	Posture and Daily Life Skills
Basketball, Elementary	Introductory Course in Sport Skills
Basketball, Intermediate	Speed Ball
Field Hockey	Sports and Dance Appreciation Course
Group Body Building	(Movies, demonstrations, and talks
Exercises for flexibility, grace and ease of movement)	by experts on sports and the dance)
	Volleyball

LECTURES

Lectures in physical education and health.

PHYSICS

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Freshman and Sophomore Courses

- 1-2†-3. Introduction to Physical Science. (9 cred.; all; prereq. high school algebra and plane geometry)
- 1a-2a†-3a.‡‡ Introduction to Physical Science. Laboratory included. (12 cred.; all; prereq. high school algebra and plane geometry)
- 7-8-9.‡‡ General Physics. Laboratory work an integral part of the course. (For students majoring in physics, mathematics, and chemistry and for students in the Institute of Technology.) (15 cred.; all; prereq. M.&M. 12 or Math. 6, 4 or equiv.)
11. Survey of Newer Developments in Physics. (3 cred.; all; prereq. 1-2-3 or reg. in 6 or 9, or permission of instructor) (Not offered in 1938-39.)
29. Introduction to Meteorology. (3 cred.; all; prereq. high school phys. or equiv.)

† To receive credit for any part of this course a student must complete the parts preceding the dagger.

‡ Students taking tennis must pay \$1 for tennis permit.

‡‡ A fee of \$2 per quarter is charged for this course.

PHYSIOLOGY

MEDICAL SCHOOL

Freshman and Sophomore Courses

4. Human Physiology. For academic, home economics, pharmacy, and other students. Lectures, recitations, and demonstrations. (4 cred.; all; pre-reg. 1 qtr. zool., 1 qtr. chem.)

Junior and Senior Courses

51. Human Physiology. (May be substituted for 4) (6 cred.; primarily for phys. ed. students*; jr., sr.; prereq. Zool. 1-2-3; Inorg. Chem. 1-2-3, or 4-5, or equiv.)
57. Physiological Chemistry. (4 cred.; primarily for dental students*; jr., sr.; prereq. Zool. 1-2-3, organic chemistry)
- 58,59. Human Physiology. (6 cred.; primarily for dental students*; jr., sr.; prereq. Zool. 1-2-3; Inorg. Chem. 1-2-3 or 4-5)
100. Physiological Chemistry. (7 cred.; jr., sr.; prereq. zool., org. chem., and phys.)
101. Physiological Chemistry. (6 cred.; jr., sr.: prereq. 100)
103. Physiology of Circulation, Respiration, etc. (9 cred.; jr., sr.; prereq. zool. and org. chem.)
104. Physiology of Endocrines, Nervous System, etc. (6 cred.; lect. only, 4 cred.; jr., sr.; prereq. 103 or org. chem. and neurology)

For additional courses and course descriptions see the Bulletin of the Medical School.

PLANT PATHOLOGY AND BOTANY

Freshman and Sophomore Courses

1. Plant Pathology. An introductory course in plant diseases. Lectures, laboratory, and reference. Not open to those who have completed Course 10. (5 cred.; soph., jr., sr.; prereq. 10 cred. in plant sciences of which at least 7 shall be in botany)
- 7-8. Weeds and Grasses. Agricultural and applied botanical study of weeds and grasses with special reference to agricultural importance. (6 cred.; fr., soph., jr., sr.; prereq. Bot. 7 cred.)
9. Weeds and Seed Testing. Detailed study of seed testing methods and seed legislation. Weed and crop seeds and weed plants studied with special reference to identification. (3 cred.; fr., soph., jr., sr.; prereq. Bot. 7 cred.)
10. Forest Pathology. Diseases of forest and shade trees, and the rotting of timber. Symptoms, etiology, and control. Lectures, laboratory, and reference work. Not open to those who have completed Course 1. (5 cred.; soph., jr., sr.; prereq. Bot. 9 cred.)

* Others may be admitted by special permission.

Junior and Senior Courses

51. Special Problems in Forest Pathology. Collection, identification, and cultural studies of tree pathogens and wood rotting fungi. (2 to 5 cred.; jr., sr.; prereq. 10)
52. Seed Problems. Special seed problems are assigned. Advanced work in seed testing methods. (3 cred.; jr., sr.; prereq. 9)
53. Food Plants of Game Animals. A study of food plants, uses, habits, reproduction, and identification. (3 cred.; jr., sr.; prereq. 1 yr. of botany and 1 yr. zool., or equiv.)
- 105-106-107. Mycology. Morphology and taxonomy of fungi. Lectures, laboratory, and field work. (3 or 5 cred. per qtr.; jr., sr.; prereq. 1 or 10 or equiv.)
110. Principles of Pathology. A systematic consideration of the basic factors governing the development of plant diseases. (3 cred.; jr., sr.; prereq. 1 or 10, Bact. 41)
111. Diseases of Field Crops. Detailed study of diseases of field crops, including symptomatology, etiology, and practical methods of control. (3 cred.; jr., sr.; prereq. 1 or 10)
112. Diseases of Fruit and Vegetable Crops. Special study of diseases of fruit and vegetable crops, especially those important in Minnesota. Laboratory, lecture, and field work. (3 cred.; jr., sr.; prereq. 1 or 10) (Given in alternate years. Offered in 1938-39)
114. Advanced Forest Pathology. A detailed study of wood rots, including a study of the deterioration of wood products caused by fungi. Lectures and laboratory work. (3 cred.; jr., sr.; prereq. 1 or 10). (Given in alternate years. Not offered in 1938-39)
118. Bacterial Diseases of Plants. Bacteria as plant pathogens; representative types with particular reference to technique used in studying bacterial diseases of plants. (3 cred.; jr., sr.; prereq. 1 or 10)
119. Principles of Plant Disease Control. A general consideration of principles and practices in controlling plant diseases. (3 cred.; jr., sr.; prereq. 1 or 10)
- 141-142. Insects in Relation to Plant Disease. 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. (6 cred.; jr., sr.; prereq. 8 cred. in ent. or plant path.)
143. Methods. Theoretical and practical consideration of methods used in mycological and pathological research. (3 cred.; jr., sr.; prereq. 1 or 10)
160. Plant Histochemistry. The localization, identification, and function of plant constituents. Lectures, demonstrations, and laboratory. (3 cred.; sr.; prereq. bot. and elem. chem.)
161. Transport, Storage, and Ripening of Fruits and Vegetables. The effects of temperature, respiration, packing, etc., on storage life. (3 cred.; sr.; prereq. Plant Physiol. 3 cred.)
162. Physiological Relations of Crop Plants to Temperature. An advanced

study of general temperature effects and especially of the relation of plants to low temperatures. Lectures, readings, and translations. (3 cred.; sr.)

163. Applied Plant Physiology. A general discussion of plant physiology as applied to the food industries and to agriculture and forestry. Lectures and demonstrations. (3 cred.; jr., sr.; prereq. Plant Physiol. 3 cred.; Org. Chem. 5 cred.)

POLITICAL SCIENCE

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Freshman and Sophomore Courses

- 1-2†-3. American Government and Politics. (9 cred.; all, except fr. who must have consent of Junior College office; no prereq.)
31. Introduction to American Government and Administration. (3 cred.; soph., jr., sr.; no prereq.)

For additional courses and course descriptions see the Bulletin of the College of Science, Literature, and the Arts.

PREVENTIVE MEDICINE AND PUBLIC HEALTH

MEDICAL SCHOOL

Freshman and Sophomore Courses

3. Personal Health. Elementary principles of normal body function; predisposing and actual causes of disease; ways in which disease may be avoided. (2 cred.; fr., soph.; no prereq.)
- 4.* Health Problems of Adult Life. Study of the health and prevention of disease in the family; its relation to community health and disease control. More important diseases and their prevention. (2 cred.; all; prereq. 3)

Junior and Senior Courses

- 50.* Public and Personal Health. Discusses the causes of diseases and of physical defects and presents the fundamental principles and working methods of health conservation and disease prevention. Lectures, discussions, and directed readings. (3 cred.; open to jr. and sr. who have not taken 4 or 52 or 53; no prereq.)
52. Health Care of the Family. First aid; communicable diseases, their transmission and prevention; prenatal hygiene, growth and development of infant and young child. The care of the sick room; observation and care of the patient. Elementary symptomatology. Arranged for students of home economics. (3 cred.; jr., sr.; prereq. Bact. 41, Physiol. 4)
57. Health of Infant and Preschool Child. Growth and development of baby and young child. Care and feeding of normal child. Prevention and correction of physical defects. Demonstration of infant clinics. (2 cred.; jr., sr.; prereq. Psy. 1-2, P.M.&P.H. 50 or 53)

* No student may receive credit for both Course 4 and Course 50.

† To receive credit for any part of this course a student must complete the parts preceding the dagger.

59. Health of the School Child. For teachers and others interested in the health development of the school child. Mental and physical growth; discovery of physical defects; exercise; fatigue, emotional problems; health habits; diseases of school children; practical problems of health supervision and health instruction. (3 cred.; prereq. 50, 52, or 53; will be waived for teachers and school nurses, but credit granted only after completion of prerequisites)
60. Tuberculosis and Its Control. History of tuberculosis movement and campaign in the United States. Early diagnosis and sanatorium treatment. Tuberculosis in children. The psychology of tuberculosis, supervision of returned sanatoria patients. State program for the eradication of tuberculosis; legislation. (2 cred.; jr., sr.; prereq. 50 or 52 or 53 and 62 which may be taken concurrently)
61. Mental Hygiene. History of movement; social importance. Factors underlying emotional maladjustments and mental disease. Relation to social work, social agencies, and psychiatric practice. Illustrative case material. (3 cred.; jr., sr.; prereq. 50 or 52 or 53 and 62 which may be taken concurrently)
102. Environmental Sanitation—General. Sanitary problems associated with water supply and purification, milk sanitation, pollution of waters, sewage, industrial waste, excreta and garbage disposal, and plumbing. Correction of defects and methods of sanitary supervision. Public health engineering methods as applied to sanitary problems in urban and rural communities including schools, institutions, camps, bathing places, dwellings, etc., and as used in the control of occupational health hazards and of diseases involving insect vectors and animal hosts. Lectures, demonstrations, and field trips. (Cred. ar.; jr., sr., grad.; prereq. Bact. 101-102, Anal. Chem. 1-2 or 7, Org. Chem. 1-2 or 51-52-53, Phys. 3, 13, 23, 33, 43)

For additional courses see the Bulletin of the Medical School.

PSYCHOLOGY

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Freshman and Sophomore Courses

- 1-2.† General Psychology. (6 cred.; 3rd qtr. fr. with C average, soph., jr., sr.; no prereq.)
3. Psychology Applied to Daily Life. (3 cred.; soph., jr., sr.; prereq. 1-2)
- 4-5.†† Introductory Laboratory Psychology. (4 cred.; soph., jr., sr.; with or after 1-2)
- 7.†† Introduction to Laboratory Psychology. (See 4-5)

For additional courses and course descriptions see the Bulletin of the College of Science, Literature, and the Arts.

† To receive credit for any part of this course a student must complete the parts preceding the dagger.

† A fee of \$1 per quarter is charged for this course.

†† A fee of \$2 is charged for this course.

PUBLICATIONS AND RURAL JOURNALISM

- 50-51-52. Agricultural Journalism. Intended for students who may wish to enter the field of agricultural journalism as a profession. (9 cred.; jr., sr.; prereq. Journ. 13-14-15, 51-52, and permission of instructor)
53. Publicity. For students planning careers in agriculture or some allied industry, in which the co-operation of the press will be needed. (3 cred.; jr., sr.; prereq. Rhet. 1,2,3)

For additional courses see the Department of Journalism in the Bulletin of the College of Science, Literature, and the Arts.

RHETORIC

Students upon entering the college are registered in Rhetoric I or II according to the results of their tests in proficiency in English.

Those students who maintain a high standard in Rhetoric II and III and who complete suitable tests may be exempted from the requirement of Rhetoric 51.

Freshman and Sophomore Courses

1. Rhetoric I. Written and Oral Themes. Review of the elements of English composition. (3 cred.; no prereq.)
2. Rhetoric II. Exposition. (3 cred.; prereq. 1 or exemption on basis of placement test.)
3. Rhetoric III. Description and Narration. (3 cred.; prereq. 2)
11. Argumentation. Gathering evidence, reasoning, briefing, formal and informal argument, persuasion, debating. (3 cred.; soph., jr., sr.; prereq. 3, 22 recommended)
- 22.* Public Speaking. (3-hour course.) A practical course in fundamentals of speech making. (3 cred.; soph., jr.; prereq. 3)
- 23.* Public Speaking. (5-hour course.) (5 cred.; soph., jr., sr.; prereq. 3)
24. Advanced Public Speaking. Types of audiences, persuasion, voice, extemporaneous speeches for special occasions. (3 cred.; soph., jr., sr.; prereq. 22)
28. Play Production. History of the theater, theories of acting, staging, etc. A survey of the problems confronting the producer of amateur plays. (3 cred.; soph., jr., sr.; prereq. 3)
31. Survey of English Literature I. Survey of English literature of the sixteenth, seventeenth, and eighteenth centuries. (5 cred.; soph., jr., sr.; prereq. 3)
32. Survey of English Literature II. Survey of English literature of the nineteenth century. (3 cred.; soph., jr., sr.; prereq. 3)
34. Books and Reading. The selection of books and periodicals for the home library. (1 cred.; no prereq.)

* Students may not receive credit for both Rhet. 22 and 23.

Junior and Senior Courses

51. Exposition. Reports and thesis writing; articles and essays; criticism; survey of English usage. (3 cred.; jr., sr.; prereq. 3)
59. Advanced Play Production. Continuation of Course 28. Problems of directing, staging, and make-up. Study of representative one-act plays. Each student is required to produce a one-act play. A practical course for teachers. (3 cred.; jr., sr.; prereq. permission of instructor)
60. Contemporary Literature. Contemporary English and American writers. (3 cred.; jr., sr.; prereq. 3)

ROMANCE LANGUAGES

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

FRENCH

Freshman and Sophomore Courses

- 1-2.† Beginning French. (10 cred.; all; no prereq.; must complete both qtrs. to receive credit. Credit is not given for more than one beginning language)
- 3-4. Intermediate French. (10 cred.; all; prereq. 1-2, or two yrs. high school French. Students who have had three yrs. high school French may omit Course 3 and take Course 4)
20. Oral and Written French. (5 cred.; all; prereq. 4, or four§ yrs. high school French)

Junior and Senior Courses

53. French Composition. (3 cred.; jr., sr.; prereq. 3-4)
- 54-55. French Conversation. (4 cred.; jr., sr.; prereq. 53 or 20)
- 70-71-72.† Survey of French Literature. (9 cred.; jr., sr.; prereq. 3-4)

SPANISH

Freshman and Sophomore Courses

- 1-2.† Beginning Spanish. (10 cred.; all; no prereq.; must complete both qtrs. to receive cred. Credit is not given for more than one beginning language)
- 3-4. Intermediate Spanish. (10 cred.; all; prereq. 1-2, or two yrs. high school Spanish. Students who have had three yrs. high school Spanish may omit Course 3 and take Course 4)
20. Oral and Written Spanish. (5 cred.; all; prereq. 4, or four§ yrs. high school Spanish)

† To receive credit for any part of this course a student must complete the parts preceding the dagger.

§ Students who have had three years of high school French may be admitted to Course 20 with the consent of the department.

¶ Students who have had three years of high school Spanish may be admitted to Course 20 with the consent of the department.

Junior and Senior Courses

53. Spanish Composition. (3 cred.; jr., sr.; prereq. 3-4)
 54-55. Spanish Conversation. (4 cred.; jr., sr.; prereq. 53 or 20)
 68-69.† Survey of Spanish Literature. (10 cred.; jr., sr.; prereq. 3-4)

For additional courses and course descriptions see the Bulletin of the College of Science, Literature, and the Arts.

SOCIOLOGY AND SOCIAL WORK

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Freshman and Sophomore Courses

1. Introduction to Sociology. (3 or 5 cred.; 3rd qtr. fr., soph., jr., sr.; no prereq.)
 6. Social Interaction. (3 cred.; soph., jr., sr.; prereq. 1)
 14. Rural Sociology. (3 cred.; soph., jr., sr.; prereq. 1)
 45. Social Statistics. (5 cred.; soph., jr., sr.; prereq. 1)
 49. Social Pathology. (3 cred.; 3rd qtr. soph., jr., sr.; prereq. 10 cred. in sociology or Soc. 1 and 10 cred. in soc. sci. or psy.)

Junior and Senior Courses

60. Social Protection of the Child. (3 cred.; sr.; prereq. 49)
 100. Social Psychology. (3 cred.; jr., sr., grad.; prereq. Soc. 1 and 6, or Psy. 1-2, and 9 cred. in soc. sci., ed., phil., or psy.)
 110. Rural Organization. (3 cred.; jr., sr., grad.; prereq. 4 courses in soc. or Soc. 1 and 15 cred. in soc. sci., ed., phil., or psy.)
 112. Methods of Rural Social Research. (2 cred.; grad.*; prereq. same as for 110)
 114. Rural Social Institutions. (3 cred.; jr., sr., grad.; prereq. same as for 110)
 116. The Newspaper As a Social Institution. (3 cred.; jr., sr., grad.; prereq. same as for 110) (Not offered in 1938-39)
 119. The Family. (3 cred.; jr., sr., grad.; prereq. same as for 110)
 120. Social Life and Cultural Change. (3 cred.; jr., sr., grad.; prereq. same as for 110)
 161. Social Aspects of Housing and Standards of Living. (3 cred.; jr., sr., grad.; prereq. same as for 110)

For additional courses and course descriptions see the Bulletin of the College of Science, Literature, and the Arts.

* Primarily for graduates, but mature students who are not graduates may be admitted with the consent of the adviser and the instructor.

† To receive credit for any part of this course a student must complete the parts preceding the dagger.

SOILS

Freshman and Sophomore Courses

6. Soils. Origin, formation, physical properties, moisture relations; principles of soil fertility, use of lime, commercial fertilizers, and stable manure; soil organisms and green manures; tillage. (5 cred.; soph., jr., sr.; prereq. Agr. Biochem. 4)

Junior and Senior Courses

50. Forest Soils. Origin, formation, texture, structure; soil profiles, soil mapping; water, air, and heat supply; nutrient maintenance of the forest, soil acidity; forest floor, use of forest litter, effect of forest fires; fertilization in forest nursery practice. (2 cred.; jr. in forestry; prereq. Agr. Biochem. 4. Given at Cloquet)
101. Chemical Analysis of Soils. A laboratory course in the chemical analysis of soils, including the determination of replaceable bases. (3 to 5 cred.; jr., sr.; prereq. 6, quant. anal.)
103. Soil Erosion. Causes and types of erosion; relation of erosion to soil type; principle of control of erosion, by tillage, contour-cultivation, strip farming, choice of crops and terracing; conservation of moisture and plant nutrients; relation of forests to erosion control. Lectures and field observation. (3 cred.; jr., sr.; prereq. 6)
104. Soil Mapping. Principles of soil surveying and classification with field practice in the preparation of soil maps. (3 cred.; jr., sr.; prereq. 108)
107. Fertilizers. Development of the use of commercial fertilizers; their sources, preparation, composition, combination, and uses. (3 cred.; jr., sr.; prereq. 6)
108. Physical Properties of Soils. The determination of physical constants of soils, including mechanical composition. (3 cred.; jr., sr.; prereq. 6)

THEORY AND PRACTICE OF TEACHING

COLLEGE OF EDUCATION

For courses and course descriptions see the Bulletin of the College of Education.

VETERINARY MEDICINE

Junior and Senior Courses

- 50-51-52. Anatomy, Physiology, and Hygiene of Domestic Animals. Fundamentals of structure, function, and reproduction of domestic animals. The principles of animal hygiene, including the etiology and means of control of the more important communicable diseases. (9 cred.; jr., sr.)

ZOOLOGY

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Freshman and Sophomore Courses

Courses in this department are closely correlated with those offered by the Division of Entomology and Economic Zoology of the College of Agriculture, Forestry, and Home Economics. For courses of that division, see page 72.

Credit is given for acceptable work done at any approved seaside laboratory.

Freshman and Sophomore Courses

- 14-15.†† General Zoology. Structure, physiology, embryology, classification, and evolution of animals. (6 cred.; all; no prereq.) (Lecture section limited to 320; laboratory sections limited to 174 each)
- 21.§ Histology. (5 cred.; soph., jr., sr.; prereq. 1-2-3)
- 22.††§ Comparative Anatomy. (5 cred.; soph., jr., sr.; prereq. 1-2-3)
- 46-47.† Ornithology. (6 cred.; soph., jr., sr.; prereq. 1-2-3 and permission of instructor)

Junior and Senior Courses

50. Introduction to General Physiology. (5 cred.; soph., jr., sr.; prereq. 1-2-3 and high school or college chem.)
- 51.§ Introductory Animal Parasitology. (5 cred.; jr., sr.; prereq. 1-2-3)
- 52.¶ Introductory Entomology. (5 cred.; jr., sr.; prereq. 1-2-3)
- 53.§ Faunistic Ecology. (5 cred.; jr., sr.; prereq. 1-2-3)
- 107-108. Protozoology. (6 cred.; jr., sr., grad.; prereq. 15 cred.)
- 117-118-119. Animal Ecology. (9 cred.; jr., sr., grad.; prereq. 15 cred.)
120. General Ecology of Insects. (3 cred.; jr., sr.; prereq. 15 cred. in zool. or ent.)
- 125-126-127. Advanced Entomology. (9 cred.; jr., sr., grad.; prereq. 15 cred.)
- 144-145-146. Animal Parasites and Parasitism. (6 or 9 cred.; jr., sr., grad.; prereq. 15 cred.)
- 149-150. Histology and Organology. (6 cred.; jr., sr., grad.; prereq. 15 cred. in zool. Permission of instructor necessary)

For additional courses and course descriptions see the Bulletin of the College of Science, Literature, and the Arts.

† To receive credit for any part of this course a student must complete the parts preceding the dagger.

‡ A fee of \$1 per quarter is charged for this course.

†† A fee of \$2 is charged for this course.

§ Sections are limited. Written permission must be obtained from the Junior College office, 106 Folwell Hall.

¶ Sections limited to 20 each.

BULLETIN OF THE
UNIVERSITY OF MINNESOTA

Region Ten University of Scouting

*Twentieth Annual Short Course in
Scouting Leadership*

For Local Council Officers and Instructors



"CLASS OF 1937"

July 24 to 31, 1938

University of Minnesota Forestry Camp
ITASCA PARK

Vol. XLI

No. 28

April 18, 1938

Entered at the post office in Minneapolis as second-class matter. Accepted for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917. Authorized July 12, 1918.

REGION TEN UNIVERSITY OF SCOUTING

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W. C. Coffey, Dean, Department of Agriculture
P. E. Miller, Director of Agricultural Extension
R. M. West, Registrar

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E. G. Cheyney, Professor of Forestry, University Administrator
E. M. Freeman, Professor of Plant Pathology and Botany
A. C. Hodson, Instructor in Forest Entomology
R. H. Landon, Instructor in Plant Physiology
C. O. Rost, Instructor in Soil Management and Geology

REPRESENTING THE BOY SCOUTS OF AMERICA

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Frank A. Bean, Minneapolis, Minn., Vice-Chairman of Region Ten

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H. H. Prescott, Deputy Regional Scout Executive
C. S. Chase, Deputy Regional Scout Executive
E. H. Bakken, Executive, St. Paul Area, St. Paul, Minn.
H. C. Gilbert, Executive, Red River Valley Council, Fargo, N. Dak.
C. D. Rollins, Executive, Arrowhead Council, Watertown, S. Dak.
Lee E. Harbottle, Executive, Sioux Area Council, Sioux Falls, S. Dak.
A. Mattioli, Executive, Headwaters Council, Hibbing, Minn.
Ben Conger, Executive, Cedar Valley Council, Albert Lea, Minn.
Geo. R. Boardman, Assistant Executive, Minneapolis, Minn.

Volunteer Scouter Staff

Professor E. H. Comstock, Minneapolis, Minn.
Dr. J. A. Kjelland, St. Paul, Minn.
J. M. "Daddy" Drew, St. Paul, Minn.
D. W. Raudenbush, St. Paul, Minn.
H. A. McCune, Fairmont, Minn.
W. N. Brown, Minneapolis, Minn.
Frank G. Watson, Superior, Wis.

REGION TEN UNIVERSITY OF SCOUTING

SHORT COURSE IN SCOUTING LEADERSHIP

PURPOSE

The University of Minnesota and Region Ten, Boy Scouts of America, offer this opportunity to Scout councils to train men in Scout leadership methods under expert instructors, ideal conditions, and beautiful surroundings.

The courses are designed to train men to be administrators, officers, and instructors in local council training courses.

Each man completing courses at Itasca will not only understand the principles of troop operation but will also be prepared to serve as an administrator or instructor in similar courses in his own council's training program for Scout leaders.



A BEAUTY SPOT AT "ITASCA"

ENROLLMENT AND COST

All registered scouters are eligible to enroll for courses at the University of Scouting, including council presidents, executive board members, district chairmen, district committee members, chairmen and members of council and district leadership training committees, and all others who will serve in some capacity to help train other men through their local council training program.

The minimum age limit is 21 years. The University of Minnesota short course fee is \$5; board, \$8; and incidentals, \$2. Total cost, \$15 for the entire period, including meals and all necessary notebooks, textbooks, and printed material.

REGION TEN UNIVERSITY OF SCOUTING



WHAT TREE IS THAT?

Dean E. M. Freeman, Chairman of the Region Ten Educational Committee, points it out.

ACCOMMODATIONS AND MEALS

The building and equipment of the University of Minnesota Forestry School provide ample accommodations. The main Forestry Lodge, a large log building, provides an assembly room with fireplace and roomy screened porches and sleeping quarters, equipped with cots and mattresses. Newly erected cabins furnish additional quarters. The library building, also of logs, is used for class purposes. Meals are served in a separate log building. An efficient patrol of Eagle Scouts will again be on duty as the Service Patrol.

COURSES OFFERED

In Accordance with the Five-Year Progressive Training Program
of the Boy Scouts of America

Summary of Courses

Each man will enroll for not more than one course in each of the three principal groups of courses.

1. Major Courses

- a) Elements of Scoutmastership
- b) Troop Camping
- c) Principles of Scout and Cub Leadership
- d) Health & Safety and First Aid
- e) Senior Scouting
- f) Elements of Cubbing
- g) Special Course for Council Officers

2. University Specialization Courses

- a) Forestry
- b) Plant Life
- c) Insect Life
- d) Conservation
- e) Soil Management

3. Scoutcraft Specialization Courses

- a) Archery
- b) Leathercraft
- c) Ropecraft
- d) Horncraft
- e) Wood Carving

REGION TEN UNIVERSITY OF SCOUTING

1. MAJOR COURSES

a) Elements of Scoutmastership

The men enrolled in this course will form patrols under the leadership of the instructor and will maintain this patrol formation throughout the week. The work is practical and enjoyable. Here a man will gain elementary knowledge of troop organization, of the things to be learned by a boy in advancing through the Tenderfoot Scout, Second Class Scout, and First Class Scout ranks, such as fire-building, cooking, mapping, signaling, observation, first aid, nature study, camping, etc. Methods of teaching this information to other men will be part of the course.

Men enrolling in this course will have the option of combining the work of the course with the Troop Camping course, thus receiving credit for each upon completion. Come prepared to live under canvas with extra blankets, a ground cloth, and other needed equipment. Bring your own tent, if you wish. Mattresses and cooking utensils are furnished.

This course outline will be: Part I, Introduction to Scouting; Part II, Troop Operation; and Part III, Short-Term Camps. Professor E. H. (Diogenes) Comstock is Director of this course.

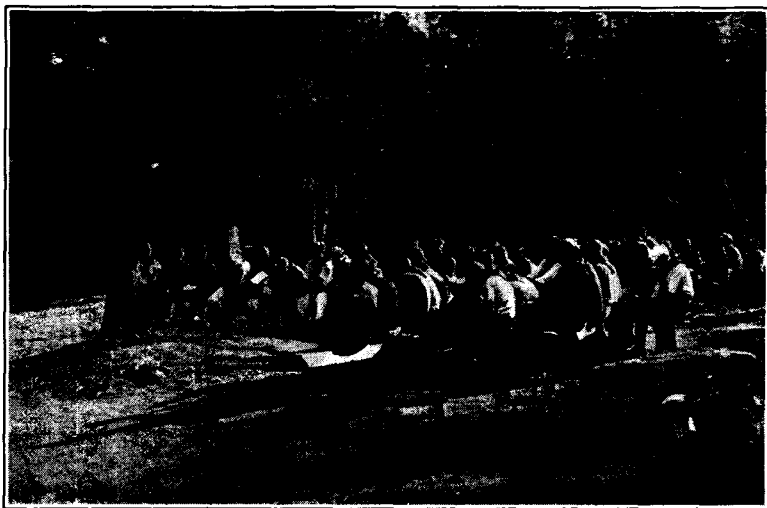
b) Troop Camping

A course in practical Troop Camping, to prepare men as instructors in similar courses conducted by local Scout councils. Those in this course will form patrols, and instead of being housed in the school buildings will live under canvas in a model troop camp on the shore of Lake



INFORMAL BUT ATTENTIVE TROOP CAMPING STUDENTS GET SOME "TIPS"
FROM INSTRUCTOR COMSTOCK

REGION TEN UNIVERSITY OF SCOUTING



REGIONAL CHAIRMAN CHARLES L. SOMMERS SPEAKS TO THE SCHOOL
AT A "BIG IDEA" SESSION

Itasca adjacent to the school. It is a happy combination of lectures and discussion and practical experience in the art of troop camping.

Come prepared to live under canvas with extra blankets, a ground cloth, and other needed equipment. Bring your own tent, if you wish. Mattresses and cooking utensils are furnished. Those in this course will cook one meal a day in the open and take the remaining meals in the dining hall with the rest of the school.

Men completing this course are qualified as instructors in similar local council training courses. Chief Camp Director Geo. R. Boardman, of Minneapolis, is the instructor in this course.

c) Principles of Scout and Cub Leadership

This is not an old friend in a new coat but a new friend in a new coat. A new course entirely, evolved by the rewriting of the Five-Year Training Program. It includes administration and management of all phases of the Scouting Program as related to the group basis plan of Scouting, Cubbing, and Senior Scouting. Those who take this course will study the principles of troop program building and the methods of troop administration and discuss informally in round table the major subject, "Boy Nature and Boy and Young Man Problems." This will be the first time this course has been presented in Region Ten.

Men who successfully complete the course will receive the large certificate for both Part I and Part II. Ben Conger will be the instructor.

REGION TEN UNIVERSITY OF SCOUTING

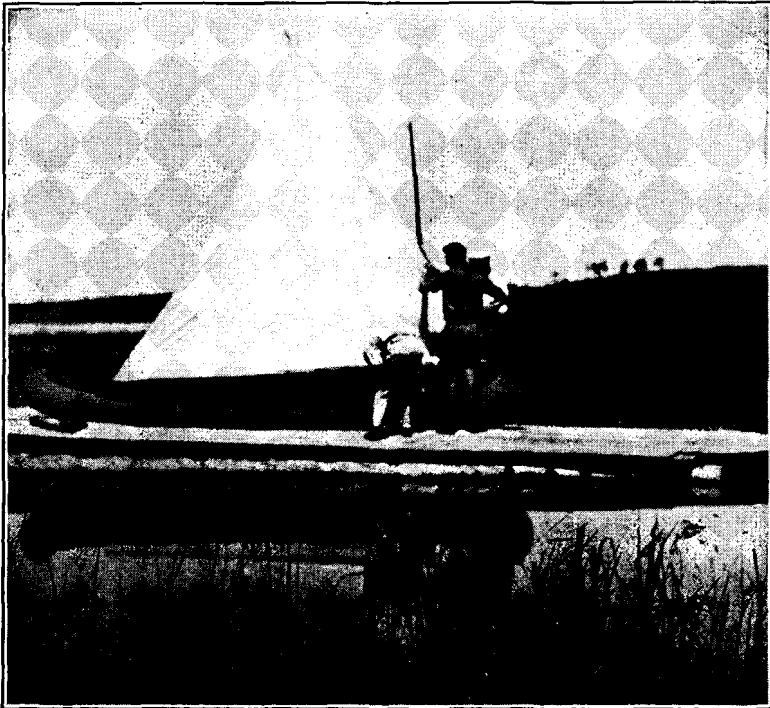
d) Health & Safety and First Aid Course

This is the new course prepared by the Educational Service of the Boy Scouts of America and will include all material presented in the course known as the Standard American Red Cross First Aid Course plus a new Health and Safety Course.

Men completing this course will not only gain a teaching knowledge of First Aid but will also receive complete training in the essentials of Health and Safety. The Standard American Red Cross and the Boy Scouts of America Specialization Certificates in Health and Safety will be awarded. Lew W. Hall, of Chicago, will act as advisor in this course as well as assist in the Health and Safety work in other courses of the school. Dr. J. A. Kjelland will be instructor.

e) Senior Scouting

This course will be presented by expert leadership on all the phases of Senior Scouting as it applies particularly to the group plan of organization of Scouting. To qualify men as instructors in the Local Council or training for leadership in a Senior Scouting group, there will be dis-



SEA SCOUTERS RIG A CANOE FOR SAILING

REGION TEN UNIVERSITY OF SCOUTING

cussions of Senior Scouting, Sea Scouting, Explorers, and various organizations that apply to the Older Boy Program.

The Specialization Certificate in Senior Scouting will be presented to all who complete the course.

f) Elements of Cubbing

A course in the Elements of Cubbing Leadership under expert instructors. The principles and practice, of organization and leadership of Cub Packs will be thoroughly covered and interesting project work developed. This course is to qualify men to serve as instructors in local council training courses for Cub leaders. David Raudenbush, Regional Chairman of Cubbing, is instructor.

g) Course for Council Officers

By special request, Mr. Charles L. Sommers, assisted by an able staff of instructors, is heading a course for Council Officers, Council and District Committeemen, and Commissioners, who are all cordially invited to attend. The popularity of this course will greatly exceed that of past years.



"DADDY" DREW, INSTRUCTOR IN ROPECRAFT, TELLING J. J. LUMM, PRESIDENT OF THE NORTH STAR COUNCIL, HOW "KNOT" TO DO IT

This course will include a study of Constitutional procedures; methods of operation, finance, and office administration; committees and their responsibilities; activities; relationships, and a thoro analysis of the five-year national plan of training as practical throughout the Region. The courses given at the University of Scouting will be reviewed. The course will allow for a liberal exchange of experiences.

REGION TEN UNIVERSITY OF SCOUTING

2. UNIVERSITY OF MINNESOTA SPECIALIZATION COURSES

Some of the following courses will be offered only in alternate years. Their selection will depend partly on advance requests from the field. These courses are given under the personal direction of University of Minnesota staff members.



REGIONAL CUBBING CHAIRMAN RAUDENBUSH SLIPS IN A FEW MINUTES OF STUDY BETWEEN SESSIONS

a) Forestry, b) Plant Life

There are between forty and fifty species of trees and shrubs and about an equal number of smaller plants in Itasca Park. The identification and common uses of these are taught in the simplest manner possible. Emphasis is placed on the common uses of the trees and of the food and other uses of small plants. Forestry relations are stressed. Play and game methods are used as an aid in teaching and in learning to know the plants and trees. Animal signs, birds' nests, survey markings, fire scars, and other points of woodcraft are incidentally observed and discussed during the field trips.

The aim is to make the method simple and direct enough to permit students to use the same methods in local council training courses. It also permits Scout leaders to continue and later increase their acquaintance with plants and trees. No preliminary knowledge of these subjects is required. Courses are especially adapted to the Merit Badge subjects in Forestry and Botany.

REGION TEN UNIVERSITY OF SCOUTING

The student may select from the two groups the one on which he wishes to lay chief stress:

- a) Forestry—Mr. Cheyney b) Plant Life—Mr. Freeman and Mr. Landon

c) Insect Life*

The most important orders of insects are well represented in the Itasca fauna. Important and interesting things concerning the members of these orders are studied. Collections of insects will be made. Practical experience in capturing, identifying, and mounting insects and butterflies makes this a very interesting course. Merit Badge requirements are carefully followed. A. C. Hodson—Instructor.

d) Conservation*

Conservation of wild life is especially studied in this course. Itasca Park is probably the best locality in Minnesota for this study. A. C. Hodson—Instructor.

e) Soil Management and Geology

Instruction in basic qualities of soils, their composition, sources, and characteristics will be given. To this will be added elementary study of rocks and minerals. The Merit Badge subjects in Soil Management will be covered. C. O. Rost—Instructor.



CAREFUL INSTRUCTION AND PRACTICE IN THE FIRST AID COURSE

* Either "Insect Life" or "Conservation" will be given in 1938, the selection to be made by students in attendance.

REGION TEN UNIVERSITY OF SCOUTING



"CUBBERS" SHARE INFORMALLY IN A DISCUSSION

3. SPECIALIZATION COURSES IN SCOUTING CRAFTS

Two periods each day are set aside for five of the approved courses in Scouting Crafts. The Scouting courses are under the general direction of J. M. (Daddy) Drew, veteran Scouting instructor at "Itasca" for 18 years. Assisting will be experts in each of the special fields.

a) Archery

A very popular course is the making of the bow and arrows and the art of shooting. Each man enrolled in this course completes from raw material his own bow and arrows. H. A. McCune—Instructor.

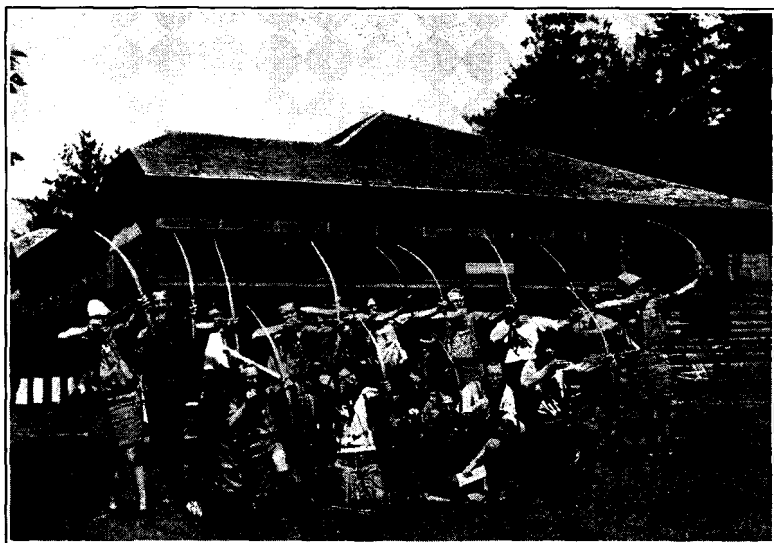
b) Leathercraft

Instruction will be offered in leather-braiding, tooling, stitching, and lacing, and opportunity will be given for the making of lanyards, belts, purses, and other useful and ornamental leather objects. Methods of teaching are stressed. L. E. Harbottle—Instructor.

c) Ropecraft

The work will include practice in the use of knots, splicing, lashing, and the methods of teaching ropecraft to other men. J. M. "Knotty" Drew—Instructor.

REGION TEN UNIVERSITY OF SCOUTING



ARCHERY IS ONE OF THE CRAFT COURSES OPEN TO STUDENTS

d) Horncraft

A unique course in making beautiful and useful articles of all kinds from cow horns, such as hunting horns, neckerchief slides, shoe horns, whistles, wall brackets, flower containers, etc. An inexpensive and popular handicraft project for Scouts. C. D. Rollins—Instructor.

e) Wood Carving

Probably the most inexpensive craft is woodcarving. This course touches jack knife carving of all sorts. Frank Watson—Instructor.

SCOUTMASTER'S KEY



SCOUTER'S TRAINING AWARD



CERTIFICATES ISSUED

All courses listed are part of the Five-Year Progressive Training Program of the Boy Scouts of America, and credit is given toward the Scoutmaster's Key and Scouter's Training Award. Certificates will be issued at the close of this school for work completed as follows:

REGION TEN UNIVERSITY OF SCOUTING

Certificates You Can Earn at Itasca

(One in each of the following three groups)

1. Major Course Certificates in one of the following:
 - Elements of Scoutmastership Certificate.
 - Troop Camping Certificate.
 - Principles of Scout and Cub Leadership Certificate.
 - Health and Safety Certificate and Standard Red Cross First Aid.
 - Senior Scouting Certificate.
 - Elements of Cubbing.
 - Council Officers' Training Certificate.
2. Specialization Certificates in one of the following:
 - University Courses:
 - a) Forestry
 - b) Plant Life
 - c) Insect Life
 - d) Conservation
 - e) Soil Management
3. Scoutcraft Specialization Certificates in one of the following:
 - a) Archery
 - b) Leathercraft
 - c) Ropecraft
 - d) Horncraft
 - e) Wood Carving

The Advanced Certificate is given to all Course Instructors.



EAGLE SCOUTS FORM AN EFFICIENT "SERVICE PATROL"

REGION TEN UNIVERSITY OF SCOUTING

ORGANIZATION

The school will function as a troop, with complete troop organization, including sponsoring institution, troop committee, scoutmaster and assistant scoutmasters, instructors, junior assistant scoutmasters, senior patrol leaders and patrols. This method provides the highest degree of practical instruction in troop operation and management.

GENERAL INFORMATION

Registration.—To enroll, fill out the enclosed enrollment blank and send with the registration fee of \$5 (see page 3) to your local council office for approval and transmittal to the Region Ten Office. Enroll early. Attendance at all sessions of the school (including meals) is necessary for receiving the certificates awarded.

Personal Equipment.—Every man will bring his own personal equipment and bedding. The University furnishes cots and mattresses. The following is recommended: *At least* two heavy double blankets or equivalent, sheets and pillow (if desired), Scout uniform (urgently recommended but not required), entire change of clothing, toilet articles and sewing kit, personal first-aid kit, towels and soap, swimming suit, pocket knife. Optional list: Camera, compass, flashlight, waterproof ground cloth, musical instruments, fishing tackle, hand axe (in sheath). *Guns and dogs are not allowed in the park.*

Address.—Send all express to Park Rapids, Minnesota, and all mail to Arago, Minnesota, care of University of Minnesota Forestry School.

How To Get There.—If by car, consult Minnesota state road maps.

If by bus, get ticket to Douglas Lodge, Itasca Park. Report to clerk at Douglas Lodge, on arrival, for further information.

If by train, get ticket to Park Rapids, Minnesota, and take bus from there to Douglas Lodge, Itasca State Park. Those from northern Minnesota or northern North Dakota may get tickets to Bemidji, Minnesota, and take bus from Bemidji to Douglas Lodge.

Arrangements for transportation can be cleared through your local council office, and you may be able to join an automobile party at a reduced expense.

Time of Arrival.—In order to receive proper recognition for work done, it is necessary that all members of the course be on the grounds Monday morning, July 25, ready to begin work at 8:30 a.m. Evening meal, Sunday, July 24, and accommodations for the night available for those arriving Sunday afternoon or evening. The University of Minnesota Forestry School will be in session until Saturday, July 23. Therefore, accommodations for Scouters will not be available earlier than noon, Sunday, July 24.

REGION TEN UNIVERSITY OF SCOUTING

All Scouters should arrange to stay for the closing graduation, Saturday afternoon, the 30th. Early breakfast will be served to those who wish to start driving home early July 31.

Family Camping and Accommodations.—There are facilities for camping-out or for the rental of cottages one mile from the Forestry School. Resort accommodations are available at \$13 and up per week per person. Scouters who can are urged to bring their families and take advantage of these facilities. However, attendance regulations as outlined must be observed to qualify for certificates. We advise making reservations well in advance.

Enrollment Blank Enclosed

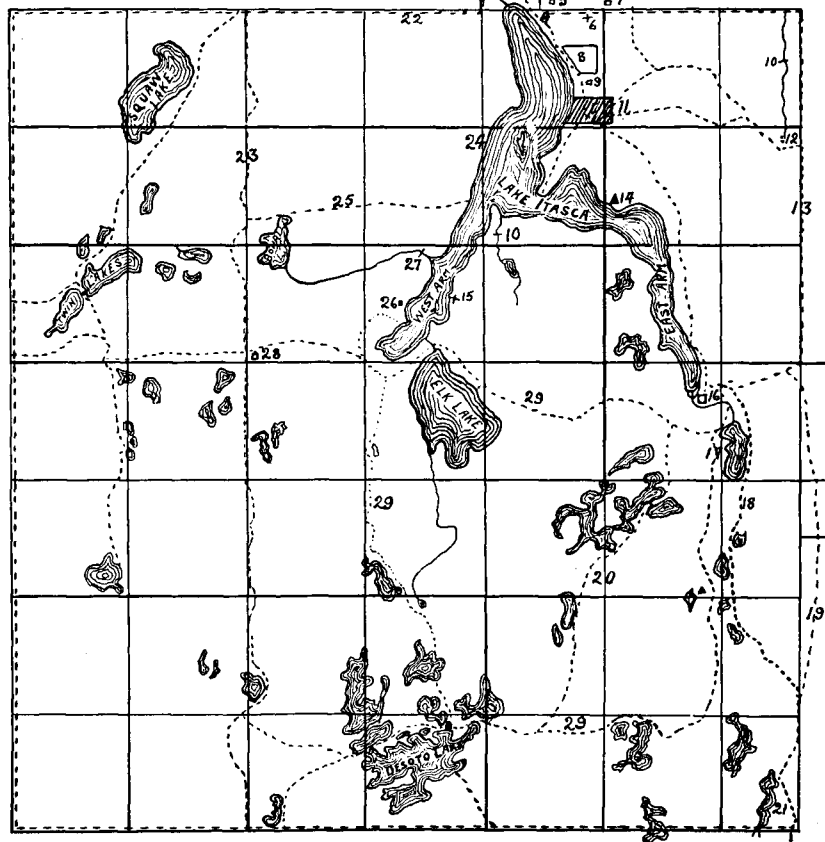
SUMMER SCHEDULE OF REGIONAL PROJECTS AND EVENTS

Region Ten, Boy Scouts of America

CAMP SCHOOL	May 28-30
AQUATIC SCHOOL	June 15-25
SEA SCOUT RENDEZVOUS	June 18-19
CANOE TRIPS	June to September
UNIVERSITY OF SCOUTING	July 24-31
EAGLE TRAIL	August 1-10
PACK SADDLE TRIP	August 7-14
SEA SCOUT CRUISE	August 14-21
MINNESOTA STATE FAIR	September 3-10
SOUTH DAKOTA STATE FAIR	September 10-17

ITASCA STATE PARK

AREA 30640 ACRES



- 22. ONE WAY ROAD AROUND PARK
- 23. WEST BOUNDARY OF OLD PARK
- 24. BEAVER DAM
- 25. BOHALL TRAIL
- 26. EAGLE'S NEST
- 27. BEAVER DAM & CEDAR SWAMP
- 28. MIDDLE WEST CABIN
- 29. LIND SADDLE TRAIL

- 1. MISSISSIPPI RIVER
- 2. DAM
- 3. INDIAN MOUNDS
- 4. CAMP GROUNDS
- 5. WEGMAN'S STORE
- 6. LOOKOUT TOWER
- 7. SCHNEIDER'S RESORT
- 8. ELK PASTURE
- 9. SUPT. HEADQUARTERS
- 10. BEAVER DAM
- 11. FORESTRY SCHOOL
- 12. LA SALLE SPRINGS
- 13. EAST FIRE BREAK
- 14. PEACE PIPE SPRINGS
- 15. EAGLE'S NEST
- 16. DOUGLAS LODGE
- 17. MARY LAKE
- 18. OLD ROAD
- 19. HIGHWAY FROM PARK RAPIDS
- 20. DEER PARK TRAIL TO DE SOTO
- 21. LITTLE MANTRAP LAKE



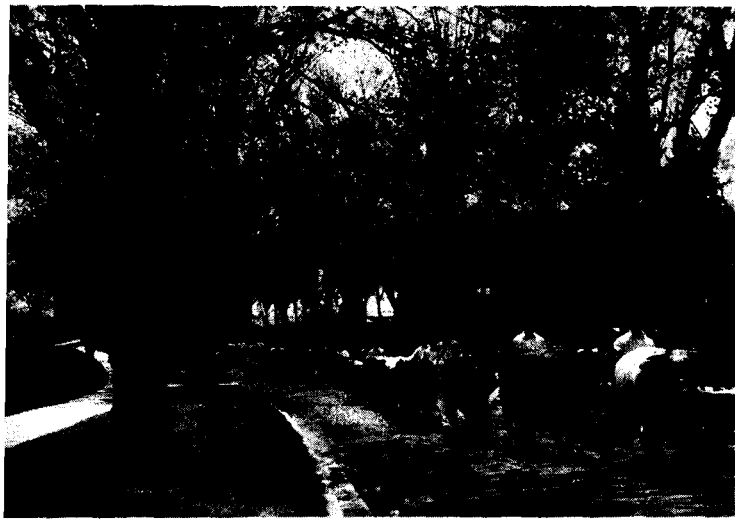
The Bulletin of the
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Vol. XLI

No. 31

May 3, 1938

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Act of October 3, 1917, authorized July 12, 1918*



**AG. ROYAL DAY
ON THE FARM CAMPUS**

**STUDENTS AT WORK IN THE
COLLEGE OF DENTISTRY
LABORATORY**



**A CLASS IN TYPESETTING
IN THE DEPARTMENT
OF JOURNALISM**



If you expect to enter the

UNIVERSITY OF MINNESOTA

IT IS becoming the fashion to go to college, and many high school graduates go on without thinking very much about what it means. Some of them succeed; others are disappointed and discouraged by failure.

When you are thinking of going to college you should keep in mind two or three facts. One is that going to college is just one way of educating yourself. You doubtless know several persons who have never gone to college yet possess cultivated tastes, discriminating judgment, knowledge in various fields, and all those qualities which go to make up an educated person. Do not think that you cannot be an educated person if you do not go to college.

The second fact that you should remember is that success in college work requires certain abilities and qualities. It is not possible to list them all here but you will find that these two are among the most important: a fair amount of intellectual ability, and the ability to do hard, concentrated mental work. It is in this connection that your high school work serves as an indication of your success in college. If you have disliked mental effort in high school and have avoided it as much as possible, it is difficult to believe that you can or will change your attitude when you get to college. In addition many people succeed better in their college courses if they set for themselves a definite objective.

Before you decide, therefore, to go to college you should think over the whole matter carefully. Your high school principal or counselor will be glad to discuss these things with you.

THE PURPOSE OF THIS BULLETIN

Doubtless you sometimes think of the time when you will enter college. You may have thought about studying law, or

medicine, or engineering. You may not yet have a very clear idea of just what training is required in each of these fields, and you may not have a very complete idea of what opportunities each of these fields offers. Perhaps there are other studies, such as dentistry, education, or nursing, about which you would like to know more. This booklet tries to describe in simple terms (1) the work of the various colleges at the University of Minnesota, (2) the opportunities open to graduates of each college, (3) the entrance requirements, and (4) the subjects which each of these colleges recommends that you study while you are still in high school.

This bulletin is not issued in an attempt to tell you what profession or occupation you should follow. It does try to help you prepare for the one you have chosen and to assist you in planning your high school work. This bulletin gives only the most general information. Before applying for admission, you may wish to secure the bulletin of the college you plan to enter.

WHICH COLLEGE?

In thinking about going to college, you have probably considered several factors. You may have thought about a certain college because it is near your home, or because your father attended it, or because your church supports it, or because your friend goes there, or because the expenses are low. These are important factors, but there are several others perhaps equally important.

The choice of a college is of vital importance to a student. Among the factors you should consider are (1) the quality of the teaching, (2) the equipment in libraries and laboratories, (3) the reputation of the institution among those who are familiar with the colleges of the region in which it is located, (4) the recognition given it by graduate and professional schools, (5) cost, and (6) location.

It is the purpose of this bulletin to furnish you information

about the colleges and professional and technical schools at the University of Minnesota in order that you may plan your high school course to the best advantage; however, much of the information and many of the suggestions will probably be useful to you whether you attend this university or some other institution.

A university is a collection of colleges. On one campus there may be located a college of liberal arts, college of education, school of medicine, institute of technology, and various other schools and colleges. You can enter a university only by being admitted to one of its schools or colleges.

At a university the student comes into contact with those who are studying law, music, education, medicine, agriculture, engineering, etc. These contacts enrich student life and extend cultural and educational opportunities. If you think of coming to the University of Minnesota, investigate its possibilities and confer with its staff. The remainder of this booklet will help you to understand what it has to offer.

COLLEGES AND SCHOOLS OF THE UNIVERSITY OF MINNESOTA

It is well for you while still in high school to realize that several of the professional schools preparing students in medicine, law, and education are not open to high school graduates, and therefore the student who purposes to enter them must first take some college work. As you read the description of the various units, you should note carefully which ones require some *college* training for admission. For example, in order to enter the Law School the student must first enter some liberal arts college and take two years of work. He then transfers to the Law School.

The following colleges of the University of Minnesota admit high school graduates to all of their curricula:

1. College of Science, Literature, and the Arts
2. Institute of Technology
3. College of Agriculture, Forestry, and Home Economics
4. College of Pharmacy
5. General College

The following colleges have some curricula to which high school graduates are admitted; others require one or more years of college work:

1. College of Education
2. College of Dentistry
3. School of Nursing

The following colleges have curricula open only to students who have had previous college work:

1. Medical School
2. Law School
3. School of Business Administration

Turn now to the description of the college or school in which you are interested. Under each college you will find (1) a brief statement of its organization, curriculum, or function, (2) a list of opportunities which are open to those who pursue its courses, (3) a summary of the entrance requirements, and (4) what high school courses will best prepare you for success in that college or school. The order in which these schools appear in this booklet follows the list above.

REQUIREMENTS FOR ADMISSION

First, in order that you may understand the statements made later regarding admission requirements, the general requirements for admission are listed here.

The following lists of subjects are those taught in most of the high schools of Minnesota. They are arranged in groups. Most of the colleges require that you take some subject from at least *three* of these groups with additional requirements as to majors and minors explained below. Look over these lists

and refer to them again as you read the entrance requirements for each college.

In order to understand the statement of requirements under the different colleges of the university, the following definitions are given:

A "unit" of high school work means not less than five recitations of forty minutes each week for a school year of thirty-six weeks. In such subjects as shop, drawing, cooking, typewriting, and similar courses, a "unit" means the equivalent of ten recitation periods a week for thirty-six weeks. Double laboratory periods will not be required from schools organized on a sixty-minute class period schedule.

"Admission group" refers to the special grouping of the high school subjects as they appear below.

A "major" means at least three units in one admission group.

A "minor" means at least two units in one admission group.

The admission groups, requirements for a major and a minor in them, and the minimum and maximum number of units in any one subject that will be accepted for admission are as follows:

Group A: English.—Composition and literature, one to three units, not to exceed one unit of public speaking. Journalism may be presented in partial satisfaction of these requirements.

Group B: Foreign languages.—Requirements for a major in this group are three units in one language; for a minor, two units in one language.

French, one to four units

German, one to four units

Greek, one to four units

Latin, one to four units

Scandinavian languages, one to four units

Spanish, one to four units

Group C: History and social sciences.—Requirements for a major in this group include at least two units in history; for a minor, at least one unit in history.

History:

American, one-half or one unit

English, one-half or one unit

European, one or two units

Social sciences:

American government, one-half or one unit

Commercial geography, one-half or one unit

Elementary economics, one-half unit

History of commerce, one-half or one unit

Sociology, one-half or one unit

Group D: Mathematics

Elementary algebra, one unit

Higher algebra, one-half or one unit

Plane geometry, one unit

Solid geometry, one-half unit

Trigonometry, one-half unit

Unified mathematics, two units

Group E: Natural sciences.—For a major or minor in this group, not more than two half-unit courses may be included.

Astronomy, one-half unit

Biology, one unit

Botany, one-half or one unit

Chemistry, one unit

Geology, one-half unit

Physics, one unit

Physiography, one-half or one unit

Physiology, one-half unit

Zoology, one-half or one unit

Group F: Vocational and miscellaneous subjects.—One-half to three units. In this group there may be included any subjects not specifically listed in groups A, B, C, D, or E which have been accepted by the high school toward its diploma.

For admission to any college of the university which accepts students without preliminary college training, an applicant must present a record of at least twelve units completed in grades 10, 11, and 12 (senior high school).

For all except the General College, at least nine of these

twelve units must be subjects listed in admission groups A, B, C, D, and E. The other three units may be in group F.

The nine units from admission groups A, B, C, D, and E must include a major and two minors, or preferably, two majors and one minor from at least three different admission groups.

Either one major or one minor must be in admission group A (English). From either admission group B (foreign languages) or admission group D (mathematics), but not from both, one unit completed in grade 9 may be used to make a major or a minor. However, the unit completed in grade 9 may not be counted as a part of the minimum of twelve units required from grades 10, 11, and 12.

If the subjects you are taking in high school do not fit these requirements, it may be that you can be admitted by examination to the college you wish to enter. For details you should consult the Bulletin of General Information.

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

FUNCTIONS

The College of Science, Literature, and the Arts offers four-year courses leading to the degree of Bachelor of Arts (B.A.). This college serves three very definite purposes.

1. It offers a four-year course for those who wish a general cultural education. The maintenance of one's place in modern society requires some acquaintance with a great variety of subjects and fields. At the same time the demands of business and the professions require that the student have a fairly adequate grasp of one or more subjects. This need of specialization is met by offering groups of advanced courses in various fields. For example, one may major in history, or English, or mathematics. The four-year course is thus designed to build a broad

base in several fields and to erect thereon a structure that represents the somewhat specialized interests and needs of the student.

2. In the second place, the College of Science, Literature, and the Arts offers professional training in four fields: (1) library work, (2) social work, (3) music, and (4) journalism. In each of these four fields the student is expected, however, to devote the major part of his freshman and sophomore years to basic rather than to specialized courses. The opportunities in each of these fields are fairly clearly indicated by their very titles. (1) The course in library work enables one to become a librarian, a cataloguer, or a compiler of bibliographies. The demand for persons with this training is steady although not extensive. This program is not designed for those who expect to become teachers and school librarians. Such persons must obtain their training through the College of Education. (2) The training in social work prepares one for welfare work and social group work in connection with religious and recreational organizations. Within recent years, however, for nearly all of the social case work a fifth college year has been required. (3) The field of music offers many opportunities for those gifted enough to play an instrument, compose music, or direct an orchestra. This curriculum in SLA (the abbreviated title by which students refer to the College of Science, Literature, and the Arts) does not, of course, lead to positions in public school music. (4) The curriculum in journalism trains for positions as reporters, editors, and for various types of writing.

3. The third function of the College of Science, Literature, and the Arts is that of preprofessional preparation. Some professional schools require two or three years of college work for admission. For example, the Law School requires two years of college training. Thus the student will enroll in SLA, and at the beginning of his junior year will transfer to the Law

School. Many students spend two or three years in SLA and then enroll in one of the professional schools.

OPPORTUNITIES

You very naturally raise such questions as: What does graduation from SLA mean? What good will the pursuit of the degree do me? Of what value is the degree? No very specific answers can be given to these questions, but a few general remarks may be helpful.

A degree conferred by a good college usually indicates that the graduate has pursued a fairly systematic course of study for four years. It means that he has come into contact with a great variety of subjects, that he has met many new and stimulating ideas. It also means that he has come in contact with some first-class scholars, and that he has met through books and references the world's greatest thinkers. It indicates, but does not guarantee, a certain degree of cultivation. The social, professional, and business world recognizes that the college graduate has had the opportunity for extended study and reading; consequently, he is expected to become a leader and to demonstrate the value of his training.

The pursuit of a degree is a privilege and also an obligation. Society expects the college graduate to use the training he has received not merely for his own advancement but for the common good. For four years the student is systematically directed through various fields and studies. The typical student should therefore be able to acquire knowledge; to develop his interests, skills, and taste; and to grow in those personal qualities of courage, honesty, and resourcefulness that mark the fully rounded personality.

The B.A. degree itself is frequently of great value. For example, it admits one to almost any professional school and to the graduate school of any university. The degree is a con-

venient badge of achievement and is usually respected as evidence of both achievement and promise.

ENTRANCE REQUIREMENTS

Since the College of Science, Literature, and the Arts serves as the *college* as well as the preprofessional school for most of the university, its requirements for admission are especially important. For admission it requires:

1. A major (three units) in group A
2. A major or minor (two units) in group D
3. A major or minor in group B, or C, or E
4. Enough other subjects from any group to bring the total to twelve senior high school credits

In addition, the entering student must prove his ability to profit from college instruction by a sufficiently high rank in the college aptitude tests.

RECOMMENDED SUBJECTS

The University of Minnesota is very liberal in its entrance requirements; it prescribes very few fields of study and almost no specific subjects. The faculty of the College of Science, Literature, and the Arts feels, however, that some subjects are valuable either as training or as furnishing background for other courses. The high school student is therefore *advised* to consider the following early in his course.

Group B: Foreign languages.—The college recommends that high school students study foreign languages. If a student is to take only one unit of a language in high school, it might best be taken in grade 12; if only two units, in grades 11 and 12; if only three units, in grades 10, 11, and 12. Only those who expect to earn four units of a language should begin it in grade 9. The college recommends a larger number of units in one language rather than a smaller number in each of two languages.

Group C: History and the social sciences.—The College of Science, Literature, and the Arts has no definite suggestion to make regarding high school courses in this field. It would be well, however, for each student to take some work in these subjects. Anyone who plans to major in one of the social sciences in college will do well to take at least a high school minor (2 units) in these courses.

Group D: Mathematics.—The required minor (two units) in mathematics consists of one unit of elementary algebra and one unit of plane geometry or of two units of unified mathematics, usually completed in grades 9 and 10. If a student takes any more mathematics—and there are good reasons why he should—he should take elective courses in this order: (1) higher algebra (of which one unit rather than one-half unit is strongly recommended); (2) solid geometry; (3) trigonometry. Higher algebra is the most important of the three for students who expect to study mathematics, physics, chemistry, astronomy, geology, accounting, or statistics in college. Solid geometry is especially recommended for those who plan to study mathematics, physics, or astronomy in college.

Group E: Natural sciences.—What has been said about the social sciences above applies also to the natural sciences. With the exception of chemistry a student may begin any one of these in the university without loss of time. In chemistry, high school preparation permits a student to carry a more advanced course than that for beginning students.

INSTITUTE OF TECHNOLOGY

FUNCTIONS

The Institute of Technology embraces the College of Engineering and Architecture, the School of Chemistry, and the

School of Mines and Metallurgy. Most of the curricula in the institute consist of four-year courses and lead to such degrees as Bachelor of Physics, Bachelor of Electrical Engineering, etc. The institute also offers the last two years of a four-year course in interior architecture, the first two of which are given in the College of Science, Literature, and the Arts.

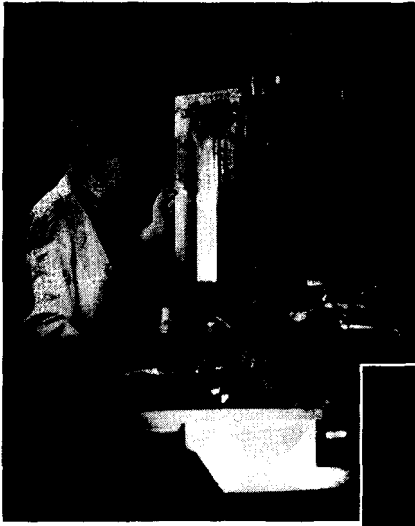
OPPORTUNITIES

Training in any of the units of the Institute of Technology leads to a variety of opportunities. From the College of Engineering and Architecture one may enter aeronautical, civil, electrical, mechanical, or agricultural engineering, or architecture. The School of Chemistry prepares one to specialize in physics or chemistry. The School of Mines and Metallurgy trains its students to become engineers of mines, engineers of mines in geology, engineers of mines in petroleum, and metallurgical engineers. In brief, the Institute of Technology undertakes to prepare its students to enter the various technical fields which are so important in the contemporary industrial world.

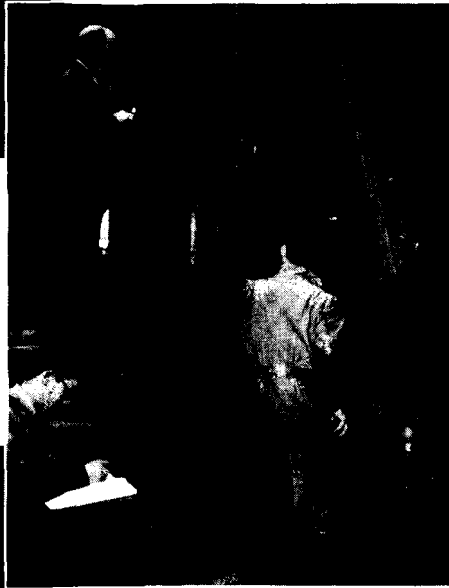
ENTRANCE REQUIREMENTS

The high school graduate who wishes to enter any of the units of the Institute of Technology should present majors or minors from groups A and D, and enough other credits to make up twelve senior high school credits. Students who plan to enter the institute should carefully note that they must stand in the upper 60 per cent of their high school class. Only under exceptional circumstances can a student from the lower 40 per cent of the class obtain admission. Students in high school who contemplate entering the institute should be very well prepared in elementary and advanced algebra, plane and solid geometry, physics, and chemistry.

For their general background of knowledge and culture, such



**IN THE BIOCHEMISTRY
LABORATORY**



EXPERIMENTAL ENGINEERING



MAKING CEMENT BLOCKS

students are urged to include in their high school programs English, two years of Latin, two years of German or French (the latter is preferable for architecture), world history, American history and civics, and general science. Vocational training and mechanical drawing are interesting and useful but should not be permitted to replace the foregoing cultural subjects.

College work in the technical fields is exacting and requires close application. Students who are below the average in ability should not undertake it. The best indication of ability to study effectively and to overcome difficulties in one's studies is contained in the high school record. If this is satisfactory, the student may undertake a course in technology with hope of success. It is a requirement that students whose high school record ranks them in the lower 40 per cent of their high school graduating class may not enter the Institute of Technology unless they receive special permission from the appropriate college committee on admissions. Prospective students should give this matter of ability to do college work of satisfactory grade their most careful consideration.

COLLEGE OF AGRICULTURE, FORESTRY, AND HOME ECONOMICS

FUNCTIONS

The College of Agriculture, Forestry, and Home Economics offers a variety of four-year courses leading to the degree of Bachelor of Science or to equivalent degrees. The various curricula are planned to train students for the opportunities described in the next section.

OPPORTUNITIES

The fields of agriculture, forestry, and home economics offer rather stable vocational opportunities. Agriculture provides

many of the raw products that are basic to our domestic life and national prosperity. Forests are the source of wood products, so forestry can never disappear from our national economy. Home economics, a basic occupation for women, will continue, in spite of all changes, to be an integral part of our domestic and national life.

The agricultural curricula offer vocational and professional training for all types of farming and for many of the industries that grow out of farming; for specialization in the various sciences that relate to agriculture, such as botany, zoology, chemistry, plant diseases, entomology, soils, etc.; for preparation and processing of various kinds of farm products—canning, pickling, etc.; for federal and state jobs in control of wild life and for commercial positions in the same field; for teaching agriculture in the high schools; for professional work in agricultural engineering and in business related to that field; for many business fields related to agriculture; and for journalism in agriculture.

The forestry curricula offer vocational and professional training for technical forest work in federal or state service or in private practice; for various branches of the commercial lumber industry; for pulp and paper manufacture, wood preservation, etc.; for cattle and sheep grazing and range management, especially in the West; for game management in national and state forests; and for specialization in the various branches of forestry or of the forest sciences, such as botany, chemistry, or other related subjects.

The home economics curricula offer vocational and professional training for teaching home economics in the high schools; for hospital dietetics; for business fields closely related to home economics, such as foods and nutrition, related art, textiles, and clothing; for management of such institutions as tearooms, cafeterias, dormitories, and institutional homes; for

the important business of homemaking; and for the combination of home economics and nursery school education.

ENTRANCE REQUIREMENTS

In order to enter most of the curricula of the College of Agriculture, Forestry, and Home Economics the candidate must present majors or minors from groups A and D, and enough electives to make up the twelve units required from senior high school (grades 9, 10, and 11). For the courses in the forestry and agricultural science curricula the candidate must present majors or minors from groups A and D, one unit from group E, and enough electives to make up the twelve units from the senior high school.

RECOMMENDED SUBJECTS

Practically all of the curricula offered in the College of Agriculture, Forestry, and Home Economics require courses in biological and physical sciences. Students who do not like or who do not succeed in such courses are not likely to be successful in this college. Students who plan to enter this college should, during their high school course, take general biology or botany and zoology (if such are available), chemistry, and physics. While high school mathematics is not required for all curricula of the college, it has been found that ability to solve problems with mathematical precision and in a scientific manner is essential to success in this college. Algebra and geometry are therefore recommended for all entrants. Furthermore, for all students who plan to enter forestry or the curricula in agricultural-, forestry-, or home economics-science, wild life management, or professional agricultural engineering, high school algebra and geometry are required and higher algebra recommended for entrance. Of English, the indispensable and most important tool in all professions, at least three years are recommended in high school. Economics, sociology, government,

and history are also especially recommended. High school work in the modern languages is not required, but those who are interested in scientific careers involving graduate work are advised to elect two years of high school German or French. Only three units of vocational subjects in high school are accepted by this college. High school agriculture and home economics may be valuable in acquainting the student with the future field of work but are not required. Vocational specialization should be postponed until college.

COLLEGE OF PHARMACY

FUNCTIONS

The College of Pharmacy offers work leading to the degree of Bachelor of Science in pharmacy. The minimum of four years of study is required for graduation. Upon graduation the student is eligible to take the state examination for a license to practice pharmacy in Minnesota.

OPPORTUNITIES

The graduate in pharmacy has the opportunity of becoming either a retail pharmacist, a food and drug chemist, or a manufacturing pharmacist and chemist. The curriculum in pharmacy is so designed as to facilitate preparation for one or more of these specialized fields. Advisers in the college assist the student in choosing the most suitable courses.

ENTRANCE REQUIREMENTS

In order to enter the College of Pharmacy the candidate must present a major from group A and a major or a minor from group D.

RECOMMENDED SUBJECTS

The faculty of the College of Pharmacy recommends that the high school student include as many as possible of the fol-

lowing subjects in his high school work: (1) Both Latin and physics are strongly recommended; if not presented for admission, courses must be taken after entering pharmacy; (2) mathematics (up to and including trigonometry); (3) one year of general inorganic chemistry; (4) one year of botany; (5) physiology; (6) two years of a modern foreign language, preferably French or German; (7) history, American, medieval, and ancient; (8) general science; (9) civics.

THE GENERAL COLLEGE

FUNCTIONS

The General College offers a two-year course leading to the degree of Associate in Arts. The courses which it offers are designed to acquaint the student with the various fields of knowledge and to assist him in meeting the problems of everyday life.

OPPORTUNITIES

While the General College is not a professional or a pre-professional school, its courses lead to possible openings in the business and social world. Those who do good work can usually transfer into other colleges if they wish to, but the prime purpose of the college is to offer training that will function in the daily lives of its students.

ENTRANCE REQUIREMENTS

The General College requires no set pattern of high school subjects. Any high school graduate who has the aggregate of twelve senior high school credits is admitted.

RECOMMENDED SUBJECTS

In view of the nature of the work in the General College and of its purpose to serve the needs of individual students, it makes no recommendation as to the high school subjects which students should take.

COLLEGE OF EDUCATION

FUNCTIONS

The four-year training course for elementary or secondary schoolteachers leads to a Bachelor of Science degree in education and a teaching certificate from the State Department of Education. Training for teaching in the grade schools includes a variety of subjects, outlined in the College of Education bulletin. For the secondary school certificate, the prospective teacher selects the subject he would like best to teach in high schools, and takes his major training in that field. Then he prepares himself to teach at least one other high school subject. For most of the major fields, such as English, history, or science, he will enter first the College of Science, Literature, and the Arts and take the basic freshman and sophomore courses there. After two years he will transfer to the College of Education to continue with a combination of professional courses in education and advanced work in the subjects he plans to teach. In agricultural and home economics education, the freshman and sophomore years are taken in the College of Agriculture, Forestry, and Home Economics.

There are, however, some very important exceptions to the requirement that one must have two years of college work before entering the College of Education. These exceptions are (1) art education, (2) industrial education, (3) physical education, (4) music education, and (5) school health work. In each of these fields the high school graduate enters the College of Education in his freshman year.

OPPORTUNITIES

High school students often think of teaching as the only vocational possibility open to them in the field of education, since teachers are the educational workers with whom they have come in closest contact. Besides the teachers for nursery

school, kindergarten, elementary school, and all the variety of subjects taught in junior and senior high school, the profession of education includes persons with other types of specialized training, such as school administrators, counselors, librarians, psychologists, and recreational directors. Preparation for such positions as these covers varying lengths of time and types of study. Students who are interested in any one of them may write to the College of Education; an adviser will be glad to supply information.

ENTRANCE REQUIREMENTS

In the five fields listed above as requiring no previous college work the requirements for admission to the College of Education are identical with those for SLA, except that a minor in group D is not required.

For those who plan to teach in the elementary school or to teach the usual academic subjects in the high school, the requirements for admission are two years of college work. These two years may be taken in SLA, a junior college, a teachers' college, or in any liberal arts college which is accredited by the University of Minnesota.

RECOMMENDED SUBJECTS

Since the field of education offers such a variety of vocational possibilities, it is impossible to tell prospective students as a group what additional subjects they should take in high school to supplement the entrance requirements which the university has listed. A high school student who is interested in public education should use all possible means to discover his interests and abilities. He may well make a tentative selection of a field in which he would be most likely to succeed and plan his high school program accordingly. For example, if he would like to become a science teacher, he should study in high school more science than ordinarily would be required for en-

trance to the university; if his abilities lie in mathematics and he wishes to prepare for teaching in that field, he should study as much of this subject as is offered in his high school; or if he plans to become a foreign-language teacher, he should begin his foreign-language study as early as possible.

Teachers and other workers in the schools need a broad training, too, in order to understand how their own particular fields fit into the whole complex structure of the schools. A high school student who is planning to enter educational work, therefore, can feel that his whole high school course, as well as subjects in which he may later want to specialize, will be of value to him in broadening his understanding of the world and of its people. The quality of his high school classwork, his contribution to his school in student activities, and his development as a person will determine largely how well he will succeed in the profession of education.

SCHOOL OF DENTISTRY

FUNCTIONS

The School of Dentistry offers a four-year course leading to the degree of Doctor of Dental Surgery (D.D.S.). The graduate is then permitted to take the state board examination for a license to practice dentistry in Minnesota. The school also offers a two-year course, open to high school graduates, leading to the degree of Graduate Dental Hygienist. The dental hygienist must also pass a state examination before entering active practice.

OPPORTUNITIES

Most graduates of the School of Dentistry open an office and enter upon active practice. A smaller number of dentists are employed by schools, hospitals, clinics, and industries. Dental hygiene offers young women a somewhat specialized opportunity. Dental hygienists secure employment in schools, hos-

pitals, clinics, industrial institutions, and in private dental offices.

ENTRANCE REQUIREMENTS

The high school graduate does not enter the dental school directly, for two years of college work are required for admission. These two college years may be taken in SLA, in a junior college, or in any college accredited by the University of Minnesota. The high school student who plans to study dentistry should therefore examine the requirements for admission to SLA. For the course for dental hygienists the only specific requirement beyond the general requirements for admission is a major or minor in group A.

RECOMMENDED SUBJECTS

Since the high school graduate cannot enter the School of Dentistry directly, the school is not immediately concerned about the pattern of his high school subjects. In view of the nature of the dental course, however, it is well for the high school student looking toward dentistry to take as many courses as possible from group E.

SCHOOL OF NURSING

FUNCTIONS

The School of Nursing is under the supervision of the Medical School. It offers courses leading to the degrees of Bachelor of Science and Graduate in Nursing. The three-year course, open to high school graduates, leads to a diploma of Graduate in Nursing. For those persons who are interested in such positions as instructor or supervisor in a school of nursing, school nurse, or public health nurse, the five-year course which leads to a degree of B.S. is offered. The first year or year and a half may be spent in an accredited college and is devoted to the study of biological and other sciences, and to additional cul-



**IN THE SCHOOL
OF NURSING**

**FREEHAND DRAWING
IN ART EDUCATION**



**A NUTRITION GROUP IN
HOME ECONOMICS**

tural courses. The next two and a half years are spent in the clinical field of hospital, out-patient, or other community nursing practice. The last year is devoted to clinical practice and academic work connected with nursing.

OPPORTUNITIES

The profession of nursing is one that offers a special opportunity to girls. The nurse may practice her profession in a hospital or home; she may also enter the field of administration, supervision, or teaching. Many schools and public health agencies employ nurses.

ENTRANCE REQUIREMENTS

In order to be admitted to the School of Nursing the candidate must meet the requirements given under SLA. No student in the lower two-thirds of her high school graduating class may be admitted unless she obtains satisfactory scores in nursing aptitude tests. In addition, the candidate must be eighteen years of age and be able to pass a health examination.

RECOMMENDED SUBJECTS

The School of Nursing requires no specific subjects, but the high school student who plans to enter it will do well to elect as many courses as practicable from group E.

MEDICAL SCHOOL

FUNCTIONS

The Medical School offers training for those who wish to become physicians, medical technologists, and nurses. The four-year medical course leads to the degree of Bachelor of Medicine. After an additional year as intern (i.e., resident doctor) in some good hospital, the student is granted the degree of doctor of medicine. He is then privileged to practice medicine. The medical technologist is one who makes chemical

analyses, X-rays, microscopic examinations, and various kinds of medical tests. For this kind of work the student takes a four-year course, the last year being taken in a hospital laboratory. The preparation for nurses is described under a separate heading.

OPPORTUNITIES

The field of medicine offers many opportunities. The doctor who maintains a general practice is only the outstanding example of the opportunities which medical training opens. Some graduates of the Medical School, after further training, become specialists in various diseases; others become supervisors of hospitals and clinics; others serve on the staffs of hospitals or practice among the employees of a factory or industry; others practice in the army and navy; and the technologists carry on their work in hospitals and laboratories. In brief, medicine offers a variety of opportunities for work that is socially useful. Competent and well-trained doctors are always in demand.

ENTRANCE REQUIREMENTS

High school graduates cannot enter the Medical School directly, as three years of college work are required for admission to the medical course and two years for the course in medical technology. Therefore the student who plans to take either of these must register first in the College of Science, Literature, and the Arts and must meet its entrance requirements. It should be borne in mind that only 120 beginning medical students are admitted each year; the Medical School selects these from the applicants who seem best qualified.

RECOMMENDED SUBJECTS

While the Medical School has no direct contact with high schools, it is possible to point out certain subjects that will be of particular value to the doctor. Biology, zoology, and chemistry are particularly valuable. All the subjects listed

under group E will be helpful to the student who plans to study medicine. While the social studies, economics, political science, and sociology are not directly involved in the study of medicine, they offer a good approach to the study of the social situation in which the doctor must work.

LAW SCHOOL

FUNCTIONS

The Law School offers courses leading to the degree of Bachelor of Laws and Bachelor of Science in law. The latter degree is conferred upon those who take two years of college work and two years of work in the Law School. This plan is designed primarily for those who wish to study law but do not intend to practice the profession. The degree of Bachelor of Laws is conferred upon those who complete successfully either (1) two years of college work and four years in the Law School or (2) four years of college work and three years in the Law School. The degree of Bachelor of Laws entitles its holder to take the state bar examinations.

OPPORTUNITIES

The profession of law offers a wide variety of opportunities. Court practice, which readily occurs to one as the typical work of lawyers, is in reality only a minor part of the work of most lawyers. The drawing of wills and contracts, the settling of estates, the management of property and corporations, and the legal guidance of clients are important functions of the lawyer. Many graduates of law schools enter businesses, such as banking, real estate, and insurance, where legal knowledge is of prime importance.

ENTRANCE REQUIREMENTS

Since the Law School does not admit high school graduates, the prospective student of law should examine the require-

ments for admission to the College of Science, Literature, and the Arts. After entering this college, he will be instructed to take the subjects that are designated as the prelegal course, but the details of these college requirements do not need to be known to the high school students.

RECOMMENDED SUBJECTS

The faculty of the Law School recommends that students looking forward to the study of law obtain approximately the following high school credits: English, 4; mathematics, 4; Latin, 4; natural science (chemistry, physics, biology), 2; history, 2. This pattern is chosen to fit into the prelaw college course to make an integrated whole.

SCHOOL OF BUSINESS ADMINISTRATION

FUNCTIONS

The School of Business Administration offers a two-year course at the senior-college level leading to the degree of Bachelor of Business Administration. Various fields, such as accounting, advertising, personnel management, and banking, receive special emphasis. In addition there is offered a five-year course in conjunction with the Institute of Technology for those going into administrative positions in industrial establishments.

OPPORTUNITIES

Graduates of the School of Business Administration enter such fields as banking, advertising, financing, accounting, foreign trade, and plant and personnel management. Each year the representatives of large corporations visit the school and select the most promising candidates, who then receive intensive training in company methods in company schools. The government service also offers many opportunities to the student who is trained in economics and business principles.

ENTRANCE REQUIREMENTS

In general, entrance to the School of Business Administration requires two years of college work. Therefore, the high school student who plans to enter this school should consult the requirements for admission given above under the College of Science, Literature, and the Arts. Preparation for certain specialized sequences may be obtained in the College of Agriculture or the Institute of Technology.

RECOMMENDED SUBJECTS

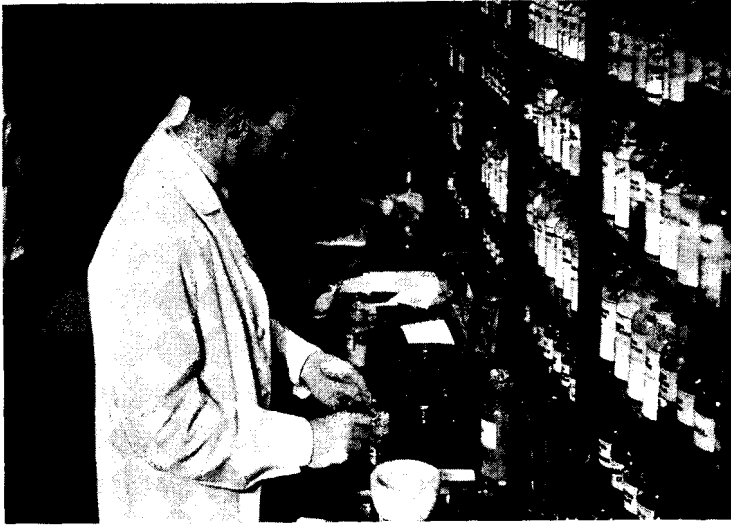
Since the high school graduate does not enter the School of Business Administration directly, its faculty has no specific recommendations as to high school subjects. It is well, however, to remember that both mathematics and the social studies furnish training that will be of specific value in the School of Business Administration.

OTHER COURSES

You should understand that this bulletin has given in briefest outline only the more important curricula offered by the University of Minnesota. It is possible to make a combination of these to meet the needs of an individual student.

If you cannot find listed in the bulletins of the various colleges a course of study to fit you for what you wish to do, write to the Registrar, University of Minnesota, Minneapolis. He will refer your letter to the proper adviser, who will be glad to help you.

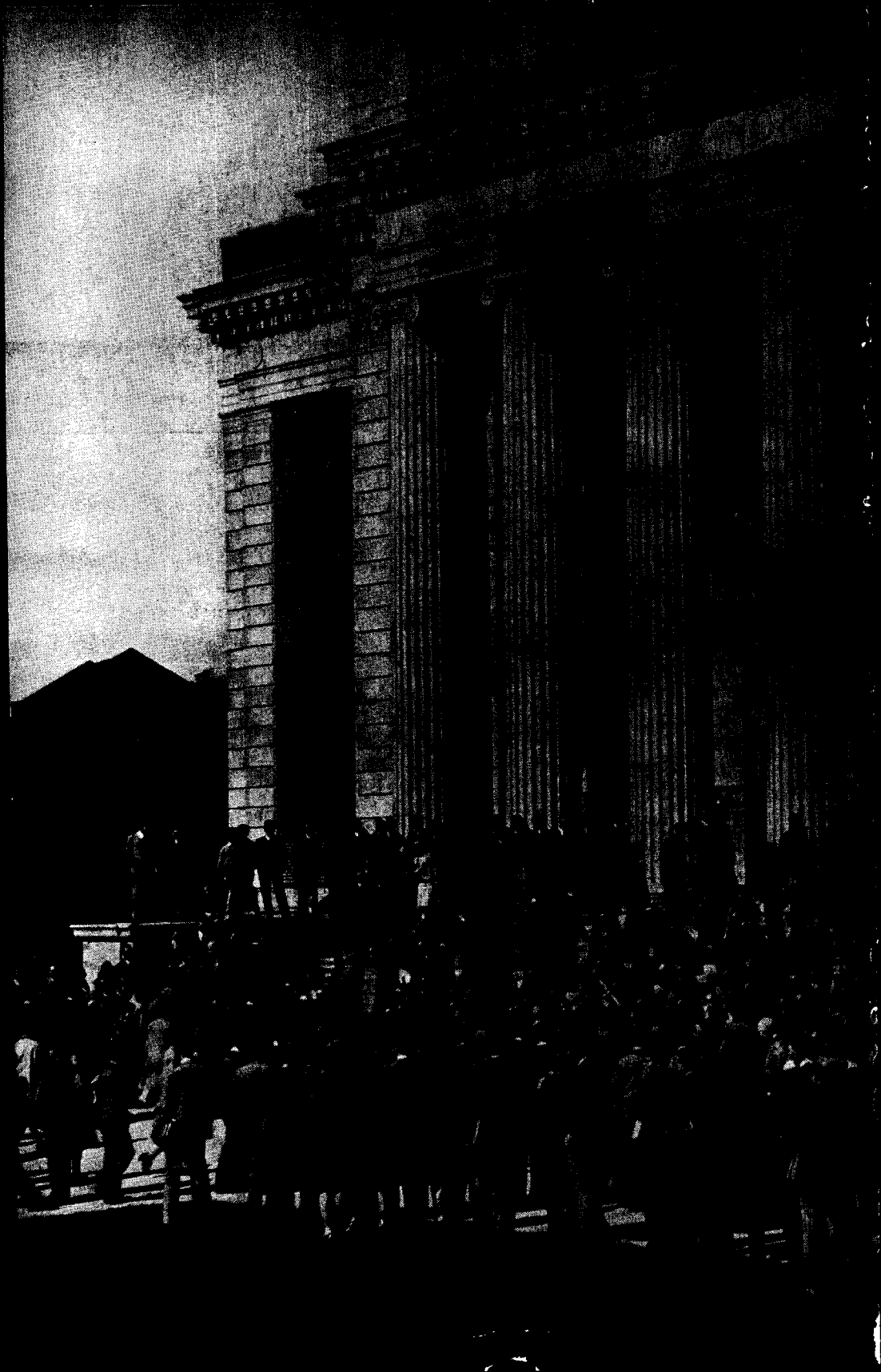
**IN THE PHARMACY
LABORATORY**



**AN ART CLASS IN THE
GENERAL COLLEGE**

**A CLASS IN ONE OF THE
CHEMICAL LABORATORIES**





The Bulletin
of the University of
Minnesota

Institute of Technology
1938-1939

UNIVERSITY CALENDAR

1938-39

Fall Quarter

1938			
September	15	Thursday	Payment of fees closes, except for new students ¹
September	19	Monday	Entrance tests
September	19-20		Registration for Freshman Week for all new students entering the freshman class
September	19-23		Examinations for removal of conditions Physical examinations
September	20-23		Registration period, ² College of Science, Literature, and the Arts
September	21-24		Freshman Week
September	22-23		Registration days ² for all colleges not included above
September	23	Friday	Payment of fees for new students closes ¹ at 4:30 p.m.
September	26	Monday	Fall quarter classes begin 8:30 a.m. ³
October	15	Saturday	Homecoming Day
October	20	Thursday	Senate meeting, 4:30 p.m.
November	2	Wednesday	Mid-quarter grades due
November	5	Saturday	Dad's Day
November	8	Tuesday	Election Day; a holiday
November	11	Friday	Armistice Day Convocation
November	24	Thursday	Thanksgiving Day; a holiday
December	1	Thursday	State Day Convocation
December	12-17		Final examination period
December	15	Thursday	Commencement Convocation Senate meeting, 4:30 p.m.
December	17	Saturday	Fall quarter ends, 6:00 p.m.

Winter Quarter

December	22	Thursday	Payment of fees closes for all students in residence fall quarter ¹
1939			
January	3	Tuesday	Entrance tests
January	3-4		Registration ² and payment of fees ¹ for new students in all colleges Registration and payment of fees close at 4:30 p.m., January 4
January	5	Thursday	Winter quarter classes begin 8:30 a.m. ³
February	8	Wednesday	Mid-quarter grades due
February	13	Monday	(Sunday, February 12, Lincoln's Birthday); a holiday
February	16	Thursday	Charter Day Convocation Senate meeting, 4:30 p.m.
February	22	Wednesday	Washington's Birthday; a holiday
March	20-25		Final examination period

See footnotes on page 3.

March	23	Thursday	Commencement Convocation Payment of fees closes for all students ¹ in residence winter quarter
March	25	Saturday	Winter quarter ends, 6:00 p.m.

Spring Quarter

March	31	Friday	Entrance tests
Mar. 31, Apr. 1			Registration ² and payment of fees ¹ for new students in all colleges
			Registration and payment of fees close at 12:00 m. on April 1
April	3	Monday	Spring quarter classes begin, 8:30 a.m. ³
April	7	Friday	Good Friday; a holiday
May	3	Wednesday	Mid-quarter grades due
May	6	Saturday	Mother's Day
May	11	Thursday	Cap and Gown Day Convocation
May	18	Thursday	Senate meeting, 4:30 p.m.
May	30	Tuesday	Memorial Day; a holiday
June 9-10 and 12-16			Final examination period
June	11	Sunday	Baccalaureate service
June	16	Friday	Spring quarter ends, 6:00 p.m.
June	17	Saturday	Sixty-seventh annual commencement

Summer Session

June	19-20		Registration, first term
June	21	Wednesday	First term Summer Session classes begin 8:00 a.m.
July	4	Tuesday	Independence Day; a holiday
July	27	Thursday	Commencement Convocation
July	28	Friday	First term closes
July	31	Monday	Registration and payment of fees for sec- ond term close at 4:30 p.m.

Second term classes begin 8:00 a.m.

September 1 Friday Second term closes

Entrance Examinations

Entrance examinations for admission to the Institute of Technology will be conducted for students whose credentials do not meet the requirements.

Candidates wishing to take any of these examinations should notify the registrar in writing not later than September 1 or December 1.

For further information concerning these examinations see "Admission by Examination," page 19.

¹ New students must pay fees on dates announced for registration. Fees of graduate students are due one week after their registration is approved by the dean of the Graduate School.

² Registration subsequent to the date specified will necessitate the approval of the college concerned. See also late fees for late registration, page 21. No student will be allowed to register in the University after one week from the beginning of the quarter excepting in unusual cases wherein special circumstances shall justify the appropriate committee of the college concerned permitting registration at a later date.

³ First hour classes begin at 8:15 a.m. at University Farm.

INSTITUTE OF TECHNOLOGY

EMBRACING THE COLLEGE OF ENGINEERING AND ARCHITECTURE, THE
SCHOOL OF CHEMISTRY, AND THE SCHOOL OF MINES AND METALLURGY

FACULTY AND STAFF

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George Filipetti, Ph.D., Secretary of Students' Work Committee for five-year combined courses
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* Absent on leave, 1938-39.

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 ———, Research Assistant in Aeronautical Engineering

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 Lillian Cohen, Ph.D., Associate Professor of Inorganic Chemistry
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George E. Mitchell, B.Ch.E., du Pont Fellow

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Paul Andersen, Ph.D., Assistant Professor of Structural Engineering
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George O. Pierce, B.S., Assistant Professor of Public Health

* Absent on leave, 1938-39.

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 ———, Research Assistant in Structural Engineering

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 gineering
 Elmer W. Johnson, B.S., M.E., E.E., Associate Professor of Electric Power
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 ———, Assistant in Mathematics and Mechanics
 ———, Research Fellow in Hydraulics
 ———, Research Fellow in Hydraulics

MECHANICAL ENGINEERING

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 Charles A. Koepke, M.S.(M.E.), Professor of Industrial Engineering and Superintendent of Shops
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 Charles F. Shoop, B.S., B.S.(M.E.), Professor of Steam Engineering
 John V. Martenis, M.E., Associate Professor of Machine Design
 Burton J. Robertson, B.S., E.E., Associate Professor of Internal Combustion Engines
 Axel B. Algren, M.S.(M.E.), Assistant Professor of Mechanical Engineering

Arthur R. Ford, M.S.(M.E.), Assistant Professor of Internal Combustion Engines
 Thomas P. Hughes, M.S., Assistant Professor of Mechanical Engineering
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 ———, Assistant Professor of Steam Engineering
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 William H. Easton, B.S.(M.E.), Instructor in Mechanical Engineering
 Fulton Holtby, M.E., Instructor in Foundry Practice
 Otis M. Larson, M.S.(M.E.), Instructor in Mechanical Engineering
 Herald K. Palmer, B.S., B.S.(E.E.), Instructor in Mechanical Engineering
 Charles M. Raver, B.S.(Ind.Ed.), Instructor in Foundry
 Millard D. Sink, B.P.E., Instructor in Machine Shop Practice

METALLURGY

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 William R. Appleby, M.A., Professor of Metallurgy, Emeritus
 Peter Christianson, B.S., E.M., Professor of Ferrous Metallurgy, Emeritus
 Ralph L. Dowdell, Met.E., Ph.D., Professor of Metallography
 Levi B. Pease, M.S., Professor of Non-ferrous Metallurgy
 Henry S. Jerabek, Ph.D., Assistant Professor of Metallography
 John N. Searles, E.M., M.S., Assistant Professor of Ore Dressing
 Arthur C. Forsyth, Met.E., Ph.D., Instructor in Metallography
 Myron W. Griswold, E.M., Instructor in Non-ferrous Metallurgy
 Frank W. Scott, M.S., Instructor in Ferrous Metallurgy
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 Carrie H. Green, Teaching Assistant in Metallography
 Michael Tenenbaum, Met.E., Teaching Assistant in Metallurgy

MINES EXPERIMENT STATION

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 Henry H. Wade, E.M., Metallurgist
 John C. Durfee, Met.E., Junior Metallurgical Engineer

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 Walter H. Parker, E.M., Professor of Mining and Petroleum Engineering
 Louis S. Heilig, E.M., Associate Professor of Mine Plant and Mining
 Stanley A. Trengove,* E.M., Ph.D., Assistant Professor of Mining and Petroleum Engineering

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

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Willem J. Luyten, Ph.D., Professor of Astronomy

* Absent on leave, 1938-39.

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Ned L. Huff, M.A., Assistant Professor of Botany

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Frank F. Grout, Ph.D., Professor of Geology and Mineralogy
Clinton R. Stauffer, Ph.D., Professor of Geology and Mineralogy
John W. Gruner, Ph.D., Associate Professor of Geology and Mineralogy
George M. Schwartz, Ph.D., Associate Professor of Geology and Mineralogy
George A. Thiel, Ph.D., Associate Professor of Geology and Mineralogy
Reuben B. Ellestad, Ph.D., Instructor in Rock Analysis
Franklin B. Hanley, B.A., Instructor in Geology and Mineralogy

GERMAN

Samuel Kroesch, Ph.D., Professor of German and Chairman of the Department
Donald F. Munro, Ph.D., Instructor in German
Alvin Prottengeier, M.S., Instructor in German

PHYSICS

Henry A. Erikson, B.E.E., Ph.D., Professor of Physics and Chairman of the Department

Louallen F. Miller, Ph.D., Professor of Physics
John T. Tate, Ph.D., Professor of Physics
Anthony Zeleny, Ph.D., Professor of Physics
J. William Buchta, Ph.D., Associate Professor of Physics
Edward L. Hill, Ph.D., Associate Professor of Theoretical Physics
Joseph Valasek, Ph.D., Associate Professor of Physics
John H. Williams, Ph.D., Associate Professor of Physics
Lynn H. Rumbaugh, Ph.D., Assistant Professor of Physics
Wilfred W. Wetzel, Ph.D., Assistant Professor of Physics

POLITICAL SCIENCE

William Anderson, Ph.D., Professor of Political Science and Chairman of the Department
Asher N. Christensen, B.A., Instructor in Political Science
Evron M. Kirkpatrick, M.A., Instructor in Political Science

ZOOLOGY

Dwight E. Minnich, Ph.D., Professor of Zoology and Chairman of the Department
Jerry E. Wodsedalek, Ph.D., Professor of Zoology
Samuel Eddy, Ph.D., Associate Professor of Zoology
Ralph Dawson, Ph.D., Assistant Professor of Zoology

COLLEGE OF AGRICULTURE, FORESTRY, AND HOME ECONOMICS

AGRICULTURAL BIOCHEMISTRY

Ross A. Gortner, Ph.D., D.Sc., Professor of Agricultural Biochemistry and Chief of the Division
Clyde H. Bailey, Ph.D., Professor of Agricultural Biochemistry
David R. Briggs, Ph.D., Associate Professor of Agricultural Biochemistry
William M. Sandstrom, Ph.D., Associate Professor of Agricultural Biochemistry

INSTITUTE OF TECHNOLOGY

AGRICULTURAL ECONOMICS

Oscar B. Jesness, Ph.D., Professor of Agricultural Economics and Chief of the Division

George A. Pond, Ph.D., Associate Professor of Agricultural Economics

AGRONOMY AND PLANT GENETICS

Herbert K. Hayes, D.Sc., Professor of Agronomy and Plant Genetics and Chief of the Division

Iver J. Johnson, Ph.D., Assistant Professor of Agronomy and Plant Genetics

ANIMAL AND POULTRY HUSBANDRY

Walter H. Peters, M.Agr., Professor of Animal Husbandry and Chief of the Division

DAIRY HUSBANDRY

James B. Fitch, M.S., Professor of Dairy Husbandry and Chief of the Division

Willes B. Combs, M.A., Professor of Dairy Husbandry

Harold Macy, Ph.D., Professor of Dairy Bacteriology

FORESTRY

Henry Schmitz, Ph.D., Professor of Forestry and Chief of the Division

Edward G. Cheyney, B.A., Professor of Forestry

HORTICULTURE

William H. Alderman, B.S.A., Professor of Horticulture and Chief of the Division

Ernest Angelo, Ph.D., Instructor in Horticulture

RHETORIC

Robert C. Lansing, M.A., Assistant Professor of Rhetoric

William J. Routledge, B.A., Assistant Professor of Rhetoric

Ralph G. Nichols, M.A., Instructor in Rhetoric

SOILS

Frederick J. Alway, Ph.D., Professor of Soil Chemistry and Chief of the Division

Clayton O. Rost, Ph.D., Professor of Soils

Paul R. McMiller, M.S., Assistant Professor of Soils

MEDICAL SCHOOL

BACTERIOLOGY AND IMMUNOLOGY

Winford P. Larson, M.D., Professor of Bacteriology and Immunology and Head of the Department

Robert G. Green, M.A., M.D., Professor of Bacteriology and Immunology

Arthur T. Henrici, M.D., Professor of Bacteriology and Immunology

H. Orin Halvorson, Ch.E., Ph.D., Associate Professor of Bacteriology and Immunology

PHYSIOLOGICAL CHEMISTRY

Jesse F. McClendon Ph.D., Professor of Physiological Chemistry

Wallace D. Armstrong, M.D., Ph.D., Assistant Professor of Physiological Chemistry

Allan Hemingway, Ph.D., Assistant Professor of Physiological Chemistry
 Leo T. Samuels, Ph.D., Assistant Professor of Physiological Chemistry
 L. Earle Arnow, Ph.D., Instructor in Physiological Chemistry

SCHOOL OF BUSINESS ADMINISTRATION

Russell A. Stevenson, Ph.D., Dean of the School of Business Administration
 John J. Reighard, M.A., C.P.A., Assistant Dean of the School of Business Administration
 George Filipetti, Ph.D., Professor of Economics and Business Administration and
 Adviser in Engineering Business Courses
 Roy G. Blakey, Ph.D., Professor of Economics
 Frederic B. Garver, Ph.D., Professor of Economics
 Arthur W. Marget, Ph.D., Professor of Economics and Finance
 Bruce D. Mudgett, Ph.D., Professor of Economics and Statistics
 J. Warren Stehman, Ph.D., Professor of Finance
 Roland S. Vaile, M.A., Professor of Economics and Marketing
 Dale Yoder, Ph.D., Professor of Economics and Personnel Administration
 Ernest A. Heilman, Ph.D., Associate Professor of Accounting
 Richard L. Kozelka, Ph.D., Associate Professor of Economics and Statistics
 Emerson P. Schmidt, Ph.D., Associate Professor of Economics
 Arthur R. Upgren, B.A., Associate Professor of Economics and Finance
 Arthur M. Borak, Ph.D., Assistant Professor of Economics
 A. Hamilton Chute, Ph.D., Assistant Professor of Marketing
 Walter R. Myers, Ph.D., Assistant Professor of Economics and Finance
 Harry J. Ostlund, B.A., Assistant Professor of Accounting
 Francis M. Boddy, M.A., Lecturer in Economics
 Franklin D. Gray, B.A., B.C.L. (Oxon.), Lecturer in Business Law
 Ben W. Palmer, M.A., LL.B., Lecturer in Business Law
 Marshman Wattson, B.A., LL.B., Lecturer in Business Law
 Richard A. Graves, M.A., Instructor in Economics and Insurance
 Reuel I. Lund, M.A., C.P.A., Instructor in Economics and Accounting
 Edmund A. Nightingale, M.A., Instructor in Economics and Transportation

MILITARY SCIENCE AND TACTICS

Adam E. Potts, Lieutenant Colonel, Coast Artillery Corps, B.S., Professor of
 Military Science and Tactics
 Edwin L. Brackney, Lieutenant Colonel Medical Corps, M.D., Assistant Professor
 of Military Science and Tactics
 Coburn L. Berry, Major, Coast Artillery Corps, B.S., Assistant Professor of
 Military Science and Tactics
 Thomas H. Maddocks, Captain, Signal Corps, M.S., Assistant Professor of Military
 Science and Tactics
 Layton A. Zimmer, Captain, Coast Artillery Corps, B.S., Assistant Professor
 of Military Science and Tactics
 Roy Cunningham, Staff Sergeant, Detached Enlisted Men's List, Instructor in
 Military Science and Tactics
 Ernest R. Mylke, Staff Sergeant, Detached Enlisted Men's List, Instructor in Military
 Science and Tactics

Kenneth Cruse, Sergeant, Detached Enlisted Men's List, Instructor in Military Science and Tactics

William E. Bowen, Sergeant, Detached Enlisted Men's List, Instructor in Military Science and Tactics

PHYSICAL EDUCATION

PHYSICAL EDUCATION FOR MEN

Frank McCormick, B.A., LL.B., Professor of Physical Education for Men and Director of Athletics

Bernard W. Bierman, B.A., Professor of Physical Education for Men and Head Football Coach

Louis F. Keller, M.A., Associate Professor of Physical Education for Men

David MacMillan, B.S., Assistant Professor of Physical Education for Men

Ralph A. Piper, M.A., Assistant Professor of Physical Education for Men

David C. Bartelma, M.A., Instructor in Physical Education for Men

Phil Brain, Instructor in Physical Education for Men

Clarence R. Osell, B.S., Instructor in Physical Education for Men

Niels Thorpe, B.S., Instructor in Physical Education for Men

PHYSICAL EDUCATION FOR WOMEN

J. Anna Norris, M.D., Professor and Director of Physical Education for Women

GENERAL INFORMATION

INSTITUTE OF TECHNOLOGY

The Institute of Technology was established by action of the Board of Regents on October 19, 1935, to embrace the College of Engineering and Architecture, the School of Chemistry, and the School of Mines and Metallurgy, effective November 1, 1935.

College of Engineering and Architecture

The College of Engineering and Architecture had its beginning in the College of Agriculture and the Mechanic Arts which was authorized by the legislative act of 1868. Courses in civil and mechanical engineering were first offered in 1871. In the reorganization of the University, in 1872, the College of the Mechanic Arts was established. It became the College of Engineering, Metallurgy, and the Mechanic Arts in 1892, the College of Engineering and the Mechanic Arts in 1897, and the College of Engineering and Architecture in 1916. A course in Electrical Engineering was first offered in 1887. Architecture and Architectural Engineering were announced in 1912. In 1925, the name of the Department of Architecture was changed to the School of Architecture. The course in Interior Architecture was established in 1923 being called Interior Decoration until 1929. The Agricultural Engineering course was offered in 1925, and the courses in Aeronautical Engineering in 1928. Combined courses with Business Administration were established in 1934.

The departments of this college occupy the following buildings on the Main campus: Main Engineering, Electrical Engineering, Mechanical Engineering, and the Experimental Engineering Laboratories. Portions of the School of Chemistry and the Armory are also utilized. The new Hydraulic Laboratory is situated at the St. Anthony Falls of the Mississippi River about a mile upstream from the campus. Agricultural Engineering has its own building on the Agricultural campus. The libraries of Engineering and Architecture are situated in the Main Engineering Building.

The purpose of this college is to give the students a broad foundation in the fundamental principles of engineering and architecture, together with sufficient knowledge of professional practice to enable them to apply those principles successfully. It is not possible in college to educate a fully trained engineer, as the application of the principles to the practice of engineering is to be learned through experience. There are certain subjects, such as surveying and drafting, in which some proficiency is required. This enables a student upon graduation to fill satisfactorily a subordinate position while obtaining a basis for growth and advancement.

It is intended that all of the technical courses given in this college shall be taught by men who have had practical experience in their respective fields in addition to their professional training.

The field of engineering is very broad and is continually becoming more extensive. From the technical lines of design, construction, maintenance, and operation of engineering works, which have always belonged to him, the trained engineer has been drawn into the business world to occupy positions of an executive character. To meet the demand for such service, the importance of the broader training in economic and commercial principles and industrial relations is recognized.

Withal, it is intended that the young graduate shall have obtained material assistance in developing those traits of character which will make him a loyal and exemplary citizen and a true gentleman.

School of Chemistry

The School of Chemistry was established in 1897 as a school of analytical and applied chemistry, subsidiary to the College of Science, Literature, and the Arts. In 1904 it was made a separate unit of the University, and in 1919, its present name was adopted, and its administration was correlated with that of the College of Engineering and Architecture under one dean.

The courses in chemistry and chemical engineering were developed from the beginning of the school. The course in physics was established in 1936.

The school occupies a large modern building, 180 by 200 feet, having six floors. Its laboratories are designed to afford facilities for instruction in the various branches of chemistry. The Chemistry library is well provided with complete sets of journals and compendia of chemical literature, among which are important sets not frequently found in university libraries. Many special laboratories for private research have been provided and ample facilities are available for graduate work leading to the higher degrees.

School of Mines and Metallurgy

The School of Mines and Metallurgy was established by the Board of Regents in 1888, upon recommendation of the general faculty of the University. A course in mining and metallurgy was announced in 1889. The school was affiliated with the College of Engineering, under the name of the College of Engineering, Metallurgy, and the Mechanic Arts, until 1897, when the School of Mines was made an independent college. In 1926 the name was changed to School of Mines and Metallurgy.

The school occupies the building provided by the Legislature of 1913. This building contains the library of the school together with the offices, classrooms, drafting rooms, and laboratories necessary to administer the courses in mining, metallurgy, metallography, and petroleum engineering. For other fields of work necessary to the completion of well-rounded curricula advantage is taken of the instruction afforded by various departments in other units of the University.

The Mines Experiment Station was established by the Board of Regents in 1911. It occupies a specially constructed laboratory building of which a portion is assigned to the North Central Station of the United States Bureau of Mines.

The mining districts of Minnesota are within a few hours of Minneapolis by rail or paved road. The heartiest co-operation exists between the officials of the various mining companies and the school. As a result, the mining properties are at all times open to parties from the school for observation and study trips. Practical surveying, geological field work, and underground work are carried on in one or more of the districts.

Ample opportunity for field work in metallurgy is also available. Numerous fabrication and heat treating plants are located in the Twin Cities. Plants for the study of smelting and other processes can be reached with not more than an over-night trip by rail.

Students in the School of Mines and Metallurgy have, therefore, all the advantages afforded by a large university combined with ample opportunity for field observation and experience.

COURSES AND DEGREES

The College of Engineering and Architecture offers four-year courses of study in Aeronautical, Agricultural, Civil, Electrical, and Mechanical Engineering, and a five-year course in Architecture. These courses lead to the degree of bachelor of aeronautical, agricultural, civil, electrical, or mechanical engineering, or architecture. In some of the courses, optional groups of electives are arranged for the guidance of students who desire to devote special attention to certain fields.

A four-year course in Interior Architecture is provided, of which the first two years are taken in the College of Science, Literature, and the Arts and the last two years in the College of Engineering and Architecture, leading to the degree of bachelor of interior architecture.

The Engineering Prebusiness course requires the first two years of work in this college. This is followed by two years in the School of Business Administration upon the completion of which the degree of bachelor of business administration is conferred.

In co-operation with the College of Science, Literature, and the Arts, a six-year course in Arts and Architecture is offered. It leads to the degrees of bachelor of arts, at the end of four years in the College of Science, Literature, and the Arts, and bachelor of architecture at the end of the sixth year in the Institute of Technology.

The School of Chemistry offers four-year courses in Chemistry, Chemical Engineering, and Physics, leading to the degree of bachelor of chemistry, bachelor of chemical engineering, or bachelor of physics, respectively.

Five-year combined courses in Engineering or Chemistry with Business Administration lead to two bachelor's degrees, one in each of the two fields.

The School of Mines and Metallurgy offers four-year courses in Mining, Geological, Petroleum, and Metallurgical Engineering leading to the respective degrees of bachelor of mining engineering, B.Min.E.; bachelor of geological engineering, B.Geol.E.; bachelor of petroleum engineering, B.Pet.E.; and bachelor of metallurgical engineering, B.Met.E.

These colleges also offer work in the Graduate School leading to the Master's degree in the appropriate branch of engineering, in architecture, or in chemistry, or to the Doctor's degree.

The professional degree of aeronautical, agricultural, chemical, civil, electrical, geological, mechanical, metallurgical, mining, or petroleum engineer will be conferred upon those who have received the degree of bachelor of aeronautical, agricultural, chemical, civil, electrical, geological, mechanical, metallurgical, mining, or petroleum engineering, when they have completed the equivalent of one additional year's college work, four years of engineering experience in positions of responsibility, and have presented a satisfactory professional thesis.

Graduates of these colleges may be granted permission to pursue the year of graduate study *in absentia* under the direction of the faculty. It is recommended, however, that this year be spent in residence at this University and that the Master's degree be obtained in this manner. There are many advantages in taking this year immediately following graduation from the four-year course, thus making a five-year course leading to the Master's degree in the corresponding branch of engineering or in architecture. Then after four years of approved experience and the preparation of the professional thesis, the Engineer degree may be obtained. This procedure is especially recommended to those students whose undergraduate

work is of high grade and who desire additional preparation for the higher positions which require strong character and leadership.

Candidates for the Engineer degrees register in the Graduate School.

ADMISSION

Detailed information concerning admission, entrance requirements, advanced standing, and expenses will be found in the Bulletin of General Information which will be sent to any address upon application to the registrar, University of Minnesota.

Students are admitted on certificate or by examination. In special cases, with the approval of the dean of the college, persons of mature age (twenty-four years or older) and experience may be admitted as adult special students to pursue specific courses of study.

Admission by certificate.—Applicants must present twelve units of work obtained in the last three years of high school (senior high school) of which at least nine must be included in Groups A, B, C, D, and E as listed below. These nine units must include a major of three units in one group and two minors of two units each in two other groups. Subject to these requirements, the applicant for admission to the Institute of Technology must include at least two units of English and two units of mathematics, including elementary algebra and plane geometry. One unit of mathematics and one unit of foreign language taken in the ninth grade may be counted in these groups. Applicants who stand in the upper 60 per cent of their high school class on the basis of their scholastic records, will be admitted directly; those in the lower 40 per cent will be given individual consideration and may be permitted to take special tests to qualify for admission. Chemistry is desirable for admission to the School of Chemistry.

Students who expect to enter the Institute of Technology are urged to include in their high school courses additional mathematics, beyond the two years required, especially higher algebra and solid geometry; Latin, two units; German or French, two units; chemistry one unit; physics, one unit; ancient, modern, and American history; and American government or civics. French is desirable for students in architecture. German is important for students entering the School of Chemistry; students who have had two years of high school German or one year of college German take placement tests in the fall to determine whether or not they may take German 27-28-29, nine credits, instead of 25-26, eight credits. French is also desirable for chemistry students who plan to enter the Graduate School.

Students who are able are advised to take as many courses in the College of Science, Literature, and the Arts as may be possible or desirable before entering the Institute of Technology or during the courses therein. If the bachelor of arts degree were taken first, enough of the required basic courses in science and mathematics could be included to shorten the subsequent Bachelor's course in the Institute of Technology to three or possibly two years. Such broadening and cultural courses are becoming increasingly important in the training of engineers and scientists.

Applicants deficient in one or more of the subjects: chemistry, higher algebra, and solid geometry will be admitted provisionally at the beginning of the school year. In order to continue in the Institute of Technology these deficiencies must be removed during the fall quarter. Opportunities to remove the deficiencies will be offered within the institute in the fall quarter. Students with deficiencies in mathematics will be required to attend one Summer Session if they desire to graduate in four years. It is recommended that such deficiencies be made up in the

Summer Session before entering the institute, and thereby avoid the complications incident to making them up during the freshman year.

List of entrance subjects.—Only those subjects included in the following groups may be counted toward admission.

The term *unit* means not less than five recitations of forty minutes each per week for a school year of thirty-six weeks. In laboratory, drawing, and other manual courses, twice this amount of class time is required for one unit.

Group A English: 2 or 3 units.

Group B Foreign languages: Latin, Greek, German, French, Spanish, Scandinavian, 1 to 4 units each.

Group C History and social sciences: European history, $\frac{1}{2}$ to 2 units; English and American history, $\frac{1}{2}$ or 1 unit each; economics and sociology, $\frac{1}{2}$ unit each; American government, commercial geography, and history of commerce, $\frac{1}{2}$ or 1 unit each.

Group D Mathematics: elementary algebra and plane geometry, 1 unit each; unified mathematics, 2 units; higher algebra, $\frac{1}{2}$ or 1 unit; solid geometry and trigonometry, $\frac{1}{2}$ unit each.

Group E Natural sciences: biology, physics, and chemistry, 1 unit each; botany and zoology, $\frac{1}{2}$ or 1 unit each; physiology, astronomy, and geology, $\frac{1}{2}$ unit each.

Group F Vocational and miscellaneous subjects: The three units which are not required to be in Groups A, B, C, D, E, may be in work which the superintendent certifies as being of acceptable nature and as having been counted toward the applicant's graduation.

Admission by examination.—Applicants who are high school graduates or at least nineteen years of age may be admitted provisionally and subject to one year of satisfactory work, upon passing the following tests:

- a. College aptitude test
- b. Test of proficiency in English
- c. Test in mathematics including arithmetic, algebra, and geometry
- d. Test in chemistry, if entering School of Chemistry.

Applicants failing to pass test (b), (c), or (d) may apply for a subsequent examination at any scheduled date on payment of a fee of five dollars. Those failing to pass test (a) may enter only upon satisfactorily meeting the entrance requirements by the certificate method.

Time of admission.—The regular time to enter the institute is in September. However, students will be admitted at the beginning of the winter quarter in January. Such students must have entrance credits in higher algebra and solid geometry and should have credits in high school chemistry. Students cannot be admitted at the beginning of the spring quarter, since no beginning courses in mathematics, chemistry, English, or drawing are given in this quarter.

ADVANCED STANDING

Students who have pursued courses of study in other colleges of recognized standing may receive advanced credit under the rules of the University and of the institute. See Requirements for Graduation.

Students who have taken college algebra or trigonometry in high school with satisfactory records may be permitted to take comprehensive examinations for credit in these subjects, if they apply before registration day at the office of the Department of Mathematics and Mechanics.

REGISTRATION

All undergraduate students are required to pay the prescribed fees to the university bursar at the beginning of each quarter. Necessary classification blanks showing the courses a student expects to pursue are to be filled out and filed either

at the beginning of the fall quarter for the entire year or at the beginning of each quarter during the college year. Classification and enrolling of students registering in Aeronautical, Agricultural, Civil, Electrical, Mechanical, or Prebusiness Engineering and Architecture or Interior Architecture take place in the Main Engineering Building; for those registering in Chemistry, Chemical Engineering, and Physics in the Chemistry Building; and in Mining, Metallurgical, Geological, and Petroleum Engineering in the Mines Building.

All students entering the institute for the first time must send or present their credentials to the registrar of the University, who will notify each applicant in regard to his admission. Before registering, all new matriculants are required to take a physical examination, and the following tests:

1. Co-operative English test.
2. Impromptu English theme.

On the basis of his standing in these tests and his scholarship rank in preparatory school, he will be classified in one of the two groups in English as follows:

1. Required to take English 4-5-6, nine (9) credits in composition.
2. Required to make up minimum essentials as a preliminary to English 4-5-6.

Any student who takes these tests when they are given in the high school and preparatory schools of the state and who applies for admission to the University before September 1 will be mailed a card showing his classification in English. Those who have not taken the tests will be required to take them on Friday or Saturday preceding the regularly scheduled Freshman Week. *No freshman will be allowed to register without presenting a card giving his assignment in English.*

Students should consult the university calendar in regard to registration dates.

Students will not be allowed to register for more than 19 credit hours without the approval of the Students' Work Committee.

Freshmen are not permitted to take additional courses (except Military Science and Tactics) without permission of the Freshman Students' Work Committee.

No change in registration will be permitted later than 10 days after the beginning of the quarter.

FEEES AND EXPENSES

The annual fee for students in this college is \$90 for residents and \$135 for nonresidents, one third of which is due at the beginning of each quarter. Fellows, scholars, assistants, and instructors are not required to pay university fees or tuition when they are regularly enrolled in the Graduate School.

Tuition fee (per quarter):

Residents of Minnesota	\$30.00
Nonresidents	45.00

Matriculation deposit† (first quarter only)

Men	15.00
Women	5.00

Incidental fee, per quarter 6.40

Special fees:

Examination for removal of condition	1.00
Examination for credit (after the first six weeks in residence)	5.00
Special examination	5.00
Chemistry deposits, including laboratory fee of \$2.00 per quarter	10.00

Graduation fee 7.50

† Such charges as may be incurred for lockers, library penalties, laboratory breakage, etc., will be deducted from the amount of this deposit and the balance will be refunded by mail upon graduation or after the beginning of the first quarter the student fails to return to the University.

Late fees.—The fee for the privilege of late registration or late payment of fees shall be \$2 prior to the day classes begin, on and after which the fee increases at the rate of \$1 per day, provided no student shall pay more than \$10 in fees for late privileges in any given quarter. The fee for late change of registration is \$2.

Living expenses.—Detailed statements regarding living expenses may be found in the Bulletin of General Information. For students not living at home, the approximate expense of a year in this college has been estimated at about \$500 minimum, \$800 average, and \$1,000 liberal, not including clothing, traveling, or vacations. The average estimate is based upon the following details:

Tuition and laboratory fees	\$135.00
Laundry	40.00
Room rent	120.00
Meals	270.00
Books and instruments	35.00
Incidentals	200.00
<hr/>	<hr/>
Total	\$800.00

For nonresidents of Minnesota, \$45 should be added for tuition.

A great deal depends upon the frugality of the student. By reducing the amount spent for incidentals and by obtaining cheaper board and room many students will be able to live for less than the amount estimated above. Likewise other students will pay more for board, room, and incidentals and will not be able to live within these amounts. To live within the minimum amount, a student should expect to forego all luxuries and economize in every way possible.

When coming to the University for the first time, the student should have money enough to cover the full expense for at least the first quarter without depending upon outside employment for his support. After a term at the University, he will know more about the possibilities of supplementing his income by employment, especially as regards the spare time at his disposal for such work.

UNIT OF CREDIT

The standard unit of credit in the University is the quarter credit, or simply, the *credit*. It corresponds to one class period per week for one quarter. This class period may be a one-hour lecture or recitation, or a two- or three-hour class in laboratory, drawing, surveying, or computations, but in any case one credit is supposed to require three actual hours of the average student's time per week for one quarter. One hour of recitation is assumed to require two hours of preparation or study. A two-hour laboratory period may require one hour of home work to complete the credit. A three-hour period usually carries one credit without additional work outside of class. The credit allowed for a lecture may be from one-third to one hour depending upon the amount of outside work or study required in connection with it.

CREDIT FOR OUTSIDE WORK

Credit for certain courses, as a result of work done outside of the regular classes, may be obtained by satisfactorily passing comprehensive examinations. This includes work done in extension classes, by correspondence study, by the aid of a private tutor, by individual study, through practical experience, or otherwise.

The comprehensive examination will be of such thoro and searching character as to determine whether the student has done all the work of the course. It should require at least three times the work of the usual final or condition examina-

tion and will be conducted by a committee appointed by the head of the department in which the course is given.

Permission to take the examination must be obtained from the Students' Work Committee, and the usual fee of \$5 for each special examination must be paid unless it be taken within six weeks after first entering the University.

EXTENSION COURSES

Courses in engineering, architecture, and chemistry are offered by the General Extension Division of the University in evening classes and by correspondence study. Persons who are unable to attend the regular university courses may obtain valuable instruction in this manner.

Credits will be accepted from the Extension Division for the following types of courses:

1. Nontechnical courses taken in residence (residence as defined by the University Senate ruling).
2. Such other residence courses as have been approved by the department concerned of the Institute of Technology and by the dean, which courses shall have been designated as credit courses by the Extension Division.
3. Correspondence study courses in academic subjects will be accepted, but not in excess of 9 credits.

ATTENDANCE

It is expected that all students will be regular in attendance at all class exercises and that they will do all the work of their courses. Neglect of work, as indicated by irregularity in attendance or low scholarship, will be sufficient reason for exclusion from class. Any student who has unexcused absences equal to the number of credits in a course, but in no case less than two, may be dropped from the class with a record of failure in the course.

INSPECTION TRIPS

All seniors registered in Chemical Engineering are required to go on a trip of inspection and observation through certain large industrial plants. This trip is usually taken during the spring vacation and is under the personal supervision and guidance of members of the faculty. It includes plants in Milwaukee, Chicago, and near-by points. The expenses of the trip are minimized as far as possible, and must be defrayed by the individual student. They amount to from \$75 to \$100 per student.

Seniors in Aeronautical Engineering are required to take an inspection trip during the spring vacation to visit aeronautical manufacturing, operating, and research establishments in the central and eastern portions of the United States. The expense to each student is estimated at about \$75.

In Mines and Metallurgy, field trips are required at the end of the sophomore and junior years. The sophomore trip embraces mine surveying on the iron ranges in northern Minnesota for four weeks beginning about June 15, the expense amounts to about \$60. Field work in geologic mapping is also required. The junior mining and non-ferrous metallurgy, and petroleum trips cover a study of mine plants and operations in leading mining or oil fields in the western part of the country for nearly three weeks beginning about September 5. The expense amounts to approximately \$125. The junior geology trip embraces standard types of geological field work in the Black Hills region. The expense amounts to about \$100. The junior ferrous metallurgy trip includes inspection and reports upon iron and steel plants,

fabrication plants, and heat treating plants in the Middle West. The expense amounts to approximately \$100.

REQUIREMENT FOR GRADUATION

To be recommended for the degree of bachelor of aeronautical, civil, electrical, or mechanical engineering, the student must satisfactorily complete all of the courses prescribed in the corresponding curriculum together with sufficient electives to make a total of at least 207 credits. In the five-year course in architecture, 225 credits are required for graduation. In agricultural engineering 210 credits and in chemistry,* 207 credits are required for graduation. For the degree of bachelor of interior architecture, the requirements are 192 credits, including all required courses, plus 90 honor points from the first two years. For the degree of bachelor of chemical engineering, 218 credits are required. For the degree of bachelor of business administration in combination with engineering or chemistry, a student must complete the requirements for the Bachelor's degree in one of the engineering or chemistry curricula and include the 74 prescribed credits in business subjects. In mining and petroleum engineering a total of 235 credits must be completed. Metallurgical engineering requires 222 credits and geological engineering 233 credits.

In cases of continued low scholarship, even tho all the courses of the curriculum have been passed, the faculty reserves the right to require additional work to be completed, over and above the regular curriculum, and with a specified grade, before the degree will be recommended.

Students entering with advanced standing from other colleges or universities must spend at least one year in residence here before they will be recommended for graduation. If the term of residence is only one year it must be the senior year; and in any case such a student must spend two "quarters" of his senior year in residence.

SENIOR QUALIFYING EXAMINATIONS IN CHEMISTRY†

The Senior Qualifying Examinations, courses Inorganic Chemistry 51 (4 hours), and Analytical Chemistry 53 (3 hours), are required of all students registered in the School of Chemistry, but not of students in other colleges who may be taking chemistry courses. The following rules apply to students registered in the School of Chemistry.

1. The requirement of the two Senior Qualifying Examinations must be satisfied before registration for any required courses of the student's senior year or the summer courses in chemical manufacture (Ch.E. 151-152) or the senior courses in the minor groups in bacteriology, biochemistry, or geology.

2. They will be held regularly each year in the latter part of the spring quarter and prior to the opening of the fall quarter on specified dates. They need not be taken simultaneously, but each must be preceded by Analytical Chemistry 1-2, Quantitative Analysis, or registration in these.

3. Students who have taken their general inorganic courses, qualitative courses, or their quantitative courses in the School of Chemistry and have an average in either of these groups higher than "C," will be excused from the corresponding Senior Qualifying Examination.

* Students who enrolled in Chemistry when the requirements for graduation were 210 credits cannot offer shop as an elective if they are graduating under the curriculum which required only 204 credits for graduation.

† Optional for students registered before September 1, 1936. See New Plan described on following page, for students registering after September 1, 1936.

4. A special examination requires a fee of \$5 and the permission of the Students' Work Committee.

NEW REQUIREMENT FOR GRADUATION IN THE SCHOOL OF CHEMISTRY

General Statement

The new plan adopted by the faculty of the School of Chemistry has two objects: first, to make our graduating students better prepared to undertake the duties of their profession and second, to enable students of marked ability to begin their graduate studies at an earlier stage than is now possible. The new plan became effective September 1, 1936, for students registering in the school for the first time on or after that date. Students who registered in the school before September 1, 1936 have the *option* of accepting the new plan or of continuing under the regulations in force at the time of their first registration.

In the new plan there will be no Senior Qualifying Examinations but instead, in certain parts of his work, the student must obtain a grade of "C," at least. In the work of the freshman and sophomore years, it is made a requirement for graduation that the student must make a grade of at least "C" in each quarter of the prescribed courses in inorganic chemistry and qualitative analysis and must make an average grade of at least "C" in Quantitative Analysis (Anal. Chem. 1-2). Moreover in the work in inorganic chemistry and qualitative analysis, the student must obtain a grade of at least "C" in the work of any quarter as a prerequisite to registration for the work of any succeeding quarter. A grade of at least "C" in Qualitative Chemical Analysis (Inorg. Chem. 13) is a prerequisite to registration for either Analytical Chemistry 1 or 2. It is also a requirement for graduation that the student must make an *average* grade of "C" in courses which do not belong to his freshman or sophomore years.

As an incentive to and a recognition of excellent work on the part of the student, the faculty is introducing quality credits which will have the effect of shortening appreciably the time required for an excellent student to meet the requirements for graduation.

Details of the New Plan

1. Students registered in the School of Chemistry shall be assigned honor points on the completion of any course in accordance with the following scheme: grade A, 3 honor points per credit; grade B, 2 honor points per credit; grade C, 1 honor point per credit; grade D or lower, no honor points per credit.

As a requirement for graduation, a student must obtain at least 1 honor point per credit in each quarter of the prescribed courses of the freshman and sophomore years in inorganic chemistry and qualitative analysis, and an *average* of 1 honor point per credit in Analytical Chemistry 1-2. The satisfying of this requirement in any quarter of the courses in inorganic chemistry and qualitative analysis is a prerequisite to registration for the work of any succeeding quarter. A student who fails to satisfy this requirement in any course must repeat the course in class the next time the course is offered.

3. As a requirement for graduation a student must obtain an average of at least one honor point per credit for his total work in courses which do not belong to his freshman or sophomore years.

Excess Honor Points and Quality Credits

4. The term, "excess honor points" for any course is defined as the total number of honor points received by a student for that course minus the number of honor points associated with a grade of C.

5. For every course in which a student obtains a grade above C he shall receive not only the stated credits for the course but in addition quality credits equal to the excess honor points divided by the factor ten. These quality credits are to be accepted on the same basis as the nominal or stated credits in satisfying the credit requirement for graduation.

Special Regulations for Students Proceeding to the Degree of Bachelor of Chemistry

6. Students who at the end of the junior year have an honor point average of less than 1.9 in all courses taken while registered in the school will pursue in their senior year the prescribed curriculum and will be eligible for graduation when their total credits (stated plus quality) amount to the required number, namely 207. Students with an honor point average *close to 1.9* should be able, in the spring quarter of their senior year, to register in the Graduate School and obtain *some* residence and graduate credit.

7. A student who at the end of the junior year has an honor point average of more than 1.9 on all courses taken while registered in the school will pursue in his senior year *a course of study prescribed for him* by an adviser after thoro study by the adviser of the needs, qualifications, and desires of the student. Toward the end of his junior year or at the beginning of his senior year, the student shall select an adviser from among the chiefs of the divisions of the school. An adviser so selected may delegate his duties in this connection to a member of his staff.

8. As soon as the senior student, following the course of study prescribed by his adviser has accumulated a total of 207 quarter credits (stated plus quality) he shall be eligible to be recommended for the Bachelor's degree.

Special Regulations for Students Proceeding to the Degree of Bachelor of Chemical Engineering

9. Students in the Chemical Engineering Curriculum will be recommended for graduation when they have *completed the prescribed courses*, have satisfied the requirements of paragraphs (2) and (3) and have accumulated at least 218 quarter credits (stated plus quality.) Students whose honor point average at the end of the junior year *does not greatly exceed unity* will register in the senior year for the prescribed courses and usual electives. Students with an honor point average *considerably greater than unity* will consult with the chief of the Department of Chemical Engineering or with an adviser assigned by him, who will *prescribe the work* to be undertaken in the senior year. In exceptional cases, the adviser is authorized to *waive the requirement* that any given courses are prerequisite to graduation. In any case, gifted students will be able in the spring quarter of their senior year to obtain credit in the Graduate School for an appreciable fraction of the work of that quarter.

Students Entering with Advanced Standing

10. The above regulations shall apply to students entering with advanced standing as far as the work taken by them after entering the school is concerned.

SCHOLARSHIPS AND PRIZES

Research fellowships.—In the Engineering Experiment Station research fellowships are available from time to time which are open to engineering graduates, including chemical engineers. The holder is required to give twenty hours per week, that is, about half of his time, to such research service as may be assigned him. In addition he is expected to carry half-time work in the Graduate School toward an advanced degree.

Teaching fellowships in civil and electrical engineering are open to graduates in these fields. Each fellow renders part-time service in instruction while pursuing graduate study.

The Shevlin Fellowship in Chemistry.—The Shevlin Fellowship in Chemistry, established by the late Thomas H. Shevlin, of Minneapolis, is awarded annually and yields \$500. Candidates for this fellowship should file their applications before March 1 with the dean of the Graduate School. The Shevlin fellow devotes his entire time to graduate work and is not required to render any service to the University.

The du Pont Fellowship in Chemistry.—This fellowship was founded by E. J. du Pont de Nemours and Company, Wilmington, Delaware, and yields \$750 annually. The holder devotes his entire time to graduate work and is not required to render any service to the University. Applications for this fellowship should be submitted to the dean of the Institute of Technology before March 15.

Assistants.—The School of Chemistry employs 42 graduate assistants at from \$300 to \$600 per year, on part time. They devote from eight to twelve hours per week to instruction and other assigned work, thereby obtaining valuable experience in laboratory teaching under competent direction. In addition to these duties, each assistant is expected to pursue graduate work toward a higher degree. Application should be made to the dean of the Institute of Technology.

Prizes.—Various prizes in the University are open to students in these colleges. A list of them is given in the bulletin, University Aids for Student Expenses. Certain prizes are awarded to students in Engineering only, such as the prizes of the Northwestern section of the American Society of Civil Engineers and the Twin Cities section of the American Society of Mechanical Engineers. The Tau Beta Pi, Chi Epsilon, Eta Kappa Nu, and Pi Tau Sigma honorary engineering fraternities also offer prizes.

Two prizes are open to sophomores in chemistry and chemical engineering. These have been established by the Phi Lambda Upsilon honorary chemical fraternity and the Twin City Alumni Association of the Alpha Chi Sigma chemical fraternity. The chemistry faculty offers a prize to seniors.

Prizes and medals are open to students registered in the School of Architecture. Medals are offered by the American Institute of Architects, Alpha Rho Chi, and the Scarab Fraternity. Prizes have been established, respectively, by the Alpha Alpha Gamma Sorority, the Gargoyle Club, and the Northern States Power Company.

Loan funds.—Various loan funds are available from which worthy students may obtain financial assistance after they have been in attendance a sufficient length of time to establish satisfactory records of accomplishment. Application should be made to the dean of student affairs and to the head of the student's department.

RESERVE OFFICERS TRAINING CORPS

The War Department has established at this University units of medical coast artillery (anti-aircraft) and signal corps, in which both basic and advanced courses are given. The coast artillery and signal corps units are made up almost entirely of students in the Institute of Technology for whom this technical and military training is particularly valuable. The Basic Course is open to all physically fit male students and carries one credit per quarter for six quarters; the Advanced Course is open to selected students who have completed the Basic Course.

Students in the institute who are admitted to the Advanced Course of the signal or coast artillery corps under the prescribed regulations receive for this work fifteen and eighteen elective credits toward graduation, respectively. They receive an allowance of cash and clothing from the government during the two years of the course, pay and transportation to attend one summer training camp and, if successful, a commission in the Officers' Reserve Corps of the United States Army after graduation.

Besides receiving technical instruction, the student in the Advanced Course has the opportunity to develop and exercise leadership and discipline which will be of value to him in his professional career. Special arrangements may be made in the student's program to enable him to take this course, the advantages of which are recognized.

SELF-SUPPORT AND OUTSIDE ACTIVITIES

A large number of students contribute to their financial support by means of part-time work during the college year. Frequently such students undertake too much. They are advised to carry a lighter program of studies and to plan to spend more than four years in the college course if outside work requires a large amount of their time. Information regarding work for self-support during the college course may be obtained from the University Employment Service or the University Young Men's Christian Association.

Freshmen, in particular, are advised that the work of the first year in the institute will require their closest attention and application if they are to succeed. They should refrain from participation in unnecessary outside activities, while bearing in mind the importance of physical as well as mental development.

CHANGES IN BULLETIN

The faculties of the Institute of Technology reserve the right to change their curricula and to cancel or change without notice any course printed in this bulletin. The bulletin is a statement of present conditions, and is subject to modification in any particular by faculty action.

SOCIETIES

Branches of the following national professional societies are maintained at the University of Minnesota by students and faculty members: American Chemical Society, American Institute of Chemical Engineers, American Institute of Electrical Engineers, American Society of Civil Engineers, American Society of Mechanical Engineers, American Society of Agricultural Engineers, and the Institute of the Aeronautical Sciences. In addition there are the Architectural Society and the School of Mines and Metallurgy Society.

CURRICULA

COLLEGE OF ENGINEERING AND ARCHITECTURE

Aeronautical Engineering	Electrical Engineering
Agricultural Engineering	Engineering and Business Administration
Architecture	
Interior Architecture	Engineering Pre-Business
Civil Engineering	Mechanical Engineering

SCHOOL OF CHEMISTRY

Chemistry	Chemical Engineering
Physics	

SCHOOL OF MINES AND METALLURGY

Mining Engineering	Geological Engineering
Metallurgical Engineering	Petroleum Engineering

STUDENTS ENTERING WITHOUT CHEMISTRY, HIGHER ALGEBRA, OR SOLID GEOMETRY AND THOSE REQUIRED TO TAKE THE COURSE IN PRELIMINARY ENGLISH

Applicants deficient in one or more of the subjects, chemistry, higher algebra, and solid geometry, will be admitted provisionally at the beginning of the school year. Students entering without high school chemistry will be required to carry a special course in college chemistry during their freshman year. Students entering with deficiencies in higher algebra or solid geometry or both must register for such deficiencies in the fall quarter. In order to continue in the Institute of Technology these deficiencies must be removed during the fall quarter. Applicants deficient in either higher algebra or solid geometry will not be admitted at the beginning of the winter or spring quarter.

If students who enter with deficiencies in mathematics desire to graduate in four years, it will be necessary to attend the Summer Session immediately following their freshman year. It is recommended that such deficiencies be made up in the Summer Session before entering the institute.

Chemistry.—Students entering the engineering divisions of the College of Engineering and Architecture and all students entering the School of Mines and Metallurgy who have not had high school chemistry will take Inorganic Chemistry 14f-15w, four credits per quarter, instead of Inorganic Chemistry 4f-5w. Those entering the School of Chemistry who have not had high school chemistry will take Inorganic Chemistry 6f-7w-8s, five credits per quarter, instead of Inorganic Chemistry 9f-10w-12s.

Higher Algebra.—Freshmen entering without higher algebra will take Course 9 (Higher Algebra) without credit, and those who have had higher algebra will register for Course 11 (College Algebra). Course 9 will be followed by Courses 11, 12, and 13 during the winter and spring quarters and the following Summer Session, respectively.

Solid Geometry.—Students who do not offer solid geometry for entrance will take Drawing 10 (Solid Geometry) during the fall quarter and without university credit. Students in the engineering courses in the College of Engineering and

Architecture should follow this by Drawing 1, 2, and 3 in the winter and spring quarters and the Summer Session, respectively; in the School of Chemistry, by Drawing 7 and 8 in the winter and spring quarters; and in the School of Mines and Metallurgy, by Drawing 7, three credits, in the winter and Drawing 13 two credits and one credit of Drawing 8 in the spring quarter. Students in architecture will add solid geometry to their fall quarter programs.

English.—Students who are required to take the preliminary course in English will take this course during the fall quarter without university credit. The required courses in Composition, English 4-5-6 should follow in the winter and spring quarters and the Summer Session, respectively.

AERONAUTICAL, AGRICULTURAL, CIVIL, ELECTRICAL, AND MECHANICAL ENGINEERING, AND PRE-BUSINESS

FRESHMAN YEAR§

(For students entering with chemistry, higher algebra, and solid geometry and who pass their English tests.)

Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
M.&M. 11	College Algebra	5	5	.....	.....
Inorg. Chem. 4	General Inorganic Chemistry	4	1	3	3
Engl. 4	Composition	3	3	.....	.....
Draw. 1	Engineering Drawing	3	.....	.....	8
M.E. 5, 8, or 11*	Shop Practice (for Pre-bus.)	2	.....	1	4
G.E. 11	Orientation	0	.....	1	.....
<i>Winter Quarter</i>					
M.&M. 12	Trigonometry	5	5	.....	.....
Inorg. Chem. 5	General Inorganic Chemistry	4	1	3	3
Engl. 5	Composition	3	3	.....	.....
Draw. 2	Engineering Drawing	3	.....	.....	8
M.E. 5, 8, or 11*	Shop Practice (for Pre-bus.)	2	.....	1	4
G.E. 12	Orientation	0	.....	1	.....
<i>Spring Quarter</i>					
M.&M. 13	Analytical Geometry	5	5	.....	.....
Inorg. Chem. 16	Qualitative Chemical Analysis	5	.....	3	6
Engl. 6	Composition	3	3	.....	.....
Draw. 3	Descriptive Geometry	3	.....	.....	8
M.E. 5, 8, or 11*	Shop Practice (for Pre-bus.)	2	.....	1	4
G.E. 13†	Orientation	0	.....	1	.....

AERONAUTICAL ENGINEERING

Four-year course leading to the degree of bachelor of aeronautical engineering, B.Aero.E.

In addition to the prescribed courses, sufficient electives must be taken to complete a total of at least 207 credits for graduation.

* Freshmen in Agricultural Engineering and Engineering Pre-Business are required to take Shop Practice, M.E. 5, 8, and 11, 2 credits per quarter; not required of the others.

† Women take one of the following courses in place of G.E. 13, Phys.Ed. 1f, 2w, 3s, 4f, 5w, or 6s.

§ See statement on page 28.

The course in aeronautical engineering is intended to provide instruction and training for students who wish to enter this field of engineering as a profession. With the rapid development of aviation in recent years, aeronautical engineering is assuming a prominent and important position among the engineering professions. The production of airplanes in the United States is increasing at a rapid rate. More attention is being given to lighter-than-air craft as well. Aeronautical engineers are required in all stages of the process, from the research work preliminary to improvements in design to the actual construction, testing, operation, and maintenance. Students trained in aerodynamics and the designing of light structures have been in demand in recent years in many industries.

The aeronautical engineering course is similar to other professional engineering courses. The first year of the course is the same as that of civil, electrical, and mechanical engineering. The fundamental studies are the same. As a result, the graduates in aeronautical engineering should be prepared to enter various branches of the engineering field if, for any reason, they should prefer to do so.

As in other technical courses, so in aeronautical engineering, mathematics plays an important part. No student should enter this course who feels poorly prepared in mathematics.

It should be understood that this is a professional engineering course and not a training course for airplane pilots. It deals with the preparation of students for research, design, construction, operation, management, and maintenance of aircraft from the standpoint of the engineer or manager. However, practical flight training is important for aeronautical engineers and students are urged to take advantage of their opportunities to obtain it through the University of Minnesota Flying Club, Army Air Corps, National Guard, Naval Reserve, or private organizations.

Students taking the five-year combined course in aeronautical engineering and business administration may substitute business courses for C.E. 17, Met. 152, and six credits of the optional courses listed in the footnote on page 31.

For freshman year, see page 29.

SOPHOMORE YEAR

Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
M.&M. 24	Differential Calculus	5	5	.....	.....
Phys. 7	General Physics	5	1	4	2
Draw. 28†	Drafting	2	.....	.....	6
Aero.E. 1	Aeronautics	3	3	.....	.....
M.E. 6	Pattern Practice	2	.....	1	4
M.E. 70	Mechanical Technology	1	.....	2	.....
<i>Winter Quarter</i>					
M.&M. 25	Integral Calculus	5	5	.....	.....
Phys. 8	General Physics	5	1	4	2
Aero.E. 2	Aircraft and Auto Engines	3	2	.....	2
M.E. 12	Forging, Heat Treating, and Welding	2	.....	1	4
<i>Spring Quarter</i>					
M.&M. 26	Technical Mechanics (Statics)	5	5	.....	.....
Phys. 9	General Physics	5	1	4	2
Aero.E. 3	Aeronautics	3	3	.....	.....
C.E. 17	Surveying	3	.....	1	7
Draw. 29	Drafting	2	.....	.....	6

† For permissible substitute, see page 71.

JUNIOR YEARS

Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
M.&M. 129	Hydraulics	4	3	1	.....
M.&M. 143	Hydraulics Laboratory	1	.....	.....	2
Aero.E. 100	Aerodynamics	3	3	.....	.....
M.E. 30	Steam Engineering	3	3	.....	.....
M.E. 33	Elementary Mechanical Laboratory	2	.....	.....	4
M.E. 17	Machine Shop Practice	3	.....	1	7
	Electives*				
<i>Winter Quarter</i>					
M.&M. 128	Strength of Materials	5	5	.....	.....
M.&M. 141	Materials Testing Laboratory	2	.....	1	3
Aero.E. 101	Aerodynamics	3	3	.....	.....
M.E. 26	Mechanism and Kinematics	3	3	.....	.....
M.E. 31	Thermodynamics	3	2	1	2
	Electives*				
<i>Spring Quarter</i>					
M.&M. 127	Technical Mechanics (Dynamics)	5	5	.....	.....
Aero.E. 83	Stresses in Simple Structures	3	3	.....	.....
Aero.E. 102	Aerodynamics	3	3	.....	.....
Aero.E. 140	Aeronautical Laboratory	2	.....	.....	6
Aero.E. 170	Air Transport	2	2	.....	.....
M.E. 27	Machine Design	3	.....	1	6
	Electives*				

SENIOR YEARS

Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
E.E. 46	Electric Power	3	2	.....	2
M.E. 150	Internal Combustion Engines	3	3	.....	.....
Met. 152	Metallography	3	.....	2	3
Aero.E. 115†	Airplane Stresses	3	2	.....	2
Aero.E. 120	Airplane Design	3	2	.....	3
Aero.E. 140‡	Aeronautical Laboratory	2	.....	.....	6
<i>Winter Quarter</i>					
E.E. 47	Electric Power	3	2	.....	2
M.E. 151†	Advanced Internal Combustion Engines	3	3	.....	.....
M.E. 154†	Design of Airplane Engines	2	.....	.....	6
Aero.E. 121	Airplane Design	4	2	.....	6
Aero.E. 141	Aerodynamics Laboratory	3	1	.....	6
Aero.E. 190	Seminar	1	1	.....	.....
	Electives*				

* For list of elective courses in other colleges, see page 70.

† Any one or two of the following courses: Aero.E. 115, Airplane Stresses, Aero.E. 122, Airplane Design, Aero.E. 160, Airships, and M.E. 151, Advanced Internal Combustion Engines, or M.E. 154, Design of Airplane Engines, but not *both* of these M.E. courses, may be replaced by an equal number of approved elective credits in any of the following fields: aerodynamics, airplane design and stresses, internal combustion engines, and air transport and meteorology; also in business for students taking the five-year combined course with business administration. M.&M. 180 may be substituted for Aero.E. 115 in the above arrangement.

‡ Students who contemplate an extra quarter in residence should arrange their programs for this time from such courses as Aero.E. 159, 160, 164, 165, 170, 173, 174, 175, 190, 191, 193, 194, 195, in order to have the proper sequence of courses.

‡‡ Class of 1938-39 only.

Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Spring Quarter</i>					
E.E. 48	Electric Power	3	2	.....	2
M.E. 158	Aero Engine Testing	2	.....	.....	6
Aero.E. 122†	Airplane Design	3	1	.....	6
Aero.E. 159	Inspection Trip (spring vacation)	1	.....	.....	.....
Aero.E. 160†	Airships	3	2	.....	3
Aero.E. 170‡	Air Transport	2	2	.....	.....
Aero.E. 191	Seminar	1	1	.....	.....
	Electives*				

AGRICULTURAL ENGINEERING

Four-year course leading to the degree of bachelor of agricultural engineering, B.Ag.E., in co-operation with the College of Agriculture, Forestry, and Home Economics.

Requirements for graduation include all prescribed courses with sufficient approved electives to make a total of at least 207 credits. This is an average of $17\frac{1}{4}$ credits per quarter for 12 quarters.

Agricultural engineering activities are usually grouped under the heads of *farm power and machinery*, *farm structures*, and *land reclamation*. There is also need for service in the entire field necessitating general preparation in all three lines.

The farm machinery field covers the selection and management of machinery and equipment best suited to produce good results locally on any given type of farm, the design and construction of such machinery or equipment where it does not yet exist, the improvement of such design to meet special needs, and the adaptation of available types of power to local farm conditions. The farm structures field covers arrangement of the structures on the farmstead for economy, convenience, and comfort, the design and construction of farm buildings and related structures, and the adaptation of available types of building materials to local farm conditions. The land reclamation field covers development of virgin lands suited to agriculture and the improvement of lands already under cultivation through economical clearing operations, and soil conditioning through efficient design and proper installation of drainage and irrigation works and control of soil erosion.

The field, as yet comparatively new and uncrowded, offers many opportunities among which the following are prominent: with manufacturers of farm machinery, equipment, and building materials; as executives, research engineers, publicity and sales managers, and technical field experts; as managers of large farms requiring extensive machinery or equipment; as reclamation engineers with the local, state, and federal governments, and with development companies; as agricultural advisers with power companies in development of rural service; as agricultural engineering editors for farm papers and trade journals; as rural architects and builders; as teachers, investigators, and extension specialists in state agricultural colleges, ex-

* For list of elective courses in other colleges, see page 70.

† Any one or two of the following courses: Aero.E. 115, Airplane Stresses, Aero.E. 122, Airplane Design, Aero.E. 160, Airships, and M.E. 151, Advanced Internal Combustion Engines, or M.E. 154, Design of Airplane Engines, but not *both* of these M.E. courses, may be replaced by an equal number of approved elective credits in any of the following fields: aerodynamics, airplane design and stresses, internal combustion engines, and air transport and meteorology; also in business for students taking the five-year combined course with business administration. M.&M. 180 may be substituted for Aero.E. 115 in the above arrangement.

‡ Class of 1938-39 only.

periment stations, and in the United States Department of Agriculture; as consulting agricultural engineers in general practice.

Students taking the combined five-year course in agricultural engineering and business administration may substitute Botany 1 for Horticulture 6 and may fill all junior and senior elective opportunities in the junior and senior years with required business courses under the direction of the agricultural engineering adviser and with the approval of the School of Business Administration.

For freshman year, see page 29.

SOPHOMORE YEAR

Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
M.&M. 24	Differential Calculus	5	5	.....	.....
Phys. 7	General Physics	5	1	4	2
Ag.E. 19	Elementary Surveying	3	.....	1	6
Ag.E. 91	Seminar	0	.....	1	.....
Agron. 1	General Farm Crops	3	3	.....	.....
Hort. 6	Fruit Growing	3	.....	2	4
<i>Winter Quarter</i>					
M.&M. 25	Integral Calculus	5	5	.....	.....
Phys. 8	General Physics	5	1	4	2
Ag.E. 5	Farm Building Construction	3	.....	1	4
Ag.E. 91	Seminar	0	.....	1	.....
Soils 6	Soils	5	5	.....	.....
<i>Spring Quarter</i>					
M.&M. 84§	Technical Mechanics	5	5	.....	.....
Phys. 9	General Physics	5	1	4	2
Ag.E. 12	Agricultural Machinery	3	.....	2	3
Ag.E. 13	Gas Engines	3	.....	.....	6
Ag.E. 22	Agricultural Machinery Laboratory	1	.....	.....	3
Ag.E. 91	Seminar	0	.....	1	.....

JUNIOR YEAR

<i>Fall Quarter</i>					
M.&M.128	Strength of Materials	5	5	.....	.....
Ag.E. 14	Tractors	3	.....	2	4
Ag.E. 20	Advanced Surveying	3	.....	1	6
Ag.E. 92	Seminar	0	.....	1	.....
Econ. 8	General Economics	3	3	.....	.....
Geol. 5	Engineering Geology	3	.....	3	.....
<i>Winter Quarter</i>					
M.&M. 86§	Hydraulics	2	2	.....	.....
M.&M. 143	Hydraulics Laboratory	1	.....	.....	2
Econ. 9	General Economics	3	3	.....	.....
Ag.Econ. 102	Farm Management: Organization	3	.....	3	.....
Ag.E. 51†	Land Reclamation	5	1	4	.....
or					
Soils 108	Physical Properties of Soils	3	.....	1	6
M.E. 26	Mechanism and Kinematics	3	3	.....	.....
Ag.F. 92	Seminar	0	.....	1	.....

† Given only in alternate years, 1940, 1942, etc.

§ For permissible substitute, see page 71.

Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Spring Quarter</i>					
A.H. 50* or D.H. 52† M.E. 27	Fundamentals of Livestock Production	3	3	.....	.....
Ag.Econ. 103	The Dairy Industry	3	.....	3	.....
Ag.E. 7	Machine Design	3	.....	1	6
Ag.E. 43	Farm Management: Operation	3	.....	3	.....
Ag.E. 72† or C.E. 37	Farm Structures	3	1	1	3
Ag.E. 92	Mechanical Laboratory	3	.....	1	5
	Applied Electricity	3	.....	1	6
	Structural Engineering	3	.....	1	7
	Seminar	1	.....	1	.....

SENIOR YEAR

Fall Quarter

Ag.E. 67	Farm Structures Design	3	.....	1	6
Ag.E. 71	Design and Economics of Agricultural Machinery	3	.....	2	3
Ag.E. 93	Seminar	0	.....	1	.....
C.E. 146	Plain Concrete	3	.....	2	4
	Electives to complete program.				

Winter Quarter

Ag.E. 51† or Soils 108	Land Reclamation	5	1	4	.....
G.E. 101	Physical Properties of Soils	3	.....	1	6
Rhet. 22	Contracts and Specifications	3	.....	3	.....
Ag.E. 37	Public Speaking	3	3	.....	.....
Ag.E. 93	Rural Sanitation	3	.....	3	.....
	Seminar	0	.....	1	.....
	Electives to complete program.				

Spring Quarter

Ag.E. 70	Steam Boilers and Engines	3	.....	3	.....
D.H. 52† or A.H. 50*	The Dairy Industry	3	.....	3	.....
Ag.E. 72† or C.E. 37	Fundamentals of Livestock Production	3	3	.....	.....
G.E. 193	Applied Electricity	3	.....	1	6
Ag.E. 93	Structural Engineering	3	.....	1	7
	Engineering Practice	2	.....	2	.....
	Seminar	1	.....	1	.....
	Electives to complete program.				

RECOMMENDED ELECTIVES§

The following courses are suggested for the guidance of students who wish to elect work along the general lines indicated.

Course No.	Title	Credits
<i>Farm Structures</i>		
Ag.E. 44s	Advanced Drawing	2
Ag.E. 111f,112w,113s	Farm Building Problems, per quarter	3-6
Arch. 57f,58w,59s	Building Materials and Methods, per quarter	2
For. 10w	Farm Woodlots and Windbreaks	3
G.E. 81w	Estimating	3
Hort. 74w	Principles of Landscape Design	3

* Given only in alternate years, 1939, 1941, etc.

† Given only in alternate years, 1940, 1942, etc.

§ Students taking the combined five-year course in agricultural engineering and business administration see statement on page 33.

Course No.	Title	Credits
<i>Farm Power and Machinery</i>		
M.E. 17f,w,s	Machine Shop Practice	3
M.E. 44w,45s	Thermodynamics, per quarter	3
M.E. 121f	Mechanical Engineering Design	2
M.E. 150f,w	Internal Combustion Engines	3
Met. 156w	Metallography	3
Ag.E. 121f,122w,123s	Farm Power and Machinery Problems, per quarter	3-6
Ag.E. 126w	Selection of Farm Equipment	3
E.E. 43f,44w,45s	Electric Power, per quarter	3
<i>Land Reclamation and Development</i>		
Ag.E. 28w	Land Clearing	3
Ag.E. 101f,102w,103s	Advanced Drainage Problems, per quarter	3-6
C.E. 18w	Land Surveying	2
C.E. 161f	Power	4
M.&M. 130f	Open Channel Flow	3
M.&M. 193w	Hydraulic Measurements	3

ARCHITECTURE

The work in Architecture offered by the Institute of Technology includes courses dealing with the history, theory, and practice of architecture and the allied arts of design. It can be taken in accordance with any one of the five following plans:

1. Four-year course leading to the degree of bachelor of arts (B.A.) with a major in architecture, in the College of Science, Literature, and the Arts.
2. Four-year course leading to the degree of bachelor of arts (B.A.) with a major in fine arts, in the College of Science, Literature, and the Arts.

Plans 1 and 2 are intended for students who want to combine with their academic training, whether for cultural or vocational reasons, some study of architecture, drawing, painting, or sculpture. Plan 1 offers an advantageous approach to the five- and six-year professional courses in architecture described below, or to further training in the special fields of community and regional planning, landscape architecture, or decorative and industrial design. For further information see the Bulletin of the College of Science, Literature, and the Arts and the Combined Class Schedule.

3. Four-year course leading to the degree of bachelor of interior architecture (B.Int.Arch.) in the Institute of Technology the first two years of which are spent in the College of Science, Literature, and the Arts and the last two in the Institute of Technology.

Plan 3 is intended for students who wish to specialize in the design and decoration of interiors. For further information see page 39.

4. Five-year course leading to the degree of bachelor of architecture (B.Arch.) in the Institute of Technology.
5. Six-year course leading to the degree of bachelor of arts (B.A.) with a major in architecture, in the College of Science, Literature, and the Arts and the degree of bachelor of architecture (B.Arch.) in the Institute of Technology.

Plans 4 and 5 are intended primarily for students who expect to enter the professional practice of architecture in any of its recognized phases. They provide training which, when supplemented by practical experience in architects' offices, places the student in line for recognition as a practicing architect according to the registration laws of the various states. Secondly, they serve as advantageous approaches to various fields allied to architecture. For further information see page 36 for the five-year course, page 38 for the six-year course.

The work in architecture included in these courses falls into three general divisions. One is theory, presenting the science, philosophy, and history which forms the background of architectural design. The second is practice in drawing and modeling as a means of expression in architectural design. The third and principal division is continued practice in all phases of architectural design itself, including both composition and construction.

As high school preparation for either the five-year or six-year course, higher algebra and solid geometry are essential; physics, chemistry, history, and foreign language are strongly recommended; instrumental and freehand drawing are advantageous.

Whether the student elects the five-year or the six-year course will depend on the time and means at his disposal. He will find it highly desirable to supplement and broaden his technical training by as much general academic work of college grade as he finds possible. College work taken at institution other than Minnesota can be readily adjusted either to Plan 4 or to Plan 5. In any such work college algebra, trigonometry, and analytic geometry must be included as essential prerequisites to certain courses in structural design. Selections from language, history, economics, political science, sociology, physics, and chemistry are recommended. Prospective students should note that it takes normally four years to complete the required work in architectural design, regardless of how much other work they may have to their credit, and should calculate their time accordingly.

FIVE-YEAR COURSE

In addition to the prescribed courses, sufficient approved electives must be taken to complete a total of at least 225 credits.

The following program is that normally followed by students entering from high school. It will naturally be modified and condensed for students with previous college experience. It may also be modified by the student's progress in design and drawing since that is based on achievement, rather than time. The work of the first year is identical with the first year of the major in architecture in the College of Science, Literature, and the Arts and students may transfer from one course to the other at the end of that time without loss of credit toward either degree.

The choice and distribution of elective subjects should be arranged in advance by consultation with the faculty. Their purpose is: (1) to provide as much general education as possible, (2) to provide a certain degree of professional specialization along the line of each student's particular interests.

Course No.	Title	FIRST YEAR*		
		Credits	Rec.	Lect. Lab.
		<i>Fall Quarter</i>		
M.&M. 11	College Algebra	5	5	.....
Engl. 4	Composition	3	3	.....
Arch. DP-I	Drawing and Painting, Grade I	2	.....	..... 4
	Electives†§			

* See statement on page 28 for students entering without chemistry, higher algebra, or solid geometry and those required to take the course in preliminary English.

† For list of elective courses in other colleges, see page 70.

§ Students entering without previous college or professional experience must include Arch. 1-2-3, Introduction to Architecture, 1 cred. per qtr. In addition, foreign language, history, and a physical science are recommended. The normal program will accommodate French 1-2-3 or 4; History 1-2-3; Chemistry 1-2-3, or Chemistry 9-10; Geology 8, or Geography 11, Physics 1-2. Students who have not had physics in high school should take Physics 1-2 in either the first or second year.

Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Winter Quarter</i>					
M.&M. 12	Trigonometry	5	5	.....	.....
Engl. 5	Composition	3	3	.....	.....
Arch. DP-I	Drawing and Painting, Grade I	2	.....	.....	4
	Electives†§				
<i>Spring Quarter</i>					
M.&M. 13	Analytical Geometry	5	5	.....	.....
Engl. 6	Composition	3	3	.....	.....
Arch. DP-I	Drawing and Painting, Grade I	2	.....	.....	4
	Electives†§				
SECOND YEAR					
<i>Fall Quarter</i>					
M.&M. 91	Calculus for Architects	4	4	.....	.....
Arch. 4	Graphic Representation	2	.....	1	3
Arch. DP-II	Drawing and Painting, Grade II	2	.....	.....	4
Arch. AD-I	Architectural Design, Grade I	5	.....	.....	15
	Electives†				
<i>Winter Quarter</i>					
M.&M. 92	Mechanics for Architects	4	4	.....	.....
Arch. 5	Graphic Representation	2	.....	1	3
Arch. DP-II	Drawing and Painting, Grade II	2	.....	.....	4
Arch. AD-I	Architectural Design, Grade I	5	.....	.....	15
	Electives†				
<i>Spring Quarter</i>					
M.&M. 93	Strength of Materials for Architects	4	4	.....	.....
Arch. 6	Graphic Representation	2	.....	1	3
Arch. DP-II	Drawing and Painting, Grade II	2	.....	.....	4
Arch. AD-I	Architectural Design, Grade I	5	.....	.....	15
	Electives†				
THIRD YEAR					
<i>Fall Quarter</i>					
Arch. 51	History of Architecture	2	.....	2	.....
Arch. 57	Building Materials and Methods	2	.....	2	.....
Arch. AD-II	Architectural Design, Grade II	6	.....	.....	18
C.E. 38	Structural Engineering	3	.....	3	.....
	Electives†				
<i>Winter Quarter</i>					
Arch. 52	History of Architecture	2	.....	2	.....
Arch. 58	Building Materials and Methods	2	.....	2	.....
Arch. AD-II	Architectural Design, Grade II	6	.....	.....	18
C.E. 39	Structural Engineering	3	.....	3	.....
	Electives†				
<i>Spring Quarter</i>					
Arch. 53	History of Architecture	2	.....	2	.....
Arch. 59	Building Materials and Methods	2	.....	2	.....
Arch. AD-II	Architectural Design, Grade II	6	.....	.....	18
C.E. 41	Structural Engineering	3	.....	3	.....
	Electives†				

† For list of elective courses in other colleges, see page 70.

§ Students entering without previous college or professional experience must include Arch. 1-2-3, Introduction to Architecture, 1 cred. per qtr. In addition, foreign language, history, and a physical science are recommended. The normal program will accommodate French 1-2-3 or 4; History 1-2-3; Chemistry 1-2-3, or Chemistry 9-10; Geology 8, or Geography 11, Physics 1-2. Students who have not had physics in high school should take Physics 1-2 in either the first or second year.

INSTITUTE OF TECHNOLOGY

FOURTH YEAR				
Course No.	Title	Credits	Rec.	Lect. Lab.
<i>Fall Quarter</i>				
Arch. 54	History of Architecture	2	.....	2
Arch. 101	Building Materials and Methods	2	.....	2
Arch. AD-III	Architectural Design, Grade III	9	.....	27
E.E. 40	Electrical Wiring and Equipment	2	.....	2
<i>Winter Quarter</i>				
Arch. 55	History of Architecture	2	.....	2
Arch. 102	Building Materials and Methods	2	.....	2
Arch. AD-III	Architectural Design, Grade III	9	.....	27
C.E. 171	Sanitary Engineering	2	.....	2
<i>Spring Quarter</i>				
Arch. 56	History of Architecture	2	.....	2
Arch. 103	Building Materials and Methods	2	.....	2
Arch. AD-III	Architectural Design, Grade III	9	.....	27
M.E. 164	Heating and Ventilation	2	.....	2

FIFTH YEAR				
Course No.	Title	Credits	Rec.	Lect. Lab.
<i>Fall Quarter</i>				
Arch. AD-III	Architectural Design, Grade III	9	.....	27
	Electives†			
<i>Winter Quarter</i>				
Arch. AD-III	Architectural Design, Grade III	9	.....	27
Arch. 105	Professional Practice	2	.....	2
	Electives†			
<i>Spring Quarter</i>				
Arch. AD-IV	Architectural Thesis	12	.....	36
	Electives†			

ARCHITECTURAL ELECTIVES

In addition to the courses listed above as required for the bachelor of architecture degree, the following elective courses are offered by the School of Architecture:

Course No.	Title	Credits
Arch. 1f-2w-3s	Introduction to Architecture, per quarter	1
Arch. 104f	Housing	3
Arch. 106s	Housing	2
Arch. 107f-108w-109s	Furniture and Decoration, per quarter	2
Arch. ID-1f,w,s	Interior Design	24
Arch. DP-III f,w,s	Drawing and Painting, Grade III	6
Arch. DP-IV f,w,s	Drawing and Painting, Grade IV	6
Arch. M-1f,w,s	Modeling, Grade I	6
Arch. M-1af,w,s	Modeling for Architects	2
Arch. M-II f,w,s	Modeling, Grade II	6

For elective courses offered in other colleges and departments, see page 70 of this bulletin, and the Combined Class Schedule.

SIX-YEAR COURSE IN ARTS AND ARCHITECTURE

During the first four years of this course the student is registered in the College of Science, Literature, and the Arts and follows the plan of study prescribed for a bachelor of arts degree with a major in architecture.

† For list of elective courses in other colleges, see page 70.

The following courses should be completed during this period:
 Required for the major sequence:

Course No.	Title	Credits
Arch. 1-2-3	Introduction to Architecture	3
Arch. 4-5-6	Graphic Representation	6
Arch. DP-I	Drawing and Painting, Grade I	6
Arch. DP-II	Drawing and Painting, Grade II	6
Arch. 51-52-53	History of Architecture	6
Arch. 54-55-56	History of Architecture	6
Arch. 57-58-59	Building Materials and Methods	6
Arch. AD-I	Architectural Design, Grade I	15
Arch. AD-II	Architectural Design, Grade II	18

Additional requirements:

Math. 7-6-30	College Algebra, Trigonometry, Analytic Geometry	15
M.&M. 91-92-93	Calculus, Mechanics, Strength of Materials	12
C.E. 38-39-41	Structural Engineering	9
Total		108

During the last two years of the course, or upon completion of the requirements for the bachelor of arts degree, the student is registered in the School of Architecture of the Institute of Technology to complete the requirements for a bachelor of architecture degree as prescribed for the five-year course on page 36.

See also the Junior and Senior College requirements as given in the Bulletin of the College of Science, Literature, and the Arts; and Architecture, in the Combined Class Schedule.

INTERIOR ARCHITECTURE

Four-year course leading to the degree of bachelor of interior architecture, B.Int.Arch.

This course requires normally four years for its completion, the first two years in the College of Science, Literature, and the Arts, and the last two years in the Institute of Technology, including 192 credits.

For the freshman and sophomore years, students register in the College of Science, Literature, and the Arts and complete the requirements of the Junior College for the major in architecture, including the following courses:

Arch. 1-2-3	3
Arch. 4-5-6	6
Arch. DP-I	6
Arch. D-II	6
Arch. AD-I	15

Having satisfied the requirements of the Junior College, students transfer to the Institute of Technology and pursue the following curriculum, amounting to 102 credits for the remaining two years:

JUNIOR YEAR				
Course No.	Title	Credits Rec.	Lect.	Lab.
<i>Fall Quarter</i>				
Arch. 51	History of Architecture	2	2	.....
Arch. AD-II	Architectural Design, Grade II	6	.....	18
Arch. 57	Building Materials and Methods	2	2	.....
Arch. 107	Furniture and Decoration	2	2	.....
	Non-technical electives	5		

INSTITUTE OF TECHNOLOGY

Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Winter Quarter</i>					
Arch. 52	History of Architecture	2	.....	2	.....
Arch. AD-II	Architectural Design, Grade II	6	.....	.....	18
Arch. 108	Building Materials and Methods	2	.....	2	.....
Arch. 58	Furniture and Decoration	2	.....	2	.....
M.E. 3	Wood-Finishing	2	.....	.....	6
	Non-technical electives	3	.....	.....	.....

<i>Spring Quarter</i>					
Arch. 53	History of Architecture	2	.....	2	.....
Arch. AD-II	Architectural Design, Grade II	6	.....	.....	18
Arch. 59	Building Materials and Methods	2	.....	2	.....
Arch. 109	Furniture and Decoration	2	.....	2	.....
	Non-technical electives	5	.....	.....	.....

SENIOR YEAR

<i>Fall Quarter</i>					
Arch. 54	History of Architecture	2	.....	2	.....
Arch. DP-III	Drawing and Painting, Grade III	2	.....	.....	4
Arch. ID-I	Interior Design	8	.....	.....	24
	Non-technical electives	5	.....	.....	.....

<i>Winter Quarter</i>					
Arch. 55	History of Architecture	2	.....	2	.....
Arch. DP-III	Drawing and Painting, Grade III	2	.....	.....	4
Arch. ID-I	Interior Design	8	.....	.....	24
	Non-technical electives	5	.....	.....	.....

<i>Spring Quarter</i>					
Arch. 56	History of Architecture	2	.....	2	.....
Arch. DP-III	Drawing and Painting, Grade III	2	.....	.....	4
Arch. ID-I	Interior Design	8	.....	.....	24
	Non-technical electives	5	.....	.....	.....

CHEMISTRY AND CHEMICAL ENGINEERING

FRESHMAN AND SOPHOMORE YEARS*

FRESHMAN YEAR

Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
M.&M. 11	College Algebra	5	5	.....	.....
Inorg.Chem. 9	General Inorganic Chemistry	5	1	3	5
Engl. 4	Composition	3	3	.....	.....
Draw. 4†	Drawing and Descriptive Geometry	2	.....	.....	6
M.E. 8, 11, or 15§	Shop Practice	2	.....	1	4

<i>Winter Quarter</i>					
M.&M. 12	Trigonometry	5	5	.....	.....
Inorg.Chem. 10	General Inorganic Chemistry	5	1	3	5
Engl. 5	Composition	3	3	.....	.....
Draw. 5†	Drawing and Descriptive Geometry	2	.....	.....	6
M.E. 8, 11, or 15§	Shop Practice	2	.....	1	4

* See statement on page 28 for students entering without chemistry, higher algebra, or solid geometry and those required to take the course in preliminary English.

† For permissible substitute, see page 71.

§ Required of chemical engineers only.

Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Spring Quarter</i>					
M.&M. 13	Analytical Geometry	5	5	.....	.....
Inorg.Chem. 12	Qualitative Analysis	5	2	1	6
Engl. 6	Composition	3	3	.....	.....
Draw. 6†	Drawing and Descriptive Geometry	2	.....	.....	6
M.E. 8, 11, or 15§	Shop Practice	2	.....	1	4
G.E. 13¶	Orientation	0	.....	1	.....

SOPHOMORE YEAR

Fall Quarter

M.&M. 24	Differential Calculus	5	5	.....	.....
Inorg.Chem. 13	Qualitative Analysis	5	2	.....	9
Phys. 7	General Physics	5	1	4	2
German 24§	Chemical German	4	4	.....	.....

Winter Quarter

M.&M. 25	Integral Calculus	5	5	.....	.....
Anal. Chem. 1	Quantitative Analysis	5	1	1	10
Phys. 8	General Physics	5	1	4	2
German 25§	Chemical German	4	4	.....	.....

Spring Quarter (Chemistry)

M.&M. 84†	Technical Mechanics	5	5	.....	.....
Anal.Chem. 2	Quantitative Analysis	5	1	1	10
Phys. 9	General Physics	5	1	4	2
German 26§	Chemical German	4	4	.....	.....

Spring Quarter (Chemical Engineering)

M.&M. 84†	Technical Mechanics	5	5	.....	.....
Anal.Chem. 2	Quantitative Analysis	5	1	1	10
Chem.E. 80	Technical Engineering Materials	1	.....	2	.....
Phys. 9	General Physics	5	1	4	2
German 26§	Chemical German	4	4	.....	.....

CHEMISTRY

Four-year course leading to the degree of bachelor of chemistry, B.Chem.

In addition to the prescribed courses, sufficient approved electives must be taken to complete a total of at least 207 credits.

This professional course in Chemistry is designed to provide thoro training in the fundamentals of chemistry and related subjects. It serves as a basis for further specialization and a foundation for graduate work. Its graduates secure positions in practical chemistry, research, and teaching, in chemical industries, the government service, in colleges and laboratories, etc.

For freshman year, see page 40.

† For permissible substitute, see page 71.

§ Students who have had two years of high school German or one year of college German may take 27-28-29, three credits per quarter or 25-26, four credits per quarter, instead of 24-25-26, four credits per quarter, subject to a placement test.

¶ Women take one of the following courses in place of G.E. 13: Phys.Ed. for Women 1f, 2w, 3s, 4f, 5w, or 6s.

JUNIOR YEAR

Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
Org.Chem. 51	Organic Chemistry	5	0	5	6
Phys.Chem. 101	Physical Chemistry	5	1	3	6
Phys. 33	Optics	3	1	3	.....
Phys. 34	Optics Laboratory	1	.....	.....	2
	Electives*				
<i>Winter Quarter</i>					
Org.Chem. 52	Organic Chemistry	5	0	5	6
Phys.Chem. 102	Physical Chemistry	5	1	3	6
Ch.E. 131	Industrial Inorganic Chemistry	4	1	4	.....
	Electives*				
<i>Spring Quarter</i>					
Org.Chem. 153	Organic Chemistry	5	0	5	6
Phys.Chem. 103	Physical Chemistry	5	1	3	6
Ch.E. 132	Industrial Organic Chemistry	4	1	4	.....
	Electives*				

SENIOR YEAR (See note below)

<i>Fall Quarter</i>					
Inorg.Chem. 103	Advanced Inorganic Chemistry	3	.....	3	.....
Anal.Chem. 131	Applications of Indicators	3	.....	2	5
Phys.Chem. 161§	Nuclear Chemistry and Radioactivity	3	.....	3	.....
	Electives*				
<i>Winter Quarter</i>					
Inorg.Chem. 104	Advanced Inorganic Chemistry	3	.....	3	.....
Anal.Chem. 132†	Electrometric Measurements and Titrations	3	.....	2	5
Phys.Chem. 162§	Nuclear Chemistry and Radioactivity	3	.....	3	.....
	Electives*				
<i>Spring Quarter</i>					
Inorg.Chem. 105	Advanced Inorganic Chemistry	3	.....	3	.....
	Electives*				

NOTE.—Near the close of the junior year, each student will choose a major adviser from the following list. In consultation with the adviser he will plan a program of work for the entire senior year, based normally upon concentration of electives around a chosen field of chemistry.

LIST OF ADVISERS FOR SENIORS

Inorganic Chemistry: Professors Sneed, Cohen, Barber, Heisig, Klug, Pervier.
 Analytical Chemistry: Professors Kolthoff, Geiger, Sarver.
 Organic Chemistry: Professors Smith, Koelsch, Lauer.
 Physical Chemistry: Professors Lind, MacDougall, Glockler, Reyerson, Livingston, Hull.
 Chemical Engineering: Professors Mann, Montillon, Montonna, Rogers, Stoppel, Grove.

* For list of elective courses in other colleges, see page 70.

† For permissible substitute, see page 71.

§ In place of Phys. Chem. 161-162, students may substitute six credits in Physical Chemistry courses to which Phys. Chem. 103 is a prerequisite.

SPECIALIZATION IN BACTERIOLOGY, BIOCHEMISTRY, AND GEOLOGY

For the benefit of students in chemistry who may desire to specialize in related fields, minor groups of electives have been arranged in bacteriology, biochemistry, and geology which may be taken in the junior and senior years in addition to the required courses of the regular chemistry curriculum shown above. The completion of one of these groups will qualify the chemistry graduate to enter upon graduate work towards the Doctor's degree in that department, thus providing an exceptionally strong foundation in chemistry for specialization in the chosen field.

MINOR IN BACTERIOLOGY

JUNIOR YEAR

Four credits of botany or zoology are prerequisite to Bacteriology 41. Botany 1f, 4 credits, or Zoology 14f-15w, 6 credits, should be taken in the junior year to satisfy this requirement. By special arrangement it may be possible to take Bact. 41, 5 credits, in the winter or spring quarter of the junior year, if desired.

		SENIOR YEAR		
Course No.	Title	Credits	Rec.	Lect. Lab.
<i>Fall Quarter</i>				
Bact. 41	General Bacteriology	5	.....	3 6
Bact. 121	Physiology of Bacteria	3	.....	3
<i>Winter Quarter</i>				
Bact. 122	Physiology of Bacteria	3	.....	3
<i>Spring Quarter</i>				
Bact. 123	Applied Bacteriology	3	.....	3

MINOR IN BIOCHEMISTRY

JUNIOR YEAR

<i>Fall Quarter</i>				
Zool. 14†	General Zoology	3	.....	2 4
<i>Winter Quarter</i>				
Zool. 15†	General Zoology	3	.....	2 4

SENIOR YEAR

<i>Fall Quarter</i>				
Ag.Biochem. 113	Biochemical Laboratory Methods	2	.....	..... 6
Ag.Biochem. 119	Colloids	3	.....	3
Bact. 41	General Bacteriology	5	.....	3 6
<i>Winter Quarter</i>				
Ag.Biochem. 114	Biochemical Laboratory Methods	2	.....	..... 6
<i>Spring Quarter</i>				
Ag.Biochem. 115	Biochemical Laboratory Methods	2	.....	..... 6
Ag.Biochem. 123	Enzymes	3	.....	3

† Nine credits of Botany may be substituted for Zoology 14-15.

MINOR IN GEOLOGY

JUNIOR YEAR

Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
Min. 23	Elements of Mineralogy	4	1	2	4

Winter Quarter

Min. 24	Elements of Mineralogy	4	1	2	4
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SENIOR YEAR

Fall Quarter

Geol. 1	General Geology	3	1	3
Geol. A	General Geology Laboratory	2	4
Geol. 121	Crystallography	3	.....	3	2

Winter Quarter

Geol. 3	General Geology (Dynamic and Economic)	3	1	3	.....
Geol. C	General Geology Laboratory	2	.....	.....	4

CHEMICAL ENGINEERING

Four-year course leading to the degree of bachelor of chemical engineering, B.Ch.E.

In addition to the prescribed courses, sufficient approved electives must be taken to complete a total of 218 credits.

Eight of the additional credits above the course in Chemistry are made up of two credits for the inspection trip in the spring vacation of the senior year and six credits for the two courses in Chemical Manufacture in the Summer Session following the junior year, the balance by the courses in shop. Thus the term requirements of the two courses are approximately equal.

Chemical engineering deals with the unit operations, such as crushing, grinding, sifting, mixing, filtration, evaporation, drying, distillation, and crystallization that are so vital in making any industry based on a chemical transformation of matter a commercial success. The chemist uses these operations in the laboratory but in order to apply them to large scale industrial processes he must have a thoro understanding of the fundamental physicochemical and engineering principles on which they are based. The study of such principles constitutes the applied science of chemical engineering. For this purpose the chemical engineer must be thoro trained in the various branches of chemistry, physics, and mathematics and have a good training in the fundamentals of mechanical and electrical engineering so he can design, construct, and successfully operate a plant using these unit operations.

The chemical engineer is primarily a producer. It is his province to develop a process from the laboratory stage through semi-works equipment to the production stage which uses engineering materials for the manufacture of unit process equipment in accordance with fundamental chemical engineering principles.

As many industries are based on some chemical operation, the chemical engineer is much in demand. He may be engaged in the manufacture of inorganic products—the mineral acids, alkalies, ammonia, paint pigments, fertilizers; in the organic industries—dyes, explosives, lacquers, solvents, medicinals; in the manufacture of gases—coal gas, carbureted blue gas, hydrogen, acetylene, helium; in the electrochemical industries such as the manufacture of graphite, calcium carbide, carborundum and other abrasives, wet and dry batteries, electroplating; in the metallurgical industries; and even in the food industries such as the manufacture of

sugar, flour, salt, and starch. There are many others such as leather, paper, textiles, soaps, petroleum, glass, and cement.

In these industries the chemical engineer does investigational work, development work, design of equipment, and plant operation. Some enter the field of sales engineering and technical writing.

Students taking the five-year combined course in chemical engineering and business administration may substitute business courses for Physics 33, M.&M. 86, 143, M.E. 28, and Ch.E. 80.

For freshman and sophomore years see pages 40 and 41.

JUNIOR YEAR

Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
Chem.E. 101	Unit Processes	3	.....	5	.....
Chem.E. 105	Gas and Fuel Analysis	3	1	1	4
Org.Chem. 51	Organic Chemistry	5	0	5	6
M.&M. 85†	Strength of Materials	3	3	.....	.....
M.&M. 87†	Materials Testing Laboratory	1	.....	.....	2
Phys. 33	Optics	3	1	3	.....
<i>Winter Quarter</i>					
Chem.E. 106	Petroleum and Petroleum Products	3	1	1	4
Chem.E. 131	Industrial Inorganic Chemistry	4	1	4	.....
Org.Chem. 52	Organic Chemistry	5	0	5	6
M.&M. 86†	Hydraulics	2	2	.....	.....
M.&M. 143	Hydraulics Laboratory	1	.....	.....	2
M.E. 38	Heat Engines	3	.....	3	.....
<i>Spring Quarter</i>					
Chem.E. 102	Unit Processes	3	3	.....	.....
Chem.E. 132	Industrial Organic Chemistry	4	1	4	.....
Chem.E. 150	Unit Operations Laboratory	1	.....	.....	3
Org.Chem. 153	Organic Chemistry	5	0	5	6
M.E. 28	Machine Design	3	.....	1	6
M.E. 39	Heat Engines	3	.....	2	4

Summer Session

Summer practice consisting of Ch.E. 151f,su-152w,su, Chemical Manufacture, 6 cred., will be taken by students in Chemical Engineering in the regular Summer Session between their junior and senior years. It is required for the degree of bachelor of chemical engineering.

SENIOR YEAR

<i>Fall Quarter</i>					
Chem.E. 103	Unit Operations	3	3	.....	.....
Phys.Chem. 101	Physical Chemistry	5	1	3	6
E.E. 43	Electric Power	3	.....	2	2
Met. 160	Metallography	3	.....	2	3
	Electives*				
<i>Winter Quarter</i>					
Chem.E. 104	Unit Operations	3	3	.....	.....
Chem.E. 121	Chemical Engineering Economics	3	1	2	.....
Phys.Chem. 102	Physical Chemistry	5	1	3	6
E.E. 44	Electric Power	3	.....	2	2
	Electives*				

* For list of elective courses in other colleges, see page 70.

† For permissible substitute, see page 71.

Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Spring Quarter</i>					
Chem.E. 117	Chemical Engineering Equipment Design	3	.....	1	6
Chem.E. 187	Inspection Trip, spring vacation	2	.....	.....	.....
Phys.Chem. 103	Physical Chemistry	5	1	3	6
E.E. 45	Electric Power	3	.....	2	2
	Electives*				

CIVIL ENGINEERING

Two four-year courses are offered: Civil Engineering I and Civil Engineering II (Public Service Option).

CIVIL ENGINEERING I

In addition to the prescribed courses, sufficient electives must be taken to complete a total of at least 207 credits for graduation. This is an average of 17 credits per quarter.

The principal aim of the curriculum in civil engineering is to present to the student an opportunity to become familiar with the methods of science, so that in his attack upon any professional problem he may employ his abilities with economy and secure dependable conclusions. A secondary but important object of the course is to train the student in technique, so that at graduation he may be an economic asset to his employer.

The technique of surveying and platting, drawing, and certain laboratory procedures is taught throughout the course. Typical problems of railroad, highway, hydraulic, structural, and municipal engineering occupy the greater part of the last two years. In the junior year, there is a course of lectures and conferences on the relations of engineering projects to business and to public affairs. Elective courses are available in each of the three upper years; these offer a wide range of choice to the student who desires to extend his range of interests to those fields of knowledge and action related to civil engineering, but not strictly included therein.

For freshman year, see page 29.

SOPHOMORE YEAR

Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
M.&M. 24	Differential Calculus	5	5	.....	.....
Phys. 7	General Physics	5	1	4	2
Draw. 21	Structural Detailing	2	.....	.....	6
C.E. 11	Surveying	3	1	.....	7
	Electives*				
<i>Winter Quarter</i>					
M.&M. 25	Integral Calculus	5	5	.....	.....
Phys. 8	General Physics	5	1	4	2
Draw. 22	Structural Detailing	2	.....	.....	6
C.E. 12	Surveying	3	1	.....	7
	Electives*				
<i>Spring Quarter</i>					
M.&M. 26	Technical Mechanics (Statics)	5	5	.....	.....
Phys. 9	General Physics	5	1	4	2
Draw. 23	Structural Detailing	2	.....	.....	6
C.E. 13	Surveying	3	1	.....	7
	Electives*				

* For list of elective courses in other colleges, see page 70.

JUNIOR YEAR

Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
M.&M. 128	Strength of Materials	5	5	.....	.....
M.&M. 141	Materials Laboratory	2	.....	1	2
C.E. 14	Surveying	3	.....	.....	8
C.E. 31	Stresses in Structures	2	.....	2	2
C.E. 51	Highways and Pavements	3	.....	2	3
	Electives*				
<i>Winter Quarter</i>					
M.&M. 129	Hydraulics	4	3	1	.....
M.&M. 143	Hydraulics Laboratory	1	.....	.....	2
C.E. 15	Surveying	2	.....	4	.....
C.E. 21	Railway Engineering	2	1	.....	4
C.E. 32	Stresses in Structures	3	.....	2	4
C.E. 52	Highways and Pavements	3	.....	1	6
	Electives*				
<i>Spring Quarter</i>					
M.&M. 127	Technical Mechanics (Dynamics)	5	5	.....	.....
C.E. 16	Surveying	2	.....	4	.....
C.E. 22	Railway Engineering	2	1	.....	4
C.E. 33	Elementary Structural Design	4	.....	2	6
C.E. 53	Civil Engineering Practice	3	1	2	.....
	Electives*				

Summer Camp

C.E. 23 Summer camp is held in the vacation preceding the senior year for 6 weeks beginning about the middle of August. Nine credits. Required of all students taking the courses in Civil Engineering. Fee, \$25.

SENIOR YEAR

Fall Quarter

C.E. 121	Railway Engineering	3	.....	1	6
C.E. 134	Statically Indeterminate Structures	3	2	.....	2
C.E. 141	Reinforced Concrete	3	2	.....	2
C.E. 161	Power	4	.....	2	6
C.E. 146	Plain Concrete	3	.....	2	4
or					
C.E. 137†	Structural Laboratory	2	.....	1	3
	Electives*				

Winter Quarter

C.E. 131	Bridge Analysis	2	.....	1	3
C.E. 142	Reinforced Concrete Design	3	2	.....	2
C.E. 162	Water Supply and Sewerage	3	.....	2	4
C.E. 109	Cadastral Surveying	2	.....	2	.....
or					
C.E. 124	Transportation	3	3	.....	.....
or					
C.E. 147	Foundations	2	2	.....	.....
or					
C.E. 156	Highway Transport	3	.....	3	.....
M.E. 42	Power	4	2	2	.....
	Electives*				

* For list of elective courses in other colleges, see page 70.

† C.E. 137 limited to 20 students.

Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Spring Quarter</i>					
C.E. 132	Bridge Design	2	.....	1	3
C.E. 163	Water Supply and Sewerage	3	.....	2	5
C.E. 146	Plain Concrete	3	.....	2	4
or					
C.E. 137†	Structural Laboratory	2	.....	1	3
E.E. 42	Power	3	3	.....	.....
G.E. 101	Contracts and Specifications	3	.....	3	.....
	Electives*				

CIVIL ENGINEERING II (PUBLIC SERVICE OPTION)

The purpose of this curriculum is to present civil engineering as a part of the larger undertakings of social economy. All technical engineering practice exists in an environment of governmental or industrial control; this option places emphasis on the external relationships of engineering to these controlling forces as well as on its internal techniques. Graduates will be eligible candidates for graduate fellowships offered in public service and public health engineering.

The freshman year is identical with that of other engineering curricula. The mathematics and science courses common to all engineering courses as well as the elements of civil engineering are required subjects. The electives provided permit the student to take advanced work in surveying or structural engineering or highway engineering or advanced work in physical sciences, political science, public health, or business administration.

Applications for admission must be approved by the Department of Civil Engineering.

For freshman year, see page 29.

SOPHOMORE YEAR

Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
M.&M. 24	Differential Calculus	5	5	.....	.....
Phys. 7	General Physics	5	1	4	2
C.E. 11	Surveying	3	1	.....	7
Org.Chem. 54	Elementary Organic Chemistry	3	1	3	.....
Econ. 8	General Economics	3	3	.....	.....
<i>Winter Quarter</i>					
M.&M. 25	Integral Calculus	5	5	.....	.....
Phys. 8	General Physics	5	1	4	2
C.E. 12	Surveying	3	1	.....	7
Org.Chem. 55	Elementary Organic Chemistry	3	1	3	.....
Econ. 9	General Economics	3	3	.....	.....
<i>Spring Quarter</i>					
M.&M. 26	Technical Mechanics (Statics)	5	5	.....	.....
Phys. 9	General Physics	5	1	4	2
C.E. 13	Surveying	3	1	.....	7
Anal.Chem. 7	Quantitative Analysis	4	1	1	8
Econ. 28	Business Law	3	3	.....	.....

* For list of elective courses in other colleges, see page 70.

† C.E. 137 limited to 20 students.

JUNIOR YEAR

Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
M.&M. 128	Strength of Materials	5	5	.....	.....
M.&M. 141	Materials Laboratory	2	.....	1	2
C.E. 31	Stresses in Structures	2	.....	2	2
C.E. 51	Highways and Pavements	3	.....	2	3
Econ. 29	Principles of Accounting	3	3	.....	.....
Pol.Sci. 1	American Government and Politics	3	3	.....	.....

Winter Quarter

M.&M. 129	Hydraulics	4	3	1	.....
M.&M. 143	Hydraulics Laboratory	1	.....	.....	2
C.E. 32	Stresses in Structures	3	.....	2	4
B.A. 58	Elements of Public Finance	3	3	.....	.....
Pol.Sci. 2	American Government and Politics	3	3	.....	.....
Sp. 1	Fundamentals of Speech	3	3	.....	.....

Spring Quarter

M.&M. 127	Technical Mechanics (Dynamics)	5	5	.....	.....
C.E. 33	Elementary Structural Design	4	.....	2	6
Econ. 161	Labor Problems and Trade Unionism	3	3	.....	.....
Pol.Sci. 3	American Government and Politics	3	3	.....	.....

SENIOR YEAR

Fall Quarter

C.E. 141	Reinforced Concrete	3	2	.....	2
C.E. 146	Plain Concrete	3	.....	2	4
C.E. 161	Power	4	.....	2	6
P.M.&P.H. 53	Elements of Preventive Medicine	3	3	.....	.....
	Electives				

Winter Quarter

C.E. 162	Water Supply and Sewerage	3	.....	2	4
Bact. 41	General Bacteriology	5	.....	4	8
Econ. 167	Personnel Administration	3	3	.....	.....
M.E. 42	Power	4	2	2	.....
	Electives				

Spring Quarter

C.E. 163	Water Supply and Sewerage	3	.....	2	5
C.E. 165	Public Health Engineering	3	.....	3	.....
E.E. 42	Power	3	3	.....	.....
	Electives				

Three groups of electives are suggested:

- A. Sciences and Mathematics
 - Chemistry
 - Physics
 - Geology
 - Mathematics
- B. Social Sciences and Language
 - Economics and Business
 - Political Science
 - Public Speaking
 - English
 - Modern Language

- C. Engineering
 - Surveying
 - Highway Engineering
 - Railway Engineering
 - Structural Engineering
 - Metallography

ELECTRICAL ENGINEERING

Four-year course leading to the degree of bachelor of electrical engineering, B.E.E.

In addition to the prescribed courses, sufficient electives must be taken to complete a total of at least 207 credits for graduation.

The course in Electrical Engineering is designed to fit the student for a position of responsibility in the electrical field. This work is based upon the principles of electricity and magnetism contained in the prescribed courses in general physics and upon the principles of mathematics. In the senior year, specialized courses may be selected in the field of electric power generation, transmission, and utilization, in telephone and radio communication or in illumination.

The main laboratory of the department is well equipped for preliminary training in the operation of electrical machinery and for advanced research problems in this field. The communication laboratories contain, besides the general equipment for study of circuits and equipment, a complete commercial radio broadcasting station and an experimental high frequency, short wave station.

Graduate courses in this department, as well as in physics and mathematics, are available for those with exceptional ability who desire training beyond the usual four-year undergraduate curriculum.

Students taking the five-year combined course with business administration may substitute business courses for Draw. 26, M.&M. 141, M.E. 12, 16, and 26, Phys. 144, and E.E. 132, 134, and 136. In addition they are required to take Courses E.E. 141, 142, and G.E. 111.

For freshman year, see page 29.

SOPHOMORE YEAR

Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
M.&M. 24	Differential Calculus	5	5	.....	.....
Phys. 7	General Physics	5	1	4	2
M.E. 12	Forging, Heat Treating, and Welding	2	.....	1	4
E.E. 11	Elements of Electrical Engineering	3	2	1	.....
	Electives*				
<i>Winter Quarter</i>					
M.&M. 25	Integral Calculus	5	5	.....	.....
Phys. 8	General Physics	5	1	4	2
Draw. 26†	Drafting	2	.....	.....	6
E.E. 13	Elements of Electrical Engineering	3	2	1	.....
E.E. 14	Elements of Electrical Engineering Laboratory	1	.....	.....	2
	Electives*				
<i>Spring Quarter</i>					
M.&M. 26	Technical Mechanics (Statics)	5	5	.....	.....
Phys. 9	General Physics	5	1	4	2
E.E. 15	Elements of Electrical Engineering	3	2	1	.....
E.E. 16	Elements of Electrical Engineering Laboratory	1	.....	.....	2
M.E. 16	Machine Shop Practice	2	.....	1	4
	Electives*				

* For list of elective courses in other colleges, see page 70.

† For permissible substitute, see page 71.

JUNIOR YEAR§					
Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
M.&M. 129	Hydraulics	4	3	1	.....
M.&M. 143	Hydraulics Laboratory	1	.....	.....	2
E.E. 111	Electrical Engineering	5	5	.....	.....
E.E. 112	Electrical Engineering Laboratory	2	.....	.....	4
Phys. 144	Electrical Measurements	3	1	1	4
	Electives*				
<i>Winter Quarter</i>					
M.&M. 127	Technical Mechanics (Dynamics)	5	5	.....	.....
E.E. 113	Electrical Engineering	3	3	.....	.....
E.E. 114	Electrical Engineering Laboratory	1	.....	.....	2
E.E. 117	Engineering Electronics	3	2	.....	2
M.E. 26	Mechanism and Kinematics	3	3	.....	.....
	Electives*				
<i>Spring Quarter</i>					
M.&M. 128	Strength of Materials	5	5	.....	.....
M.&M. 141	Materials Laboratory	2	.....	1	2
E.E. 115	Electrical Engineering	3	3	.....	.....
E.E. 116	Electrical Engineering Laboratory	1	.....	.....	2
E.E. 118	Engineering Electronics	3	2	.....	2
	Electives*				
SENIOR YEAR					
POWER OPTION					
<i>Fall Quarter</i>					
E.E. 121	Electrical Engineering	3	3	.....	.....
E.E. 122	Electrical Engineering Laboratory	2	.....	.....	4
E.E. 132	Electrical Design†	2	2	.....	.....
M.E. 40	Heat Engines†	3	2	.....	3
	Electives*				
<i>Winter Quarter</i>					
E.E. 123	Electrical Engineering	3	3	.....	.....
E.E. 124	Electrical Engineering Laboratory	2	.....	.....	4
E.E. 134	Electrical Design†	2	2	.....	.....
M.E. 41	Heat Engines†	3	2	.....	3
	Electives*				
<i>Spring Quarter</i>					
E.E. 125	Electrical Engineering	3	3	.....	.....
E.E. 126	Electrical Engineering Laboratory	2	.....	.....	4
E.E. 136	Electrical Design†|| .....	2	2	.....	.....
M.E. 55	Internal Combustion Engines†	3	2	.....	3
	Electives*				

* For list of elective courses in other colleges, see page 70.

† Students specializing in chemistry, mathematics, or physics may substitute electives in that department for courses E.E. 132, 134, 136 and M.E. 40, 41, and 55. Such specialization requires at least 18 credits of elective work in chemistry, physics, or mathematics.

§ Students expecting to elect the communication option in the senior year must take E.E. 64-65-66, Elements of Communication, in the junior year.

|| Students specializing in business may substitute an approved elective in that department for Course E.E. 136.

COMMUNICATION OPTIONS§

Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
E.E. 121	Electrical Engineering	3	3	.....	.....
E.E. 122	Electrical Engineering Laboratory	2	.....	.....	4
E.E. 161	Radio Communication	3	.....	2	3
E.E. 164	Electrical Communication	4	.....	2	4
	Electives*				
<i>Winter Quarter</i>					
E.E. 123	Electrical Engineering	3	3	.....	.....
E.E. 124	Electrical Engineering Laboratory	2	.....	.....	4
E.E. 162	Radio Communication	3	.....	2	3
E.E. 165	Electrical Communication	4	.....	2	4
	Electives*				
<i>Spring Quarter</i>					
E.E. 125	Electrical Engineering	3	3	.....	.....
E.E. 126	Electrical Engineering Laboratory	2	.....	.....	4
E.E. 163	Radio Communication	3	.....	2	3
E.E. 166	Electrical Communication	4	.....	2	4
	Electives*				

SPECIALIZED COURSES IN ELECTRICAL ENGINEERING

The number of electives in the electrical engineering course makes it practicable to obtain either a broad or a specialized education. Further to facilitate such election, certain courses in the senior year may be replaced by substitutes in chemistry, mathematics, or physics, subject to the approval of the head of the department and the Students' Work Committee. By properly choosing prerequisite subjects during the sophomore or junior year, a far-seeing student may prepare for advanced specialized courses in the following undergraduate and graduate years. As examples, one may specialize in business, chemistry, communication, illumination, manufacturing, military science and tactics, physics, power generation and distribution, public utilities, railway engineering, or other chosen line. Students are advised to consult with their classifiers, or with the head of the department, concerning desirable sequences of general or special courses.

ENGINEERING AND BUSINESS ADMINISTRATION

For many years engineers have recognized the importance of a knowledge of the principles of economics in connection with their profession. Engineering students are encouraged to elect courses of various kinds in the fields of economics and administration when it is possible for them to find time to do so. This is true in all of the branches of engineering.

With the vast expansion which has taken place in the manufacturing industries in the United States, there has arisen a need for engineers having more training in economics and administration than is usually possible in the four-year engineering courses. To meet this need special groups of elective courses have been arranged. The recent economic stress has further emphasized the importance of a combination of engineering and business training in preparation for the industrial problems of the future.

The *engineering pre-business course* described on page 54 provides a four-year combined curriculum in business administration with a background of the funda-

* For list of elective courses in other colleges, see page 70.

§ Students expecting to elect the communication option in the senior year must take E.E. 64-65-66, Elements of Communication, in the junior year.

mental mathematics, chemistry, English, physics, and drawing, of the engineering courses.

As a further step to provide adequate training in engineering or chemistry, combined with business administration, a plan of *five-year courses leading to two degrees* has been arranged for the capable student who wishes to enter upon a comprehensive professional training in this combined field.

Students who desire to elect courses in economics and business administration without undertaking the five-year combined course may well include the economics, business law, accounting, and corporation finance of the first two years in this program and then select such other courses of the sequence as they may prefer. No special optional group of courses is necessary for this purpose.

FIVE-YEAR COMBINED COURSES WITH BUSINESS ADMINISTRATION

The new plan of five-year combined courses in engineering, architecture (six years), or chemistry with business administration enables the student to complete the requirements for the Bachelor's degrees in both fields, as for example, bachelor of electrical engineering and bachelor of business administration. Five years will usually be necessary for the completion of the combined course, but a longer time, perhaps six years, may be required if suitable programs cannot be arranged for the five-year period. This will depend upon the particular curriculum with which the combination with business administration is made.

For this purpose the School of Business Administration will accept the 74 credits in business subjects shown in the following list in conjunction with one of the regular curricula in engineering, architecture, or chemistry as satisfying the requirements for the degree of bachelor of business administration. The student receives his engineering degree upon the completion of his regular course, altho this may not be until the end of the fifth year, and is not eligible for the degree in business administration on this 74-credit basis unless *the work is taken in conjunction with one of the regular curricula in this college.*

The business courses are intended to be spread over four years, beginning the business sequence in the sophomore year by taking economics and business law, 3 credits per quarter, as electives, in addition to the usual engineering program.

Normally, some of the required technical work of the senior year will be postponed to the fifth year to make room for business courses, in order to secure a desirable distribution of the latter rather than to concentrate them in the fifth year. Not more than 28 credits of business should be left for the fifth year.

In certain curricula, special concessions are made to students taking this five-year combined course by permitting them to omit certain required courses or to substitute business courses for them. (See Aeronautical, Agricultural, Chemical, and Electrical Engineering.)

Under this plan the student will be registered in the Institute of Technology and in the School of Business Administration for the entire combined program. His registration for each quarter beginning with the second year is subject to *approval by the adviser representing the School of Business Administration, Professor Filipetti*, as well as by the regular classifier.

The following order and distribution by years are suggested. With the approval of the adviser in the School of Business Administration both may be varied, however, so as to accommodate individual programs.

Students are required to maintain a "C" average in the School of Business Administration courses. If this grade has not been maintained upon the completion of the 74 credits the student will then be held for the full School of Business Administration requirements as provided in the Engineering Pre-Business program.

Course No.	Title	Credits		
		F	W	S
<i>Second Year</i>				
Econ. 8f-9w	General Economics	3	3	.....
Econ. 28f,s	Business Law (8, 9) .....	.....	.....	3
<i>Third Year</i>				
Econ. 29f,s, 26f,w,s	Principles of Accounting	3	3	.....
B.A. 77f,w,s	Survey of Marketing .....	.....	.....	3
<i>Fourth Year</i>				
B.A. 58f,w,s	Public Finance (8, 9) .....	.....	3	.....
B.A. 70f	Statistics Survey (8, 9)	3	.....	.....
B.A. 71f,w,s	Transportation: Services and Charges (8, 9) .....	.....	.....	3
B.A. 87f,w,s	Report Writing	1	.....	.....
B.A. 89f,w,s	Production Management (8, 9) .....	.....	.....	3
B.A. 112f,w,s	Business Statistics (70) .....	.....	3	.....
B.A. 130f,s	Survey of Cost Accounting (29) .....	.....	.....	3
B.A. 142f,w,s	Money and Banking (8, 9)	3	.....	.....
B.A. 167f,w	Personnel Administration (161) .....	.....	3	.....
Econ. 161f,w,s	Labor Problems (8, 9)	3	.....	.....
<i>Fifth Year*</i>				
B.A. 91f,w,s	Tabulating Equipment Laboratory (Econ. 26 and B.A. 70) .....	.....	1	.....
B.A. 155f,w,s	Corporation Finance (8, 9)	3	.....	.....
B.A. 101f,w-102w,s	Advanced General Economics (8, 9)	3	3	.....
B.A. 139f,w,s	Advanced General Accounting (26) .....	.....	.....	3
B.A. 165f,w,s	Economics of Public Utilities (8, 9) .....	.....	.....	3
B.A. 180-181-182Gf,w,s	Senior Topics; Production Management (89, 130)	3	3	3
Econ. 149f,w,s	Business Cycles (142) .....	.....	3	.....
	Total credits .....	.....	.....	74

ENGINEERING PRE-BUSINESS

(Four-year course in Engineering and Business Administration)

This course has been arranged for students who wish to prepare for positions in industry for which basic technical training is necessary, accompanied by instruction in business administration. Such positions are found in the fields of purchasing, sales and sales promotion, cost accounting, employment and rate setting, and production control.

Upon the completion of two years of prescribed work in the Institute of Technology the student transfers to the School of Business Administration, where the third and fourth years are taken. The combined course leads to the degree of bachelor of business administration.

Students are required to maintain a "C" average in the School of Business Administration courses.

For freshman year, see page 29.

* A comprehensive examination in the core group of economics and business administration courses is required for graduation in Business Administration.

SOPHOMORE YEAR

Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
M.&M. 91†	Calculus	4	4	.....	.....
Phys. 7	General Physics	5	1	4	2
Econ. 8	General Economics	3	.....	3	.....
M.E. 15	Machine Shop Practice	2	.....	1	4
M.E. 70	Mechanical Technology	1	.....	2	.....
	Electives*				
<i>Winter Quarter</i>					
Econ. 3	Elements of Money and Banking	5	3	2	.....
Econ. 9	General Economics	3	3	.....	.....
Econ. 20‡	Elements of Accounting	3	3	.....	.....
Phys. 8	General Physics	5	1	4	2
	Electives*				
<i>Spring Quarter</i>					
M.&M. 84†	Technical Mechanics	5	5	.....	.....
Phys. 9	General Physics	5	1	4	2
Econ. 5	Elements of Statistics	5	5	.....	.....
Econ. 25	Principles of Accounting	3	3	.....	.....

JUNIOR YEARS

(In the School of Business Administration)

	Credits
Strength of Materials (M.&M. 85f,s)†	3
Materials Testing Laboratory (M.&M. 87f,s)†	1
Principles of Accounting (Econ. 26f,w,s)	3
Business Law (Bus.Adm. 51f-52w-53s)	9
Business Statistics (Bus.Adm. 112f,w,s)	3
Corporation Finance (Bus.Adm. 155f,w,s)	3
Money and Banking—Advanced Course (Bus.Adm. 142f,w,s)	3
Transportation: Services and Charges I (Bus.Adm. 71f,w,s)	3
Survey of Marketing (Bus.Adm. 77f,w,s)	3
Production Management (Bus.Adm. 89f,w,s)	3
Advanced General Accounting (Bus.Adm. 139f,w,s)	3
Tabulating Equipment Laboratory (Bus.Adm. 91f,w,s)	1
Electives (See list, page 56)	4

SENIOR YEARS

(In the School of Business Administration)

Transportation: Services and Charges II (Bus.Adm. 72f)	3
Cost Accounting (Bus.Adm. 130f,s)	3
Advanced General Economics (Bus.Adm. 101f,w-102w,s)	6
Business Cycles (Econ. 149f,w,s)	3
Labor Problems (Econ. 161f,w,s)	3
Personnel Administration (Bus.Adm. 167f,w)	3
Public Finance (Bus.Adm. 58f,w,s)	3
The Economics of Public Utilities (Bus.Adm. 165f,w,s)	3
Senior Topics: Production Management (Bus.Adm. 180-181-182G)	9
Electives (See list below)	12

* For list of elective courses in other colleges, see page 70.

† For permissible substitute, see page 71.

§ In addition to the required courses in the junior and senior years, the student must earn approximately 10 credits per year.

‡ Students who have had a high school course or experience in bookkeeping may be exempt from this course and admitted to Econ. 25 by passing a placement test.

ELECTIVES

Students may divide the time available for electives between Groups A and B.

A. General and Business

	Hours
Economic History (Hist. 80f-81w-82s)	9
Finance Management (Bus.Adm. 156f)	3
Theory of Statistics (Econ. 113w-114s)	3
Geography of Commercial Production (Geog. 41f,w,s)	5
Fire and Marine Insurance (Bus.Adm. 60w)	3
Casualty Insurance (Bus.Adm. 61s)	3
Senior Topics: Marketing (Bus.Adm. 180c)	3

B. Engineering

Auto and Airplane Engines (M.E. 50f,w,s)	3
Gas Manufacture and Distribution (Ch.E. 41s)	3
Civil Engineering Practice (C.E. 53s)	3
Contracts and Specifications (G.E. 101w,s)	3
Estimating (G.E. 81w)	3
Technical Writing (Engl. 36s)	3
Industrial Management Laboratory (M.E. 174f,w,s)	2

GEOPHYSICS

The institute has established a curriculum for students interested in geophysics.

It is suggested that any student who desires to enter such a curriculum would arrange his programs to include the following courses:

English	Geology
Drawing	General and Historical 1-2, A-B
Chemistry	Mineralogy 23-24
Mathematics	Sedimentation 101
Algebra, Trigonometry, and Analytics	Rock Study 105
Differential and Integral Calculus	Geology of Petroleum 112
Differential Equations	Structural Geology 124
Advanced Calculus	Map Interpretation 144-145
Technical Mechanics (Statics and Dynamics)	Field Course 85
Elective topics in Mathematical Analysis 144-145-146	Elective
Physics	Paleontology 51
General Physics 7-8-9	Economics 110
Modern Exp. Physics 108-110-112 (individual work)	Ore Deposits 111
Theoretical Physics 101-103-105	Advanced General 151-152-153
Geophysics	Field Course 150
Principles of Geophysical	Mining
Prospecting 161-162	Mining 131
	Civil Engineering
	Surveying 11-12-13
	Field Course 23

MECHANICAL ENGINEERING

Four-year course leading to the degree of bachelor of mechanical engineering, B.M.E.

In addition to the prescribed courses, sufficient electives must be taken to complete a total of at least 207 credits for graduation.

The field of mechanical engineering is very broad. Graduates hold positions in technical or non-technical work in almost every kind of industry.

The profession includes the following major divisions: design of machinery and apparatus for all purposes; production and manufacturing methods; operation of industrial plants; steam power generation, internal combustion engines; heating, ventilation, refrigeration, and air conditioning; mechanical research and development; sales engineering; and the general field of management.

The course is planned to give broad training rather than highly specialized work. A reasonable amount of time is allowed for non-technical subjects. A course in speech is required.

It is recommended that students in Mechanical Engineering spend their summer vacations in industry if possible.

For freshman year, see page 29.

SOPHOMORE YEAR

Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
M.&M. 24	Differential Calculus	5	5	.....	.....
Phys. 7	General Physics	5	1	4	2
M.E. 9	Foundry Practice	2	.....	1	4
M.E. 20	Elementary Machine Design	2	.....	.....	6
M.E. 70	Mechanical Technology	1	.....	2	.....
Engr. 37†	Technical Discussions	3	3	.....	.....
or					
M.E. 50†	Auto and Airplane Engines	3	3	.....	.....
	Electives*‡				
<i>Winter Quarter</i>					
M.&M. 25	Integral Calculus	5	5	.....	.....
Phys. 8	General Physics	5	1	4	2
M.E. 6	Pattern Practice	2	.....	1	4
Engr. 37†	Technical Discussions	3	3	.....	.....
or					
M.E. 50†	Auto and Airplane Engines	3	3	.....	.....
	Electives*‡				
<i>Spring Quarter</i>					
M.&M. 26	Technical Mechanics (Statics)	5	5	.....	.....
Phys. 9	General Physics	5	1	4	2
M.E. 12	Forging, Heat Treating, and Welding	2	.....	1	4
M.E. 21	Kinematics	2	.....	.....	6
Engr. 37†	Technical Discussions	3	3	.....	.....
or					
M.E. 50†	Auto and Airplane Engines	3	3	.....	.....
	Electives*‡				

JUNIOR YEAR

<i>Fall Quarter</i>					
M.&M. 127	Technical Mechanics (Dynamics)	5	5	.....	.....
M.E. 17	Machine Shop Practice	3	.....	1	7
M.E. 22	Mechanism	3	3	.....	.....
M.E. 33	Elementary Mechanical Laboratory	2	.....	.....	4
M.E. 43	Steam Engineering	3	3	.....	.....
	Electives*				

* For list of elective courses in other colleges, see page 70.

† Engr. 37 and M.E. 50 are offered each quarter. Both courses must be completed during the year. Enrolment in Engr. 37 is limited to 25 students.

‡ Programs are arranged to accommodate C.E. 17f,s Surveying; Chem.E. 1w, Power Plant Chemistry; and other electives. The Power Plant Chemistry section is limited to 20 students.

Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Winter Quarter</i>					
M.&M. 128	Strength of Materials	5	5	.....	.....
M.&M. 141	Materials Laboratory	2	.....	1	2
M.E. 23	Machine Design	3	.....	2	6
M.E. 34	Mechanical Laboratory	2	.....	.....	4
M.E. 44	Thermodynamics	3	2	.....	3
	Electives*				
<i>Spring Quarter</i>					
M.&M. 129	Hydraulics	4	3	1	.....
M.&M. 143	Hydraulics Laboratory	1	.....	.....	2
M.E. 24	Machine Design	3	3	.....	.....
M.E. 35	Elementary Steam and Power Laboratory	2	.....	.....	4
M.E. 45	Thermodynamics	3	2	.....	3
	Electives*				
SENIOR YEAR					
<i>Fall Quarter</i>					
M.E. 121	General Engineering Design	2	.....	.....	6
M.E. 141§	Power Plant Engineering	3	3	.....	.....
M.E. 150§	Internal Combustion Engines	3	3	.....	.....
M.E. 171§	Production Control	3	3	.....	.....
	Senior Laboratory†	2 or 4	.....	.....	4 or 8
M.E. 160	Heating and Ventilation	3	1	2	.....
M.E. 190	Seminar	1	1	.....	.....
E.E. 36	Electric Power	3	2	.....	2
	Electives*				
<i>Winter Quarter</i>					
M.E. 141§	Power Plant Engineering	3	3	.....	.....
M.E. 150§	Internal Combustion Engines	3	3	.....	.....
M.E. 171§	Production Control	3	3	.....	.....
	Senior Laboratory†	2 or 4	.....	.....	4 or 8
M.E. 191	Seminar	1	1	.....	.....
	Engineering Design¶	2	.....	.....	6
E.E. 37	Electric Power	3	2	.....	2
	Electives*				
<i>Spring Quarter</i>					
M.E. 192	Seminar	1	.....	1	1
	Engineering Design¶	2	.....	.....	6
E.E. 38	Electric Power	3	2	.....	2
G.E. 193	Engineering Practice	2	.....	2	.....
	Senior Laboratory†	2 or 4	.....	.....	4 or 8
	Electives*				

In addition to the regular four-year course in mechanical engineering, those who are qualified are urged to take a fifth year, that is, a year of graduate study. This year's work may lead to the Master's degree in mechanical engineering and

* For list of elective courses in other colleges, see page 70.

† The four laboratory courses, M.E. 149, 159, 169, 174, must be taken in the three quarters and not more than two in any one quarter.

§ Courses M.E. 141, 150, 171 must be taken in the fall and winter quarters. Each course is offered both quarters.

¶ The following courses are accepted for this requirement: M.E. 122w-123s, Mechanical Engineering Design; M.E. 147w, Design of Steam Machinery; M.E. 148s, Design of Power Plant Units; M.E. 156w, 157s, Design of Internal Combustion Engines; M.E. 161w, 162s, Heating and Ventilation Design; M.E. 170s, Tool Design and Construction; M.E. 175w, Materials Handling; C.E. 37s, Structural Engineering.

also satisfy the requirement of graduate study towards the professional degree of mechanical engineer. (For detailed information as to procedure consult the Graduate School Bulletin.)

GEOLOGICAL, METALLURGICAL, MINING, AND
PETROLEUM ENGINEERING

(For students entering with chemistry, higher algebra, and solid geometry and who pass their English test.)

FRESHMAN YEARS

Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
M.&M. 11	College Algebra	5	5	.....	.....
Inorg.Chem. 4	General Inorganic Chemistry	4	1	3	3
Engl. 4	Composition	3	3	.....	.....
Draw. 11	Engineering Drawing	2	.....	.....	6
Geol. 11	Dynamic Geology	2	2	.....	.....
<i>Winter Quarter</i>					
M.&M. 12	Trigonometry	5	5	.....	.....
Inorg.Chem. 5	General Inorganic Chemistry	4	1	3	3
Engl. 5	Composition	3	3	.....	.....
Draw. 12	Engineering Drawing	2	.....	.....	6
Geol. 12	Dynamic and Historical Geology	2	2	.....	.....
<i>Spring Quarter</i>					
M.&M. 13	Analytical Geometry	5	5	.....	.....
Inorg.Chem. 16	Qualitative Chemical Analysis	5	.....	3	6
Engl. 6	Composition	3	3	.....	.....
Draw. 13	Topographic Drawing	2	.....	.....	6
Geol. 13	Historical Geology	2	2	.....	.....

GEOLOGICAL, MINING, AND PETROLEUM ENGINEERING

Candidates for either of these degrees need not choose the field of specialization until the beginning of the junior year.

SOPHOMORE YEAR

<i>Fall Quarter</i>					
Geol. 23	Mineralogy	4	1	3	4
M.&M. 31	Calculus	3	3	.....	.....
Met. 1	Assaying	3	.....	3	4
Min. 11	Surveying	3	1	3	.....
Phys. 7	General Physics	5	1	4	2
<i>Winter Quarter</i>					
Anal.Chem. 9	Quantitative Analysis	3	1	1	6
Geol. 24	Mineralogy	4	1	3	4
M.&M. 32	Calculus	3	3	.....	.....
Min. 12	Surveying	3	1	3	.....
Phys. 8	General Physics	5	1	4	2

§ See statement on page 28 for students entering without chemistry, higher algebra, or solid geometry and those required to take the course in preliminary English.

Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Spring Quarter</i>					
Geol. 105	Rock Study	2	.....	2	2
M.&M. 33	Calculus	3	3	.....	.....
Met. 13	General Ferrous Metallurgy	2	.....	3	.....
Min. 13	Mine Surveying	2	1	2	.....
Min. 14	Surveying Field Work	5	.....	.....	20
Phvs. 9	General Physics	5	1	4	2

Summer Field Trips

Min. 15	Field work in surveying on the iron ranges of Minnesota.	8 credits.
Geol. 85	Field work in geology on the iron ranges of Minnesota.	3 credits.

GEOLOGICAL ENGINEERING

Four-year course leading to the degree of bachelor of geological engineering, B.Geol.E.

Requirements for graduation cover all prescribed courses including summer field trips and electives, making a total of 233 credits.

The course in geological engineering is designed to prepare students for responsible positions in geological departments of exploration, oil, or mining companies, or to engage in consulting geological practice.

There are in existence many ore deposits which are economically of no particular value at the present time, either because the cost of mining is excessive or because there is no known method of separating the valuable minerals from the worthless material associated with them at a profit for the operator. In addition to thoro courses in geology, the mining geologist must, therefore, be familiar with the various methods of mining and know something of the possibilities of ore dressing to recover the valuable minerals. A knowledge of the fundamental principles of the smelting and refining of metals is a decided asset in his work.

The basic training must, therefore, include thoro courses in mathematics, drafting, chemistry, and physics. It must also include plane and mine surveying, mapping, both topographic and geological, assaying, ore dressing, and the principles of metallurgy. The technical work in mining includes exploration, development, and mining methods together with the courses in mine administration, economics of mining, and mining law. The general course in geology is given in the freshman year. Then follow the courses in mineralogy, rock study, and petrography. These are followed by advanced general geology, structural and metamorphic geology, index fossils and paleontology, mineralography, sedimentation, ore deposits, oil geology. Advanced courses in petrology and petrography, blowpipe analysis, and map interpretation are also available.

The Department of Geology is well supplied with working collections of minerals, crystal models, rocks, thin sections, ores and economic minerals, fossils, and other illustrative material used in connection with the courses in paleontology, stratigraphy, and historical geology. The department has large, well-lighted, and fully equipped laboratories for the basic courses of mineralogy, rock study, and petrology. Special equipment is available for studies in sedimentation, rock analysis, and X-ray studies of minerals. Courses in geology and mineralogy extend throughout the four years.

JUNIOR YEAR				
Course No.	Title	Credits Rec.	Lect.	Lab.
<i>Fall Quarter</i>				
Geol. 106	Petrography	2	2	2
Geol. 144	Interpretation of Geologic Maps	4		8
Geol. 151	Advanced General Geology	3	3	
M.&M. 26	Technical Mechanics (Statics)	5	5	
Min. 106	Mine Mapping	2		8
Min. 111	Exploration	3	4	
<i>Winter Quarter</i>				
Draw. 14	Descriptive Geometry	4	3	3
Geol. 124	Metamorphic Geology	3	3	
Geol. 131	Advanced Petrology	4	1	3
Geol. 145	Interpretation of Geologic Maps	2		4
Geol. 152	Advanced General Geology	3	3	
Min. 112	Exploration and Development	3	4	
<i>Spring Quarter</i>				
M.&M. 127	Technical Mechanics (Dynamics)	5	5	
Geol. 125	Structural Geology	3	3	
Geol. 132	Advanced Petrology	4	4	4
Geol. 153	Advanced General Geology	3	3	
Min. 113	Development and Production	3	4	
<i>Summer Field Trip</i>				
Geol. 150	Field Geology. Detailed systematic work conforming with standards of official surveys. Preparation of geologic maps, structure sections, reports; paragenesis of ores and their relations to geologic structures. Field, Black Hills, South Dakota			6

SENIOR YEAR

(This curriculum does not go into effect until 1939-40)

<i>Fall Quarter</i>				
Geol. 61	Blowpipe Analysis	3	2	4
Geol. 91	Index Fossils of North America	3	1	6
Geol. 101	Sedimentation	3	3	
Geol. 110	Economic Geology	3	3	
Met. 106	Base Metals	2	3	
Met. 110	Ore Dressing	2	3	
Min. 141	Mine Examination and Administration	3	4	
<i>Winter Quarter</i>				
Geol. 92	Index Fossils of North America	3	1	6
Geol. 111	Ore Deposits	3	3	
Geol. 140	Applied Petrography	3	1	4
Geol. 166	Mineralography	3		6
Met. 107	Base Metals	2	3	
Met. 112	Ore Dressing	2	3	
Min. 142	Coal Mining and Mining Law	3	4	
<i>Spring Quarter</i>				
Geol. 93	Index Fossils of North America	3	1	6
Geol. 112	Geology of Petroleum	3	3	
Geol. 141	Applied Petrography	3	1	4
Geol. 167	Mineralography	3		6
Met. 108	Precious Metals	2	3	
Met. 116	Ore Dressing Laboratory	1		4
Min. 143	Placer Mining, Quarries, and Open Pits	3	4	

MINING

Four-year course leading to the degree of bachelor of mining engineering, B.Min.E.

Requirements for graduation cover all prescribed courses including summer field trips and electives, making a total of 235 credits.

The course in mining is designed to prepare the student for responsible positions in the field of mining. In such positions a mining engineer, in addition to meeting the technical problems involved in the development and operation of a mine, must be able to pass upon specifications and problems for structures and for mechanical and electrical equipment. In addition he must be familiar with the fundamental principles of ore dressing and ore testing as in the early stages of development he must be able to determine whether or not the valuable mineral in the ore deposit being opened up may be separated from the worthless material at a profit to the company.

The basic training must, therefore, include thoro courses in mathematics, drafting, chemistry, physics, and geology including the identification of minerals and rocks. It must also include plane and mine surveying, mapping, assaying, ore dressing, and ore testing. The mechanical and electrical features of the various types of machinery used in the industry must be understood. Tho it is not necessary for the mining engineer to concern himself with problems of the design of individual machines, he must be familiar with the essential characteristics in order to consider intelligently proposals and specifications. Essential to his training is a thoro knowledge of mine exploration and development, mining methods as influenced by the type of deposits, as well as the applications of economics to mining. He must have a reasonable familiarity with the basic mining laws of the various states and the laws governing corporations, etc.

The Department of Mining is well supplied with samples of the smaller mine equipment, models, drawings, photographs, lantern slides, and mine maps. The lectures treat of prospecting, development, support of excavations, mining methods, mine administration, mining law, safety and safety regulations and the necessary allied subjects. The courses in mining extend through the sophomore, junior, and senior years.

JUNIOR YEAR

Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
Geol. 106	Petrography	2	.....	2	2
M.&M. 26	Technical Mechanics (Statics)	5	5	.....	.....
Met. 106	Base Metals	2	.....	3	.....
Met. 110	Ore Dressing	2	.....	3	.....
Min. 106	Mine Mapping	2	.....	.....	8
Min. 111	Exploration	3	.....	4	.....
Min. 121	Mine Plant	3	.....	5	.....
<i>Winter Quarter</i>					
Draw. 14	Descriptive Geometry	4	.....	3	3
M.&M. 128	Strength of Materials	5	5	.....	.....
Met. 107	Base Metals	2	.....	3	.....
Met. 112	Ore Dressing	2	.....	3	.....
Min. 112	Exploration and Development	3	.....	4	.....
Min. 122	Mine Plant	3	.....	5	.....

Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Spring Quarter</i>					
E.E. 41	Electric Power	3	.....	2	3
M.&M. 127	Technical Mechanics (Dynamics)	5	5	.....	.....
Met. 108	Precious Metals	2	.....	3	.....
Met. 116	Ore Dressing Laboratory	1	.....	.....	4
Min. 113	Development and Production	3	.....	4	.....
Min. 123	Mine Plant	3	.....	5	.....
	Electives	2	.....	.....	.....

Summer Field Trip

Min. 139	Study of mining operations, mine plants, and metallurgical plants in one or more western mining camps	6
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SENIOR YEAR

(This curriculum does not go into effect until 1939-40)

Fall Quarter

Geol. 110	Economic Geology	3	.....	3	.....
M.E. 9	Foundry Practice	2	.....	1	4
Met. 121	Ore Testing	2	.....	1	3
Min. 125	Mining and Metallurgical Hydraulics	4	.....	5	.....
Min. 126	Engineering Construction	3	.....	.....	8
Min. 141	Mine Examination and Administration	3	.....	4	.....
	Electives	2	.....	.....	.....

Winter Quarter

Geol. 111	Ore Deposits	3	.....	3	.....
M.E. 12	Forging	2	.....	1	4
M.E. 138	General Laboratory	2	.....	.....	4
Met. 156	Metallography	3	.....	2	3
Min. 127	Engineering Construction	3	.....	.....	8
Min. 142	Coal Mining and Mining Law	3	.....	4	.....
Min. 144	Advanced Mining	3	.....	.....	8

Spring Quarter

Geol. 112	Petroleum Geology	3	.....	3	.....
Geol. 125	Structural Geology	3	.....	3	.....
M.E. 15	Machine Shop Practice	2	.....	1	4
Met. 126	Special Problems in Metallurgy	3	2	.....	4
Min. 143	Placer Mining, Quarries, and Open Pits	3	.....	4	.....
Min. 145	Advanced Mining	3	.....	.....	8
	Electives	2	.....	.....	.....

PETROLEUM ENGINEERING

Four-year course leading to the degree of bachelor of petroleum engineering, B.Pet.E.

Requirements for graduation cover all prescribed courses, including summer field trips and electives, making a total of 235 credits.

The course in petroleum engineering is designed to prepare the student for responsible positions in the field of petroleum production. In such a position the petroleum engineer must be familiar with geology and in particular with oil geology. This involves a knowledge of the various geological ages during which oil was formed, of the geological conditions under which the oil was collected in pools, and the methods of interpreting geological data to determine whether or not a given locality may contain such pools. He must know the methods of drilling and

the difficulties which must be overcome in this work. He must know the principles of pumping, with both gas lift and mechanical pumps, and the methods of gasoline recovery to be used in connection with these methods. He must know the causes of the formation of emulsions and methods of breaking them when formed. He must be familiar with the laws of flow of viscous fluids and be able to design pipe lines, pumping stations, and storage basins. In addition, he should know the essential economic principles involved in the industry, and be familiar with the forms, contracts, and other documents usual in the industry.

The basic training must, therefore, include thoro courses in mathematics, drafting, chemistry, physics, and geology, including in particular, a thoro familiarity with sedimentary deposits. It must also include surveying and mapping. The mechanical and electrical features of the various types of machinery used in the industry must be understood. A course in pipe lines gives the necessary preparation in flow formulas, soil corrosion, and methods of prevention. Thoro courses are included in prospecting, aerial surveying and interpreting aerial maps, oil field mapping, production technology, and petroleum economics. Due emphasis is also placed on problems of administration, including reports, leases, contracts, and specifications.

The department is well supplied with samples of the smaller oil field equipment, well logs, drill cores, models, maps, photographs, lantern slides, and samples of petroleum products. The lectures treat of location, prospecting, development, production, distribution, administration, leasing, mineral laws, safety work and safety regulations, and allied subjects affecting oil and gas production. The courses in petroleum production extend through the junior and senior years.

JUNIOR YEAR					
Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
Geol. 106	Petrography	2	.....	2	2
Geol. 144	Interpretation of Geologic Maps	3	.....	.....	6
Geol. 151	Advanced General Geology	3	.....	3	.....
M.&M. 26	Technical Mechanics (Statics)	5	5	.....	.....
Min. 121	Mine Plant	3	.....	5	.....
Pet.E. 111	Exploration	3	.....	4	.....
<i>Winter Quarter</i>					
Geol. 131	Advanced Petrology	4	1	3	4
Geol. 152	Advanced General Geology	3	.....	3	.....
M.&M. 128	Strength of Materials	5	5	.....	.....
Min. 107	Mine Maps	1	.....	.....	3
Min. 122	Mine Plant	3	.....	5	.....
Pet.E. 112	Exploration and Development	3	.....	4	.....
<i>Spring Quarter</i>					
Geol. 112	Petroleum Geology	3	.....	3	.....
Geol. 125	Structural Geology	3	.....	3	.....
M.&M. 127	Technical Mechanics (Dynamics)	5	5	.....	.....
Pet.E. 131	Petroleum Refining	2	.....	2	.....
Pet.E. 134	Petroleum Plant	2	.....	3	.....
Pet.E. 138	Oil Field Maps	2	.....	.....	6
	Electives	2	.....	.....	.....
<i>Summer Field Trip</i>					
Pet.E. 135	Study of oil well drilling and production methods and refining practice in one or more oil fields	6	.....	.....	.....

SENIOR YEAR

(This curriculum does not go into effect until 1939-40)

Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
Geol. 101	Sedimentation	3	.....	3	.....
Geol. 110	Economic Geology	3	.....	3	.....
Min. 125	Mining and Metallurgical Hydraulics	4	.....	5	.....
Min. 126	Engineering Construction	3	.....	.....	8
Pet.E. 141	Oil Field Examination and Administration	3	.....	4	.....
Pet.E. 152	Petroleum Production Technology	3	.....	1	6
<i>Winter Quarter</i>					
Geol. 111	Ore Deposits	3	.....	3	.....
M.E. 12	Forging	2	.....	1	4
Met. 156	Metallography	3	.....	2	3
Min. 127	Engineering Construction	3	.....	.....	8
Pet.E. 144	Advanced Petroleum Engineering	5	.....	4	6
Pet.E. 153	Petroleum Production Technology	3	.....	1	6
<i>Spring Quarter</i>					
Geol. 153	Advanced General Geology	3	.....	3	.....
M.E. 15	Machine Shop Practice	2	.....	1	4
Pet.E. 145	Advanced Petroleum Engineering	5	.....	4	6
Pet.E. 154	Petroleum Production Technology	3	.....	1	6
	Electives	6	.....	.....	.....

METALLURGY

Four-year course leading to the degree of bachelor of metallurgical engineering, B.Met.E.

Requirements for graduation cover all prescribed courses including summer field trips and electives, making a total of 222 credits.

Courses in metallurgy are designed to prepare the student for responsible positions in metallurgical industries. The instruction deals with the production and uses of ferrous, non-ferrous, and precious metals. Metallurgists are concerned with the preparation of raw materials for smelting, the design and operation of furnaces to convert ores into metals, and the structure and physical properties of metals and alloys.

Representative ores of all the important metals, models and drawings of furnaces, and samples of furnace products are available. Lectures cover the construction and operation of ore dressing and concentrating machinery, together with typical combinations of ore dressing machines. The sequence of physical and chemical changes occurring during smelting, furnace design, fuels, refractories, methods, and efficiency of heat application and control over quality of product are stressed in courses dealing with metallurgical processes.

Laboratories equipped with various types of furnaces are provided so that the students can become familiar with high temperature equipment and conduct experiments demonstrating important features of metallurgical processes.

Metallography is an important branch of metallurgy dealing with the application of metals and alloys. The work relates to internal structures, as studied by the microscope, and to the physical and chemical properties of metals and alloys.

A knowledge of metallography is essential in the design and development of new machines and equipment fabricated from metals.

An elaborate and up-to-date file of references and abstracts is available. A large collection of specimens, photomicrographs, and lantern slides covering all types of steels, brasses, bronzes, aluminum alloys, and other industrial alloys is available for study and comparison.

Laboratory courses accompany lecture work. The metallographic laboratory is equipped with the most up-to-date microscopes and apparatus for heat treating and physical and mechanical testing. Practice is obtained in taking photomicrographs.

Two options are open to students in metallurgy. Option A is provided for students specializing in ore dressing and the refining and smelting of non-ferrous metals. Option B is for students interested in the production of ferrous metals and the application of all metals.

Students will register for either Option A or Option B at the beginning of the junior year.

SOPHOMORE YEAR

Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>					
Geol. 23	Mineralogy	4	1	3	4
M.&M. 31	Calculus	3	3	.....	.....
Met. 1	Assaying	5	.....	3	8
Phys. 7	General Physics	5	1	4	2

Winter Quarter

Anal.Chem. 9	Quantitative Analysis	3	1	1	6
Geol. 24	Mineralogy	4	1	3	4
M.&M. 32	Calculus	3	3	.....	.....
Met. 11	Metallurgy of Pig Iron	3	1	3	.....
Phys. 8	General Physics	5	1	4	2

Spring Quarter

Geol. 105	Rock Study	2	.....	2	2
M.&M. 33	Calculus	3	3	.....	.....
Met. 12	Metallurgy of Steel	3	1	3	.....
Phys. 9	General Physics	5	1	4	2
	Elective	5	.....	.....	.....

JUNIOR YEAR

(Students will register for either Option A or Option B.)

Option	Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Fall Quarter</i>						
A&B	M.&M. 26	Technical Mechanics (Statics)	5	5	.....	.....
A&B	Met. 106	Base Metals	2	.....	3	.....
A&B	Met. 110	Ore Dressing	2	.....	3	.....
A&B	Met. 111	Ore Dressing Laboratory	1	.....	.....	4
A&B	Min. 121	Mine Plant	3	.....	5	.....
A	Geol. 106	Petrography	2	.....	2	2
A	Geol. 165	Ore Dressing Microscopy	1	.....	.....	3
A	Min. 111	Exploration	3	.....	4	.....
B	M.E. 9	Foundry Practice	2	.....	1	4
B	Met. 153	Metallography	4	.....	3	4

Option	Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Winter Quarter</i>						
A&B	M.&M. 128	Strength of Materials	5	5	.....	.....
A&B	Met. 107	Base Metals	2	.....	3	.....
A&B	Met. 133	Electrometallurgy	3	.....	3	3
A&B	Min. 122	Mine Plant	3	.....	5	.....
A	Met. 112	Ore Dressing	2	.....	3	.....
A	Met. 113	Ore Dressing Laboratory	1	.....	.....	4
A	Min. 112	Exploration and Development	3	.....	4	.....
B	M.E. 12	Forging	2	.....	1	4
B	Met. 154	Metallography	4	.....	3	4

Spring Quarter

A&B	E.E. 41	Electric Power	3	.....	2	3
A&B	M.&M. 127	Technical Mechanics (Dynamics)	5	5	.....	.....
A&B	Met. 108	Precious Metals	2	.....	3	.....
A&B		Electives	3	.....	.....	.....
A	Met. 114	Ore Dressing	2	.....	3	.....
A	Met. 115	Ore Dressing Laboratory	1	.....	.....	4
A	Min. 113	Development and Production	3	.....	4	.....
B	M.E. 15	Machine Shop Practice	2	.....	1	4
B	Met. 155	Metallography	4	.....	3	4

Summer Field Trips

A	Met. 139	Study of metallurgical and mining operations in western mining districts	6	.....	.....	.....
B	Met. 171	Study of metallurgical operations in important iron and steel centers	6	.....	.....	.....

SENIOR YEAR

(This curriculum does not go into effect until 1939-40)

Fall Quarter

A&B	Met. 121	Ore Testing	2	.....	1	3
A&B	Met. 134	Advanced Metallurgy	4	.....	3	4
A	Chem. 105	Gas and Fuel Analysis	3	1	1	4
A	Met. 153	Metallography	4	.....	3	4
A	Min. 125	Mining and Metallurgical Hydraulics	3	.....	3	.....
A		Electives	3	.....	.....	.....
B	Chem. 76	Applied Electrochemistry	3	.....	3	.....
B	Met. 141	Problems in Ferrous Metallurgy	3	.....	.....	9
	or					
B	Met. 166	Advanced Metallurgy Laboratory	3	.....	.....	9
B	Met. 163	Advanced Metallurgy	3	.....	3	.....
B		Electives	4	.....	.....	.....

Winter Quarter

A&B	Met. 135	Advanced Metallurgy	4	.....	3	4
A	Met. 122	Ore Testing	4	.....	2	8
A	Met. 137	Problems in Non-Ferrous Metallurgy	4	.....	2	8
A	Met. 154	Metallography	4	.....	3	4
A&B		Electives	3	.....	.....	.....
B	Chem. 77	Applied Electrochemistry	3	.....	3	.....
B	Chem.E. 1	Power Plant Chemistry	3	1	1	4
B	Met. 142	Problems in Ferrous Metallurgy	3	.....	.....	9
	or					
	Met. 167	Advanced Metallurgy Laboratory	3	.....	.....	9
B	Met. 164	Advanced Metallurgy	3	.....	3	.....

Option	Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Spring Quarter</i>						
A&B	Met. 136	Advanced Metallurgy	4	.....	3	4
A	Met. 123	Ore Testing	4	.....	2	8
A	Met. 138	Problems in Non-Ferrous Metallurgy	4	.....	2	8
A	Met. 155	Metallography	4	.....	3	4
A		Electives	3	.....	
B	Chem.E. 31	Chemistry of Engineering Materials	3	.....	3	.....
B	M.&M. 144	Materials Testing Laboratory	2	.....		4
B	Met. 143	Problems in Ferrous Metallurgy	3	.....		9
	or					
B	Met. 168	Advanced Metallography Laboratory	3	.....		9
B	Met. 165	Advanced Metallography	3	.....	3	.....
B		Electives	4	.....	

PHYSICS

Four-year course leading to the degree of bachelor of physics, B.Phys.

The sequence leading to the degree, bachelor of physics, is intended to be sufficiently broad to provide for the needs of those who desire to prepare for the industrial research field or for graduate work in physics as a major. The outline given is only suggestive. A student entering this course will be assigned to an adviser who will aid him in selecting the sequences best adapted to his needs.

It is clear that a student having the above objectives must attain an adequate background in mathematics and in chemistry. The work in physics is planned so as to give a greater or lesser contact with theoretical physics and experimental physics, depending upon the special aptitude of the applicant. Any special interest of the applicant may be met by a careful choice of elective courses which meets the approval of his adviser. The Department of Physics reserves the right to limit the registration in this course to those who have given evidence of being able to profit by it.

General requirements for graduation.—The student must fulfill the requirements in credits earned and standards of work required for graduation by the Institute of Technology. The student must include as a minimum:

A major in physics of 55 credits.

A minor in mathematics of 34 credits.

A minor in chemistry of 39 credits.

The following outline is offered as a guide in planning the details of the four-year course.

FRESHMAN YEAR†§

Course No.	Title	Credits	Rec.	Lect.	Lab.
M.&M. 11	College Algebra	5	5	.....	.....
Inorg.Chem. 4	General Inorganic Chemistry	4	1	3	3
Engl. 4	Composition	3	3	.....	.....
Draw. 4	Drawing	2	.....	.....	6
	Elective*	3	.....	.....	.....

* For list of elective courses in other colleges, see page 70.

† See statement on page 28 for students entering without chemistry, higher algebra, or solid geometry and those required to take the course in preliminary English.

§ The course outlined for the freshman year for engineering groups (page 29) or for Chemistry and Chemical Engineering (page 40) may be substituted for the freshman program given here.

Course No.	Title	Credits	Rec.	Lect.	Lab.
<i>Winter Quarter</i>					
M.&M. 12	Trigonometry	5	5	.....	.....
Inorg.Chem. 5	General Inorganic Chemistry	4	1	3	3
Engl. 5	Composition	3	3	.....	.....
Draw. 5	Drawing	2	.....	.....	6
	Elective*	3	.....	.....	.....

<i>Spring Quarter</i>					
M.&M. 13	Analytical Geometry	5	5	.....	.....
Inorg.Chem. 11 or 16	Qualitative Chemical Analysis	4 or 5	.....	3	4 or 6
Engl. 6	Composition	3	3	.....	.....
Draw. 6	Descriptive Geometry	2	.....	.....	6
	Elective*	3	.....	.....	.....

SOPHOMORE YEAR

<i>Fall Quarter</i>					
M.&M. 24	Differential Calculus	5	5	.....	.....
Anal. Chem. 7	Quantitative Analysis	4	1	1	8
E.E. 11	Elements of Electrical Engineering	3	2	1	.....
Phys. 7†	General Physics	5	1	4	2

<i>Winter Quarter</i>					
M.&M. 25	Integral Calculus	5	5	.....	.....
Org.Chem. 1	Elementary Organic Chemistry	4	2	3	4
E.E. 13	Elements of Electrical Engineering	3	2	1	.....
E.E. 14	Elements of Electrical Engineering Laboratory	1	.....	.....	2
Phys. 8†	General Physics	5	1	4	2

<i>Spring Quarter</i>					
Org.Chem. 2	Elementary Organic Chemistry	4	2	3	4
E.E. 15	Elements of Electrical Engineering	3	2	1	.....
E.E. 16	Elements of Electrical Engineering Laboratory	1	.....	.....	2
Phys. 9†	General Physics	5	1	4	2
Phys. 11†	Contemporary Physics	3	.....	3	.....

JUNIOR YEAR

<i>Fall Quarter</i>					
M.&M. 151	Differential Equations	3	3	.....	.....
Phys. Chem. 101	Physical Chemistry	5	2	3	5
Phys. 71	Intermediate Physics	4	4	.....	.....
Phys. 144	Electrical Measurements	3	1	1	4

<i>Winter Quarter</i>					
M.&M. 152	Advanced Calculus	3	3	.....	.....
Phys. Chem. 102	Physical Chemistry	5	2	3	5
Phys. 73	Intermediate Physics	4	4	.....	.....
	Elective*	3	.....	.....	.....

<i>Spring Quarter</i>					
M.&M. 153	Advanced Calculus	3	3	.....	.....
Phys.Chem. 103	Physical Chemistry	5	2	3	5
Phys. 75	Intermediate Physics	4	4	.....	.....
	Elective*	3	.....	.....	.....

* For list of elective courses in other colleges, see page 70.

† Students who entered the Physics Curriculum as freshmen in 1937-38 and completed Phys. 3 and 4 (old numbers) Mechanics and Mechanics Laboratory will register in Phys. 13f Acoustics in place of Phys. 7f; Phys. 23w Heat, and Phys. 24w Heat Laboratory in place of Phys. 8w; Phys. 33s Optics, Phys. 34s Optics Laboratory, Phys. 43s Electricity, and Phys. 44s Electricity Laboratory in place of Phys. 9 and 11.

SENIOR YEAR				
Course No.	Title	Credits	Rec. Lect. Lab.	
<i>Fall Quarter</i>				
Phys. 101	Theoretical Physics	5	5	.....
Phys. 107	Modern Physics	3	.....	3
Phys. 108	Modern Experimental Physics	4	.....	8
German 24	Chemical German	4	4	.....
<i>Winter Quarter</i>				
Phys. 103	Theoretical Physics	5	5	.....
Phys. 109	Modern Physics	3	.....	3
Phys. 110	Modern Experimental Physics	4	.....	8
German 25	Chemical German	4	4	.....
<i>Spring Quarter</i>				
Phys. 105	Theoretical Physics	5	5	.....
Phys. 111	Modern Physics	3	.....	3
Phys. 112	Modern Experimental Physics	4	.....	8
German 26	Chemical German	4	4	.....

RECOMMENDED ELECTIVES FOR PHYSICS CURRICULUM

Course No.	Title	Credits
Chem. E. 31s	Engineering Materials	3
Econ. 3f,w,s	Elements of Money and Banking	5
Econ. 8f,9w	General Economics, per quarter	3
Econ. 28f,s	Business Law	3
E. E. 111f	Junior Electrical Engineering	5
E. E. 113w-115s	Junior Electrical Engineering, per quarter	3
Geol. 1f-2w	General Geology	6
Geol. Af-Bw	General Geology Laboratory	4
Hist. 1f-2w	European Civilization, per quarter	5
Hist. 4f-5w-6s	English History	9
M.&M. 84f,s	Technical Mechanics	5
M.&M. 154f-155w-156s	Vector Analysis, per quarter	3
M. E. 5f,w,s,su-8f,w,s-11f,w,s,su	Shop Practice, per quarter	2
Phys. 52f,w,s	Laboratory Arts	3
Phys. 61w	Introduction to Geophysical Prospecting	3
Phys. 113w	Intermediate Acoustics	3
Phys. 114f-116w-118s	Elementary Physical Investigation, per quarter	3
Phys. 117w-119s	History of Physics, per quarter	3
Phys. 124s	Pyrometry	3
Phys. 126f,s	Advanced Heat Laboratory	3
Phys. 134f,w	Experimental Optics	3
Phys. 136w,s	Spectrum Analysis	3
Phys. 137s	Electrical Properties of Crystals	3
Phys. 144f	Electricity Measurements	3
Phys. 146w	Advanced Electricity Measurements	3
Phys. 152f	X-Rays	3
Phys. 154w,s	X-Ray Spectroscopy	3
Phys. 161f-162w	Geophysical Prospecting, per quarter	3
Phys. Chem. 116f-117w-118s	Advanced Physical Chemistry, per quarter	3
Zool. 1f-2w-3s	General Zoology	10

ADDITIONAL ELECTIVE COURSES

For detailed schedules of classes see the programs of the respective departments in the Combined Class Schedule for 1938-39.

Course No.	Title	Credits	Prerequisites
Ast. 11f,s	Descriptive Astronomy	5	None
Fine Arts 1f	History of Architecture to 1870	3	None
Fine Arts 2w	History of Modern Architecture and Sculpture	3	None
Fine Arts 3s	History of Painting	3	None
French 1f,w,s-2f,w,s	Beginning French	10	None

SUBSTITUTIONS

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Course No.	Title	Credits	Prerequisites
French 3f,w,s-4f,w,s	Intermediate French	10	None
Geog. 11f,w,s	Human Geography	5	3rd qtr. fr., soph., jr., sr.; none
Geog. 41f,w,s	Geography of Commercial Production	5	Soph., jr., sr.; none
Geog. 43f	Political Geography	5	Soph., jr., sr.; none
Geol. 8f,w,s	Introductory Geology	5	None
Geol. 27s	Outlines of Mineralogy	1	Jr., sr.; none
Ger. 1f,w,s	Beginning German A	5	None
Ger. 2f,w,s	Beginning German B	5	Ger. 1 or one year high school German
Ger. 3f,w,s	Beginning German C	5	Ger. 2 or two years high school German
Ger. 4f,w,s	Intermediate German	5	Ger. 3 or three years high school German
Greek 42s	Greek Sculpture	2	None
Hist. 1f,w-2w,s	European Civilization	10	None
Hist. 3s	Social and Economic History of Modern Europe	5	10 cred. in hist. if taken by freshmen
Hist. 4f-5w-6s	English History	9	None
Hist. 7f-8w-9s	American History	9	Soph., jr., sr.; none
Hist. 11f-12w-13s	Medieval History	9	None (Arch. only)
Italian 1f-2w	Beginning Italian	10	None
Jour. 5s	The American Newspaper	3	None
Lib.Meth. 1f,w,s	Use of Books and Libraries	2	None (fr. and soph. only)
Phil. 2f,w,s	Logic	5	Soph., jr., sr.; none
Phil. 61w	Philosophy of Science	3	Phil. 2
Phil. 62s	Logic of Science	3	Phil. 2 or 61
Pol.Sci. 1f,2w,3s	American Government and Politics	9	None
P.M.&P.H. 3f,w,s	Personal Health	2	Fr., soph.; none
Psy. 1f,s-2w,s	General Psychology	6	None
Psy. 160f	Psychology in Personnel Work	3	Psy. 1-2, Econ. 8-9
Soc. 1f,w,s	Introduction to Sociology	5	None
Span. 1f,w,s-2f,w,s	Beginning Spanish	10	None
Span. 3f,w,s-4f,w,s	Intermediate Spanish	10	Spanish 1-2 or two years' high school Spanish
Sp. 1f,w-2w,s-3f,s	Fundamentals of Speech	9	Engl. 6
Sp. 5f,w,s-6f,w,s	Fundamentals of Speech	10	Engl. 6
Study 1f,w,s	How To Study	2	Permission of instructor

SUBSTITUTIONS

In order that students who are irregular may avoid delays on account of program conflicts or other difficulties, the following substitutions will be approved by petition. Additional credits thus earned may be applied as elective credits.

Course	Cred.	Substitute Course	Cred.
Draw. 4	2	Draw. 1	3
5	2	2	3
6	2	3	3
4 and 5 and 6	6	7 and 8	6
11	2	1	3
12	2	2	3
11 and 12	4	7 and 1 cred. of 8	4
26	2	28	2
28	2	26	2
M.&M. 84	5	M.&M. 26 and 127	10
85	3	128	5
86	2	129	4
87	1	141	2
91	4	24 and 25	10
92	4	26 or 84	5
93	4	85 or 128	4 or 5
Anal.Chem. 132	3	Anal. Chem. 105	3

DESCRIPTION OF COURSES

AERONAUTICAL ENGINEERING

- 1f—Aeronautics. History. Nomenclature. Resistance of simple bodies. Theory of flight. The airplane and its parts. Constructional details. Performance. 3 cred.; prereq., M.&M. 12. Messrs. Teichmann and Brush.
- | | |
|------------------------|------------------|
| (1) I MWF; 105A | (3) I TThS; 105A |
| (2) II TS, VI Th; 105A | (4) VI MWF; 105A |
- 2w—Aircraft and Auto Engines. Principles and types. Electrical systems. Lubrication and cooling. Carburetors. Accessories. (Open only to aeronautical engineers or by petition.) 3 cred.; prereq., 1. Messrs. Teichmann and Brush.
- | | |
|-----------------------|-------------------|
| Lect. (1) I TTh; 105A | (3) III TTh; 105A |
| (2) II MTh; 105A | (4) II TS; 105A |
| Lab. (1) I-II F; A | (3) VI-VII M; A |
| (2) VIII-IX M; A | (4) I-II Th; A |
- Quiz I S; 335EE
- 3s—Aeronautics. Instruments. Meteorology. Avigation. 3 cred.; prereq., 1 and 2. Messrs. Teichmann and Brush.
- | | |
|-------------------------|--------------------|
| (1) I TThS; 105A | (3) VI MThF; 105A |
| (2) II TS, III Th; 105A | (4) VIII MWF; 105A |
- 83s—Stresses in Simple Structures. Statically determinate trusses and beams. Graphic statics. Space frameworks. Combined stresses. Airplane wing bracing. Short and long struts. 3 cred.; prereq., M.&M. 128. Mr. Wise.
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|------------------|------------------|
| (1) I TThS; 215E | (2) III MWF; 22E |
|------------------|------------------|
- 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. 3 and M.&M. 25. Mr. Boehnlein.
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|----------------------------------|------------------|
| 100f (1) III TTh; 5E; III S; 21E | (2) VI MWF; 104E |
| 101w (1) I TS, VI Th; 104E | (2) II MWF; 205E |
| 102s (1) I MWF; 104E | (2) I TThS; 104E |
- 115f—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. Mr. Wise.
- Lect. II TS; 227E
Lab. III-IV F; 229E
- 116w—Advanced Airplane Stresses. Theory and design of monocoque fuselages. Multispar and unit construction wings. Vibrations. Wing and control-surface flutter. Analysis and design of seaplane hulls and floats. 3 cred.; prereq., 115. Mr. Wise.
- 120f-121w-122s—Airplane Design. Stress analysis of wings, fuselages, chassis, control surfaces, etc. Specifications. Performance and design calculations. Propellers. 120f, 3 cred.; 121w, 4 cred.; 122s, 3 cred.; prereq., 83, 102, M.&M. 128. Messrs. Akerman, Teichmann, and Brush.
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|----------------------------------|-----------------------|
| 120f Lect. (1) IV T, II F; 105A | (2) VI T, IV S; 105A |
| Lab. (1) II-IV W; 251ME | (3) II-IV F; 251ME |
| (2) II-IV W; 255ME | (4) II-IV F; 255ME |
| 121w Lect. (1) IV T, III S; 105A | (2) VI W, VII F; 105A |
| Lab. (1) II-IV WF; 251ME | (3) II-IV TS; 251ME |
| (2) II-IV WF; 255ME | (4) II-IV TS; 255ME |
| 122s Lect. IV T; 105A | |
| Lab. (1) II-IV MF; 251ME | (2) II-IV MF; 255ME |
- 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. Messrs. Akerman, Teichmann, and Brush.

- 126f,w,s-127f,w,s-128f,w,s—Advanced Problems in Airscrew Design. Graphical and analytical methods of investigation. 2 to 5 cred. per qtr.; prereq., 122. Mr. Akerman.
- 140f,s—Aeronautical Laboratory. Study of airplane parts and their construction. Fittings. Rigging. Inspection and accessories. 2 cred.; prereq., 102. Messrs. Akerman, Teichmann, and Brush.
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|------|------------------------------|-----------------------------|
| 140f | (1) II-IV M, VII-IX T; 107A | (3) VII-IX MTh; 107A |
| | (2) I-III Th, VII-IX F; 107A | (4) II-IV T, VII-IX W; 107A |
| 140s | (1) VII-IX MF; 107A | (3) II-IV TS; 107A |
| | (2) VII-IX WTh; 107A | (4) III-V M, VII-IX T; 107A |
- 141w—Aerodynamics Laboratory. Measurement of air flow. Calibration of Pitot tubes and anemometers. Distribution of air pressure on surfaces. Wind tunnel tests of wings, propellers, and airplane models. 3 cred.; prereq., 102. Mr. Boehnlein.
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|-------|--------------------|----------------------------|
| Lect. | (1) IV S; 201Ex | (3) III W; 201Ex |
| | (2) III T; 201Ex | |
| Lab. | (1) VII-IX TF; Ex | (3) VII-IX M, I-III Th; Ex |
| | (2) VII-IX WTh; Ex | |
- 159s—Inspection Trip. Various aircraft and aircraft engine manufacturing plants are visited during the spring vacation period. Written report covering this trip will be submitted. Required of seniors in Aeronautical Engineering. 1 cred.
- 160s—Airships. Theory and design. Rigid and non-rigid types. Stresses. Performance. 3 cred.; prereq., 83, 102, M.&M. 128. Messrs. Akerman, Piccard, and Brush.
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|-------|--------------------|--------------------|
| Lect. | III Th, IV S; 105A | |
| Lab. | (1) II-IV W; 151ME | (2) II-IV W; 255ME |
- 164s—Problems Relating to the Stratosphere. 3 cred.; prereq., 102. I TThS; 105A. Mr. Piccard.
- 165f,w,s—Advanced Aeronautical Laboratory. Research problems in aeronautical engineering requiring laboratory or field research facilities. 2 to 4 cred.; prereq., 140 or 141. Messrs. Akerman and Piccard.
- 170s—Air Transport. Economics. Airports and airways and their equipment. Air commerce rules and regulations. Communication. 2 cred.; prereq., open to jr. and sr. in Aero.E. Mr. Brush.
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|-----|---------------------|------------------|
| (1) | II Th, III S; 105A | (3) VII WF; 105A |
| (2) | VII T, III Th; 105A | |
- 173f,w,s-174f,w,s-175f,w,s—Airway Meteorology. Organization of airways meteorology service; decoding of teletype weather reports; progressive study of consecutive synoptic charts; ceiling and pilot balloon observations; applications of air mass analysis and polar front theory to the construction and interpretation of airway synoptic charts; high altitude sounding with aero meteorographs; special applications of meteorology to airline operations. 3 cred. per qtr.; prereq., 3. Messrs. Piccard and Barlow.
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| 173f | III TThS; 105A |
| 174w-175s | I MWF; 105A |
- 190w-191s-192f,w,s—Seminar. Readings, reports, conferences, and discussions. 1 cred. per qtr.; prereq., 101. Messrs. Akerman and Piccard.
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|------|-----------------|-----------------|
| 190w | (1) VII M; 105A | (3) VII W; 105A |
| | (2) III M; 105A | (4) IV M; 105A |
| 191s | (1) VI W; 105A | (3) VI T; 105A |
| | (2) VII M; 105A | |
- 192f,w,s Ar

- 193f,w,s-194f,w,s-195f,w,s—Advanced Problems in Aeronautical Engineering. 2 to 5 cred. per qtr.; prereq., sr. or grad. in Aero.E. Messrs. Akerman, Piccard, Robertson, Wise, Boehnlein, Teichmann, and Brush.
- 201f-202w-203s—Advanced Aerodynamics. 3 cred. per qtr.; prereq., 102 or special permission. Mr. Boehnlein.
- 260s—Advanced Airship Stresses. Coplanar and space rigid frameworks. Secondary stresses. Buckling and elastic instability. Framework of dirigibles, gondolas, and cabins. 3 cred.; prereq., 115. Mr. Wise.
- 272f-273w-274s—Research in Aeronautical Engineering. 2 to 5 cred. per qtr.; grad. Messrs. Akerman, Piccard, Robertson, Wise, and Boehnlein.
- 275f,w,s-276f,w,s-277f,w,s—Advanced Aircraft Engines. An 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. Messrs. Akerman and Robertson.

AGRICULTURAL BIOCHEMISTRY

- 108s—Chemistry of Wheat and Wheat Products. A lecture course, with collateral library reference work, on the chemical technology of the production and milling of wheat and its conversion into food. 3 cred.; prereq., Org. Chem. 52-53; II MWF; 211BCh(UF). Mr. Bailey.
- 110s—Flour Laboratory Methods. A laboratory course. Analysis of wheat and its products. Designed to train students for the cereal industry. 3 cred.; prereq., 101-102 or food analysis; VI-IX MWF; 202BCh(UF). Mr. Bailey.
- 113f,su-114w,su-115s—Biochemical Laboratory Methods. A laboratory course paralleling the lectures in 119-123. 2 cred. per qtr.; prereq., quantitative analysis, reg. in 119-123. VI-VIII T, VII-IX Th; 202, 208BCh(UF). Mr. Sandstrom.
- 119f—Colloids. Lectures and assigned readings dealing with the colloidal state of matter, the preparation and properties of colloidal systems, and the relation of these to biochemical processes. 3 cred.; prereq., Org. Chem. 153 and one year of either zoology or botany. III MWF; 113BCh(UF). Mr. Gortner.
- 120w—Proteins. Lectures and assigned readings on composition, structure, chemical and physical properties, and the functions of proteins and amino acids. 3 cred.; prereq., 119; II MWF; 113BCh(UF). Mr. Gortner.
- 121w—Carbohydrates. Lectures and assigned readings on the composition, structure, chemical and physical properties, and the functions of the carbohydrates. 3 cred.; prereq., 119; III MWF; 113BCh(UF). Mr. Bailey.
- 122s—The Lipids and Fats. Lectures and assigned readings on the composition, structure, chemical and physical properties, and the functions of the fats and fat-like compounds. 3 cred.; prereq., 119; III TThS; 113BCh(UF). Mr. Briggs.
- 123s—Enzymes. Lectures and assigned readings on enzyme action, including the methods of preparation and investigation of enzymes and their function in biological and industrial processes. 3 cred.; prereq., 119; III MWF; 113BCh(UF). Mr. Sandstrom.

AGRICULTURAL ECONOMICS

- 102w—Farm Organization. The field of farm management; farming as a business; types of farming; selection and acquisition of a farm; planning the physical

layout; selecting the crops and livestock. Special attention given to fundamental principles of organization. 3 cred.; prereq., Agr.Econ. 1, 2 or Econ. 8, 9; II TThS; 312HH(UF). Mr. Pond.

- 103s—Farm Operation. Budgeting the farm business; factors affecting success in farming; utilization of labor, power, and machinery; use of capital and credit; farm management investigations and services. Special attention to finding and remedying weaknesses in farm organization and operation. 3 cred.; prereq., Agr.Econ. 1, 2 or Econ. 8, 9; II TThS; 312HH(UF). Mr. Pond.

AGRICULTURAL ENGINEERING

FARM STRUCTURES

- 5w—Farm Building Construction. Instruction and practice in design of details, and in construction of farm buildings. Building materials and estimates. 3 cred.; no prereq. Mr. Christopherson.
Lect. IV M; 41En(UF)
Lab. IV-V WF; 48En(UF)
- 7s—Farm Structures. Arrangement and planning of farm buildings. Special attention to convenience, economy, and durability. 3 cred.; prereq., Draw. 3 or equiv. Mr. White.
Lect. I M; 305En(UF)
Lab. I-II WF; 305En(UF)
- 37w—Rural Sanitation. Wells, pumps, and water supply. Methods of securing sanitary water systems for farmsteads and rural institutions. Sanitary sewage disposal methods for homes, creameries, etc. 3 cred.; no prereq.; I MWF; 101En(UF). Mr. Tyler.
- 44s—Advanced Drawing. Plans and pictorial drawings, including perspective, charts, graphs, and co-ordinate plotting on various scales. Mapping. Illustrations for publication. 2 cred.; prereq., Draw. 3; ar. Mr. Neubauer.
- 67f—Farm Structures Design. Planning, estimating, and designing of farm structures. Study of materials and equipment commonly used. 3 cred.; prereq., 7, M.&M. 128. Mr. White.
Lect. I TThS; 305En(UF)
Lab. II-III TTh; 305En(UF)
- 111f-112w-113s—Farm Building Problems. Investigations in building materials, methods of construction, cost and efficiency of farm buildings. 3 to 6 cred. per qtr.; prereq., 67; ar.; 305En(UF). Messrs White, Christopherson, and Neubauer.
- 211f-212w-213s—Farm Structures Research. Studies in farm structures as related to other factors in the farm business. 3 to 6 cred. per qtr.; prereq., 111; ar. Mr. White.

FARM POWER AND MACHINERY

- 12s—Agricultural Machinery. Machinery as a factor in agricultural production; development, construction, and operation. 3 cred.; no prereq.; I MWF; 216En(UF). Mr. Schwantes.
- 13s—Gas Engines. Theory, operation, care, and repair of gasoline engines. 3 cred.; no prereq.; VI-VIII TTh; 216, 37En(UF). Mr. Torrance.
- 14f—Tractors. Lecture and laboratory course dealing with the construction, operation, care, adjustment, testing, and use of the tractor. 3 cred.; prereq., 13. Mr. Torrance.
Lect. II TTh; 216En(UF)
Lab. VI-IX F; 37En(UF)

- 22s—Agricultural Machinery Laboratory. Construction and adjustment of machines; measurement of drawbar horsepower; hitches. 1 cred.; prereq., 12 or reg. in 12; VI-VIII W; 49En(UF). Mr. Schwantes.
- 43s—Mechanical Laboratory. Instruction and laboratory practice in mechanical work, embracing cement work; soldering; welding; pipe fitting; electric wiring; harness repair, etc. 3 cred.; no prereq.; III-IV MWF; 20, 106En(UF). Messrs. Dent and Manson.
- 70s—Steam Boilers and Engines. Construction, operation, and care of simple steam engines and boilers. 3 cred.; prereq., Phys. 23, 24; II MWF; 216En(UF). Mr. Boss.
- 71f—Design and Economics of Agricultural Machinery. Machine and power costs of farm operations; operating principles and design problems. 3 cred.; prereq., 12, 13, 22, M.E. 27; VI-VIII T; 105En(UF); III-IV S; 49En(UF). Mr. Schwantes.
- 72s—Applied Electricity. Laboratory work in direct and alternating current machines as used on farms, including generators, motors, storage batteries, transformers, and complete isolated electric and hydroelectric plants (offered only in alternate years, 1939-40, etc. Alternate with C.E.37). 3 cred.; prereq., Phys. 9 or 43, 44. Mr. Hustrulid.
Lect. VI T; 101En(UF)
Lab. VII-IX T, VI-VIII Th; 101En(UF)
- 121f-122w-123s—Farm Power and Machinery Problems. Special studies of farm machinery and mechanical power for the farm. Tests, design, and adaptability to various farm conditions. 3 to 6 cred. per qtr.; prereq., 126; ar. Mr. Schwantes.
- 126w—Selection and Management of Agricultural Machinery. Special problems in economical power and machine combinations and their application to the farm. 3 cred.; prereq., 14, 71, Ag.Econ. 103; III MW; 103En(UF), lab. 3 hrs. ar.; 49En(UF). Mr. Schwantes.
- 221f-222w-223s—Farm Power and Machinery Research. Studies involving the design or utilization of power machinery used in connection with farm operation. 3 to 6 cred. per qtr.; prereq., 121; ar. Mr. Schwantes.

LAND RECLAMATION

- 19f—Elementary Surveying. Use of tape, transit, level, and traverse board in agricultural and forestry field problems, e.g., mensuration surveys, traverses, differential and profile leveling; plotting and mapping. Care and adjustment of instruments. 3 cred.; prereq., Draw. 3, M.&M. 12. Messrs. Roe, Neal, Manson, and Park.
Lect. IV T; 217En(UF)
Lab. I-III TTh; 305En(UF)
- 20s—Advanced Surveying. Topographic surveys by stadia and other methods, running simple curves, cross sectioning, plotting the survey, profile building, grade determination, and figuring of quantities in earthwork. 3 cred.; prereq., 19. Messrs. Neal and Park.
Lect. VI W; 107En(UF)
Lab. VI-VIII M, VII-IX W; 305En(UF)
- 28w—Land Clearing. Land clearing methods, machinery, and care and use of explosives. (Offered only in alternate years, 1939-40, etc.) 3 cred.; no prereq.; I TThS; 105En(UF). Mr. Schwantes.

- 51w—Land Reclamation. Principles and practices of soil erosion control, land drainage, and irrigation in relation to plant growth, farm operation, land development, and community interest. (Offered only in alternate years 1939-40, etc. Alternate with Soils 108.) 5 cred.; prereq., 19 or reg. in 19, Soils 6, M.&M. 86 and 143 or reg. in M.&M. 86 and 143; VI MTWThF; 105En(UF). Messrs. Roe, Neal, and Park.
- 101f-102w-103s—Advanced Drainage Problems. Special drainage problems including surface run-off, soil permeability, relation of soil and crop type to drainage, shape and regulation of water table in relation to root growth, etc. 3 to 6 cred. per qtr.; prereq., 51; ar.; 105En(UF). Messrs. Roe and Neal.
- 201f-202w-203s—Reclamation Research. Studies of design and functioning of reclamation works with special reference to soil types and soil water conditions. 3 to 6 cred. per qtr.; prereq., 101, 102, or 103 and one qtr. Mathematical Theory of Statistics; ar. Mr. Roe.

GENERAL

- 91f,w,s-92f,w,s-93f,w,s—Seminar. General agricultural engineering seminar. All staff members and all students above freshman classification required to attend throughout the year. Junior and senior students will give reports of their investigations on certain assigned problems. 1 cred. each for 92 and 93; no prereq. Mr. Boss and staff.
- 91f-92f-93f IX Th (second Th. of each month); 107En(UF)
 91w-92w-93w I T (second T. of each month); 107En(UF)
 91s-92s-93s IX W (second W. of each month); 103En(UF)

AGRONOMY AND PLANT GENETICS

- If,s—Farm Crops. Important field crops of the United States with emphasis upon those of local importance, distribution, economic importance, agricultural classification, cultural methods, and principles of improvement and seed selection. 3 cred.; no prereq.; IV MWF; 100Ad(UF). Mr. Johnson.

ANIMAL AND POULTRY HUSBANDRY

- 50s—Fundamentals of Livestock Production. Basic principles involved in the breeding, feeding, and management of livestock. 3 cred.; jr., sr.; no prereq.; I TThS; 3St(UF). (For professional agricultural engineering students only.) Mr. Peters.

ARCHITECTURE

HISTORY AND THEORY

- 1f-2w-3s—Introduction to Architecture. Discussions and problems to inform prospective students regarding the nature of architecture as an art and a profession. 1 cred. per qtr.; no prereq.; open only to students in architecture and students majoring in architecture; III W; 320E. Mr. Roy Jones.
- 4f-5w-6s—Graphic Representation. Projections, shades and shadows, perspective and other processes involved in architectural drawing. 2 cred. per qtr.; no prereq.; lect. II S; 320E; III-IV S; 402E. Mr. Heath.
- 51f-52w-53s—History of Architecture. The more significant architecture of the past, with particular reference to the geographic, social, and technical influ-

- ences which produced it. 2 cred. per qtr.; prereq., jr. standing; IV TF; 320E. Mr. Robb.
- 54f-55w-56s—History of Architecture (continued). 2 cred. per qtr.; prereq., 53; IV MW; 320E. Mr. Robb.
- 57f-58w-59s—Building Materials and Methods. Principles, methods, and materials involved in the standard types of building construction. 2 cred. per qtr.; no prereq.; I TTh; 320E. Mr. Heath.
- 101f-102w-103s—Building Materials and Methods (continued). 2 cred. per qtr.; prereq., 59; III TTh; 320E. Mr. Robert Jones.
- 104f—Housing. Social, economic, political, and technical phases of modern group housing. Intended for mature students in the College of Science, Literature, and the Arts and the Institute of Technology. 3 cred.; prereq., sr. or grad. standing; I MWF; 320E. Messrs. Robert Jones, Anderson, Chapin, Filipetti, Vaile, and Ludwig.
- 105w—Professional Practice. Relations of the architect to client, contractor, and fellow-practitioners. Procedures of architectural practice. 2 cred.; prereq., sr. standing; III MF; 320E. Mr. Roy Jones.
- 106s—Housing. Social, economic, political, and technical phases of modern group housing, with special reference to the architects' functions therein. 2 cred.; prereq., sr. standing; III MF; 320E. Mr. Robert Jones.
- 107f-108w-109s—Furniture and Decoration. Principles, methods, and materials involved in the furnishing and decorating of interiors. 2 cred. per qtr.; prereq., consent of instructor; II TTh; 320E. Miss Carter.

For special courses for architects in structural engineering see Mathematics and Mechanics 91, 92, 93 and Civil Engineering 38, 39, 41.

For special courses for architects in building equipment see Civil Engineering 171, Electrical Engineering 40, and Mechanical Engineering 164.

DESIGN

Completion of these courses is dependent on achievement, rather than time. Students will continue their registration until the course is completed and a mark is reported. An acceptable quality of work normally allows a rate of progress as indicated for each course.

Architectural

The object of the courses in architectural design is to develop the individual student's skill in creative effort as applied to the production of architecture. They provide opportunity for the student to exercise himself in all necessary phases of that creative effort, including especially research, composition, construction, and representation as four essential and interrelated parts of one unified process.

The courses consist of a series of problems, classified into three stages of advancement called grades, and culminating in a thesis whose satisfactory completion is a prerequisite for the degree in architecture. Most problems are done under criticism in which critics representing the several phases involved will collaborate. Certain problems are done entirely without criticism, in order to develop and test more fully the student's own power of independent achievement.

Work in all these courses is carried on simultaneously and continuously. A student may enter or leave them at any time he is judged ready to do so. They

are administered by a design committee consisting of the major and consulting critics and Mr. Roy Jones, chairman. See also Statement Concerning Courses in Architectural Design as issued by the School of Architecture.

- AD-If,w,s‡—Architectural Design, Grade I. 15 cred. (normally 5 cred. per qtr.): no prereq.; hrs. ar., including VI-VIII MTWThF for criticisms; 402E. Major critic, Mr. Cerny (Composition); consulting critics, Mr. Heath (Construction), Miss Carter (Decoration).
- AD-IIf,w,s‡—Architectural Design, Grade II. 18 cred. (normally 6 cred. per qtr.); prereq., AD-I; hrs. ar., including VI-VIII MTWThF for criticisms; 302E and 309E. Major critic, Mr. Robertson (Composition); consulting critics, Mr. Heath (Construction), Miss Carter (Decoration).
- AD-IIIf,w,s‡—Architectural Design, Grade III. 45 cred. (normally 9 cred. per qtr.); prereq., AD-II; hrs. ar., including VI-VIII MTWThF for criticisms; 317E. Major critic, Mr. Arnal (Composition); consulting critic, Mr. Robert Jones (Construction).
- AD-IVf,w,s—Architectural Thesis. 12 cred. (normally 12 cred. per qtr.); prereq., AD-III; hrs. ar., including VI-VIII M for criticisms; 317E; Major critic, Mr. Roy Jones; consulting critics, Mr. Arnal (Composition), Mr. Robert Jones (Construction).

Interior

Problems dealing with the composition, decoration, and furnishing of interiors.

- Arch. ID-If,w,s‡—Interior Design. 24 cred. (normally 8 cred. per qtr.); prereq., AD-II; hrs. ar., including VI-VIII MTWThF for criticisms; 309E. Major critic, Miss Carter (Composition and Decoration); consulting critic, Mr. Heath (Construction).

Stage

Problems dealing with the design of settings and costumes for dramatic productions.

- Arch. SD-If,w—Stage Design. 4 cred. (normally 2 cred. per qtr.); no prereq.; VI-VIII TTh; 405E. Mr. Burton.

DRAWING, PAINTING, AND MODELING

Completion of these courses is dependent on achievement rather than time. Students will continue their registration until the course is completed and a mark is reported. An acceptable quality of work normally allows a rate of progress as indicated for each course.

The object of these courses is to develop student's skill in esthetic expression through the medium of form and color. They consist of studio exercises divided into successive stages of advancement called grades. Work in most of the grades is carried on continuously. A student may enter or leave them at any quarterly interval he is judged ready to do so.

‡ A fee of \$2 per quarter is charged for this course.

DP-If,w,s‡—Drawing and Painting, Grade I. Studies in graphic expression dealing with simpler compositions in form and color. 6 cred. (normally 2 cred. per qtr.); no prereq. Messrs. Young and Turner.

- DP-If (1) II-III MF; 417E (for beginners only)
 (2) VI-VII MTh; 417E (for beginners only)
 (3) II-III TTh; 417E (for students with at least one quarter's experience)
 (4) VI-VII TF; 417E (for students with at least one quarter's experience)
- DP-Iw (1) II-III MF; 417E (for students with at least one quarter's experience)
 (2) VI-VII MTh; 417E (for students with at least one quarter's experience)
 (3) II-III TTh; 417E (for beginners only)
 (4) VI-VII TF; 417E (for students with at least one quarter's experience)
- DP-Is (1) II-III MF; 417E (for students with at least one quarter's experience)
 (2) VI-VII MTh; 417E (for students with at least one quarter's experience)
 (3) II-III TTh; 417E (for students with at least one quarter's experience)
 (4) VI-VII TF; 417E (for beginners only)

DP-IIf,w,s‡—Drawing and Painting, Grade II. Studies in graphic expression dealing especially with composition in color. 6 cred. (normally 2 cred. per qtr.); prereq., DP-I. Mr. Young.

- DP-IIf (1) II-III TTh; 417E (for beginners only)
 (2) II-III WF; 417E (for beginners only)
 (3) VI-VII TF; 417E (for students with at least one quarter's experience)
- DP-IIw,s (1) II-III TTh; 417E (for students with at least one quarter's experience)
 (2) II-III WF; 417E (for students with at least one quarter's experience)
 (3) VI-VII TF; 417E (for beginners only)

DP-IIIf,w,s‡—Drawing and Painting, Grade III. Studies in graphic expression dealing especially with composition based on the human figure. 6 cred. (normally 2 cred. per qtr.); prereq., DP-II; II-III MW; 417E. Mr. Burton.

DP-IVf,w,s‡—Drawing and Painting, Grade IV. Studies in graphic expression dealing especially with advanced figure composition and mural decoration. 6 cred. (normally 2 cred. per qtr.); prereq., DP-III; VI-VIII MW; 405E. Mr. Burton.

DP-Vf,w,s—Drawing and Painting, Grade V. For graduate students only. Continuation of DP-IV. 6 cred. (normally 2 cred. per qtr.); prereq., DP-IV or equivalent; hrs. ar.; 417E. Mr. Burton.

M-If,w,s‡—Modeling, Grade I. Studies in plastic expression dealing with simpler compositions. 6 cred. (normally 2 cred. per qtr.); no prereq.; VI-VIII MW; 405E. Mr. Burton.

M-Iaf,w,s—Modeling for Architects. Studies in plastic expression as applied to architectural composition. 2 cred. (normally 2 cred. per qtr.); prereq., reg. in Arch. Design; II-III TTh; 405E. Mr. Burton.

M-IIf,w,s‡—Modeling, Grade II. Studies in plastic expression dealing especially with the human figure. 6 cred. (normally 2 cred. per qtr.); prereq., M-I; VI-VIII MW; 405E. Mr. Burton.

M-IIIf,w,s—Modeling, Grade III. For graduate students only. Continuation of M-II. 6 cred. (normally 2 cred. per qtr.); prereq., M-II or equivalent; hrs. ar.; 405E. Mr. Burton.

IHP-If—Illustration. Studies in graphic expression as applied to illustration. 2 cred. (normally 2 cred. per qtr.); prereq., DP-I; VI-VII MTh; 417E. Mr. Young.

IHP-IIw,s—Hand Print Processes. Studies in graphic expression as applied to engraving, etching, drypoint, and lithograph. 4 cred. (normally 2 cred. per qtr.); prereq., DP-I; VI-VII MTh; 417E. Mr. Young.

‡ A fee of \$1 per quarter is charged for this course.

ASTRONOMY

- 51w—General Astronomy. A survey course covering the fundamental facts and principles of astronomy. 3 cred.; prereq., M.&M. 12; IV MWF; 133Ph. Mr. Luyten.
- 101f*—Celestial Mechanics. 3 cred.; prereq., M.&M. 25; II MWF; ar. Mr. Luyten.
- 140f*—Method of Least Squares. The combination and adjustment of observations and the discussion of their precision as applied especially to engineering, physics, astronomy, and psychology. 3 cred.; prereq., 51 or 11 and M.&M. 24; ar. Mr. Luyten.

BACTERIOLOGY AND IMMUNOLOGY

- 41f,w,s,su‡—General Bacteriology. Principles and technique of general bacteriology; studies in the morphologic and biologic characters of the common bacteria; culture media; principles of sterilization and disinfection; examination of air, water, milk, food; relation of bacteriology to the industries. Lectures and laboratory. 5 cred.; prereq., 4 cred. of zoology or botany and Inorg. Chem. 10; VII-IX MWF; MH.
- 121f-122w§—Physiology of Bacteria. Effect of environment on growth; enzymes; food requirements; carbohydrates, protein, and fat metabolism; products of growth; dormancy; death. 6 cred.; prereq., 41 and 8 cred. of organic chemistry or biochemistry; III TThS; 201MH. Messrs. Green and Halvorson.
- 123s—Applied Bacteriology. Industrial fermentations; bacteriology of water and sewage; interpretation of bacteriological data. 3 cred.; prereq., 121-122; III TThS; 201MH. Mr. Halvorson.

BOTANY

- If,w,s—General Botany. Structure, physiology, life histories, and evolution of plants. Lectures and quizzes. 4 cred.; all; no prereq. Mr. Huff.
- | | | | |
|------|---------------------------|--------------|--------------------|
| If | Lect. Bot. Aud. | (1) III TThS | (2) VI W, VI-VII F |
| | Quiz Bot. Aud. | (1) I T | (6) IV T |
| | | (2) II T | (7) V T |
| | | (3) II Th | (8) V Th |
| | | (4) III M | (9) VI M |
| | | (5) III W | |
| 1w,s | Lect. III TThS; Bot. Aud. | | |
| | Quiz Bot. Aud. | (1) I T | (4) III M |
| | | (2) II T | (5) IV M |
| | | (3) II Th | (6) IV T |

CHEMISTRY

INORGANIC CHEMISTRY

(A fee of \$2 per quarter is charged for Courses 1 to 17, inclusive.)

- 1f,su-2w-3s—General Inorganic Chemistry. (Pre-med., pre-dent.) 1. Study of the general laws of chemistry and of the non-metals and their compounds.

* Courses 101 and 140 are usually offered in alternate years, and only one will be given in each year, depending on the demand.

‡ Microscope required. Student (except medical) may obtain use of microscope by purchasing \$1.50 microscope card from bursar.

§ To receive credit for any part of this course, a student must complete both quarters.

2. Continuation of Course 1. 3. Metals and their compounds. Continuation of Course 2. 4 cred. per qtr.; no prereq. Messrs. Barber and Pervier.

Lect. VI MWF; 225C

Quiz. VI T; ar C

Lab. VII-IX T; 290C

1af-2aw-3as—General Inorganic Chemistry. (Agr., arch.) 1a and 2a are similar to 1 and 2. 3a is Qualitative Analysis. 4 cred. per qtr.; no prereq. Messrs. Barber and Pervier.

1af-2aw Lect. VII MWF, 225C; VIII F, 100C

Lab. VIII-IX MW; 210C

3s Lect. VII MWF; 225C

Lab. VIII-IX MF; 210C

4f,su-5w—General Inorganic Chemistry. Study of the general laws of chemistry and of the non-metals and their compounds. More intensive than Course 1f-2w-3s. 4 cred. per qtr.; prereq., high school chemistry. Messrs. Reyerson, Heisig, and Maynard.

4f (Engrs. and miners)

Lect. IV TS, III Th; 100C

Lab. (1) I-III T; 110C

(2) II-IV W; 110C

Quiz VIII F; 100C, 305E

(3) I-III F; 110C

(4) VI-VIII T; 110C

Engineering and mining students doing unsatisfactory work in this course will be required to take 2 additional hours; IX TF; 225, 325C.

(Pre-med.)

Lect. VI MWF; 100C

Lab. VII-IX T; 210C

Quiz VI T; 100C

(Pre-dent., med. tech.)

Lect. VII MWF; 325C

Lab. VII-IX Th; 210C

Quiz VI Th; 100C

5w (Engrs. and miners)

Lect. IV TS, III Th; 100C

Lab. (1) I-III T; 110C

(2) II-IV W; 110C

Quiz IX T; 100C

(3) I-III F; 110C

(4) VI-VIII T; 110C

(Pre-med.)

Lect. VI MWF; 100C

Lab. VII-IX T; 210C

Quiz VI T; 100C

(Pre-dent., med. tech.)

Lect. VII MWF; 325C

Lab. VII-IX Th; 210C

Quiz VI Th; 100C

6f,su-7w—General Inorganic Chemistry. Study of the general laws of chemistry and of non-metals and their compounds. 5 cred. per qtr.; no prereq. Miss Cohen.

Lect. II MWF, 225C; I Th, 410C

Lab. § (1) I-III T, II-III Th; 210C

(2) I-II TS, II Th; 210C

8s*—Qualitative Chemical Analysis (S.L.A. and pharm.) Laboratory work in systematic qualitative analysis with lectures on solutions, ionization, chemical and physical equilibria, oxidation, and reduction, etc. 5 cred.; prereq., 7. Miss Cohen.

Lect. II MWF; 225C

Lab. (1) I-II TThS; 210C

(2) I-III TTh; 210C

9f,w,su-10w,s—General Inorganic Chemistry. Course 9. Study of general laws of chemistry and of non-metals and their compounds. More intensive than Courses 6 and 7. Course 10. The metals and their compounds. 5 cred. per

* To be followed by Course 13, not 12.

§ Freshmen entering the School of Chemistry without credit in high school chemistry must register in this section and for two additional hours; I-II S in both 6 and 7.

qtr.; prereq., one year of high school chemistry. Mr. Sneed, Miss Cohen, and Messrs. Klug and

9f-10w	Lect.	(1) II MWF; 100C (Chem., S.L.A.) (2) VII MWF; 100C (Agr.)	
9f	Lab.	(1) I-III ThS; 290C (Chem., S.L.A.) (2) I-II TThS; 290C (Chem., S.L.A.) (3) VIII-IX MWF; 110C (Agr.)	
10w	Lab.	(1) I-III ThS; 290C (Chem., S.L.A.) (2) I-II TThS; 290C (Chem., S.L.A.) (3) I-III TTh; 290C (Chem., S.L.A.) (4) VIII-IX MWF; 110C (Agr.)	
9w-10s	Lect.	(1) III MWF; 325C	(2) III MWF; 410C
	Lab.	VI-VII MWF; 210C, 290C	

11f,s,su†—Qualitative Chemical Analysis. Laboratory work in systematic qualitative analysis with lectures on solutions, ionization, chemical and physical equilibria, oxidation and reduction, etc. 4 cred.; prereq., 3 or 5. Mr. Reyerson, Miss Cohen, and Mr. Maynard.

11f	Lect.	IV MWF; 325C	Lab.	VI-IX F; 210C
11s	(Pre-med.) Lect.	VI MWF; 100C	Lab.	VI-IX T; 210C
	(Pre-dent., med. tech.)			
	Lect.	VII MWF; 100C	Lab.	VI-IX Th; 210C

12f,s,su†-13f,w‡—Qualitative Chemical Analysis. Laboratory work in systematic qualitative analysis with lectures on solutions, ionization, chemical and physical equilibria, oxidation, reduction, etc. 5 cred. per qtr.; prereq., 8 or 10. Messrs. Sneed, Heisig, and Maynard.

12f	Lect.	I TThS; 225C	Lab.	I-III MW; 290C
12s	Lect.	II MWF; 100C		
	Lab.	(1) I-III ThS; 290C	(2)	I-III TTh; 290C
13f,w	Lect.	VI WF; 325C		
	Lab.	VII-VIII M, VII-IX; WF; 290C	Quiz	VI M; 335EE(f), 410C(w)

14f,su-15w—General Inorganic Chemistry. (Engrs. and miners without high school chem.) General laws of chemistry; the non-metals, the metals, and their compounds. 4 cred. per qtr.; no prereq. Mr. Maynard.

	Lect.	IV TS, III Th; 225C	Lab.	(1) III-IV M, I-III F; 110C
	Quiz	IX F; 100C	(2)	VI-VIII T, VI-VII Th; 110C

16s—Qualitative Chemical Analysis. (Engrs. and miners) Laboratory work in systematic qualitative analysis with lectures on solutions, ionization, chemical and physical equilibria, oxidation and reduction, and other subjects pertinent to qualitative analysis. 5 cred.; prereq., 5 or 15. Messrs. Heisig and Maynard. (Engrs. and miners who entered with high school chem.)

	Lect.	IV TS, VI Th; 100C		
	Lab.	(1) I-III T, VII-IX Th; 110C	(3)	III-IV M, I-IV F; 110C
		(2) II-IV W, I-III S; 110C	(4)	VI-IX T, VI-VII W; 110C
	(Engrs. and miners who entered without high school chem.)			
	Lect.	IV TS, VI Th; 225C		
	Lab.	(5) III-IV M, I-IV F; 110C	(6)	VI-IX T, VI-VII W; 110C

51s—Senior Qualifying Examination in General Inorganic Chemistry and Qualitative Analysis. Required of juniors in the School of Chemistry.* Prereq., Anal. Chem. 1, 2. Mr. Sneed.

96f-97w-98s—Senior Thesis. 5 cred. per qtr.; sr.

101s—History of Chemistry. Historical development of the theories of chemistry from the period of the ancients to the present time is covered by this course,

* See New Requirement for Graduation in the School of Chemistry on p. 24.

† Course 11f,su or 12f,su may be taken by students registered in the College of Engineering and Architecture and School of Mines and Metallurgy in place of 16s.

‡ Students who have completed Course 8 should omit Course 12 and take Course 13.

- particular emphasis being given to modern theories and laws. 2 cred.; prereq., Org. Chem. 52 or permission of instructor. Miss Cohen.
- 102s—Semi-micro Qualitative Analysis. A course designed to acquaint the student with the universally applicable method and underlying principles in the identification of the more common cations by use of drop reactions on spot plate and filter paper, and separation by use of the centrifuge. 3 cred.; prereq., Anal. Chem. 1, 2. Mr. Barber.
- 103f-104w-105s—Advanced Inorganic Chemistry. Discussion of the periodic system and the chemistry of the elements and their compounds and of special subjects of inorganic chemistry such as valency, oxidation and reduction, complex ions, etc. 3 cred. per qtr.; prereq., Anal. Chem. 1, 2, Org. Chem. 52; I TThS; 215C. Mr. Sneed.
- 109w-110s—Synthetic Inorganic Chemistry. Methods of preparation and purification of inorganic compounds of special interest. Current literature. 3 to 5 cred. per qtr.; prereq., 13; 2 lect., with lab.; ar. Mr. Heisig.
- 115su—Commercial Products and Their Analysis. Study of current commercial products, their composition and methods of analysis. 5 cred.; prereq., Anal. Chem. 1 and 2; lect. and lab. Mr. Barber.
- 117s—Glassblowing. Exercises in the more important operations in building chemical apparatus. 1 cred.; jr., sr., grad.; no prereq.; VII-IX W; 10C. Mr. Greinke.
- 120f—Crystal Chemistry. A discussion of the methods, results, and applications of crystal analysis with particular emphasis on the structure and chemistry of inorganic compounds. Nature of crystals; nature and production of X-rays; interaction of X-rays and crystals; methods of crystal analysis. 3 cred. per qtr.; prereq. Phys. Chem. 103. Mr. Klug.
- 121w-122s—Crystal Chemistry. Structure of the elements; crystal chemistry of the various types of compounds; structure and chemistry of inorganic compounds, hydrates, ammoniates, intermetallic compounds, silicates, glasses; size and shape of atoms and ions in crystals; fiber structure; molecular rotation in solids; lattice energies; applications to qualitative and quantitative analysis and to colloidal phenomena. 3 cred. per qtr.; prereq., 120. Mr. Klug.
- 134f-135w-136s—Seminar: Modern Problems in Inorganic Chemistry. 1 cred.; prereq., Anal. Chem. 1 and 2 and Phys. Chem. 103. Mr. Sneed.
- 301f,su-302w-303s—Research in Inorganic Chemistry. Cred. ar. Messrs. Sneed, Reyerson, Miss Cohen, and Messrs. Barber, Heisig, and Klug.

ANALYTICAL CHEMISTRY

(A fee of \$2 per quarter is charged for Courses 1 to 9, inclusive.)

- 1w,su-2s—Quantitative Analysis. Introductory courses covering the general principles and methods of quantitative analysis. Typical problems are assigned and attention given to proper laboratory practice. Course 1, Gravimetric Analysis. Course 2, Volumetric Analysis. 5 cred. per qtr.; prereq., Inorg. Chem. 13. Mr. Geiger.
- Lect. VI M; 325C
 Quiz VI F; 410C
 Rec. (1) VI W; 111C (3) VII W; 111C
 (2) VIII W; 111C
 Lab. (1, 2) any 9 hrs. on MWF afternoons (3)_w I-IV T, I-III Th, I-II S; 310C
 (3)_s I-IV T, VII-IX T, I-II S; 310C

7f,s,su—Quantitative Analysis. (Pre-med.) Introductory courses covering the general principles and methods of quantitative analysis, both gravimetric and volumetric. Typical problems are assigned and attention is given to proper laboratory practice. 4 cred.; prereq., Inorg. Chem. 8, 11, 12, or 16. Messrs. Geiger and Sarver.

- 7f Lect. (1, 2) VI M; 325C (3) VI T; 325C
 Quiz (1, 2) VI F; 410C
 Rec. (1) VI W; 111C (Limit 35) (3) VI Th; 325C
 (2) VII W; 111C (Limit 35)
 Lab. (1, 2) any (other) 8 hrs. on MWF (3) VII-IX TTh, I-III or II-IV S; 310C
 afternoons; 310C
- 7s Lect. VI T; 325C
 Rec. VI Th; 325C
 Lab. VII-IX TTh, I-III or II-IV S; 310C

9w—Quantitative Analysis. (Dentists, engineers, miners.) Short introductory course covering general principles of quantitative analysis, both gravimetric and volumetric. Typical problems are assigned and attention given to proper laboratory practice. 3 cred.; prereq., Inorg. Chem. 8, 11, or 16. Mr. Sarver.

- Lect. VI Th; 325C
 Rec. VI T; 325C
 Lab. VII-IX TTh; 310C

52f—Fundamentals of Analytical Chemistry. Introductory lecture and recitation course covering the general principles of gravimetric and volumetric analysis for advanced standing and graduate students who have inadequate knowledge of the subject. One lect.; no rec.; no cred.; ar. Mr. Geiger.

53s—Senior Qualifying Examination in Quantitative Analysis. Required of juniors in the School of Chemistry.* Prereq. 1, 2. Mr. Kolthoff.

96f,su-97w-98s—Senior Thesis. 5 cred. per qtr.; sr. Messrs. Kolthoff, Geiger, Sandell, and Sarver.

101w-102s—Quantitative Analysis. General principles, methods, and procedure of quantitative analysis, both gravimetric and volumetric. Typical problems assigned and attention given to proper laboratory practice. 5 cred. per qtr.; prereq., Inorg. Chem. 13; VI-IX MWF; 325, 310C. Mr. Geiger.

103f—Quantitative Inorganic Microanalysis. Representative methods of micro- and semi-microgravimetric, volumetric, and colorimetric analysis. 3 cred.; prereq., 1, 2; 1 lect., 6 hrs. of lab. ar. Class limited to 16 students. Mr. Sandell.

104s—Qualitative Microchemistry. Use of microscope. Technique of handling small amounts of materials, inorganic qualitative analysis by means of crystal reactions and modern spot reactions. 3 cred.; prereq., 1, 2; 1 lect., 6 hrs. of lab.; ar. Mr. Sandell.

105w—Polarizing Microscope. Its use and application to chemistry. Identification of substances. 3 cred.; prereq., Phys. Chem. 101. Mr. Sandell.

- Lect. VI F; 215C
 Lab. ar.

106f-107w-108s—General Technical Analysis. Analysis of commercially important materials such as iron, steel, paper, and glass, also analysis of food materials. Use of microscope in technical problems. Quantitative analysis of heterogeneous mixtures, particle size determinations. 2 or 3 cred.; prereq., 1, 2; 1 lect. and 1 lab. hr. ar. Mr. Sandell.

109f,w,s—Rock Analysis. Laboratory course covering the technique of rock analysis. 3 cred.; prereq., 1, 2; 8 lab. hrs. per week ar.; 214P. Mr. Ellestad.

* See New Requirement for Graduation in the School of Chemistry on p. 24.

- 123f,su—Advanced Analytical Chemistry. Analysis of complex materials by modern methods. 3 cred.; prereq., 1, 2, or by permission; 1 lect. ar.; 6 hrs. of lab. ar. Mr. Sarver.
- 127w—Use of Organic Reagents in Analytical Chemistry. Use of organic reagents in the detection and quantitative determination (gravimetric, volumetric, and colorimetric) of cations and anions. 3 cred.; prereq., 1, 2, and Org. Chem. 52; 1 lect., 6 hrs. of lab. ar. Mr. Sarver.
- 131f—Applications of Indicators in Neutralization Reactions and pH Determinations. 3 cred.; prereq., 1, 2, and Phys. Chem. 103; VI MW; 315C; lab. hrs. ar. Mr. Kolthoff.
- 132w*—Electrometric Measurements and Titrations. Application of potentiometric and conductometric methods in analytical work. 3 cred.; prereq., 1, 2, and Phys. Chem. 103. Mr. Kolthoff.
Lect. VI MW; 315C
Lab. ar.
- 134f-135w-136s—Seminar: Modern Problems in Analytical Chemistry. 1 cred. per qtr.; prereq., 1, 2, and Phys. Chem. 103; III T; 315C. Mr. Kolthoff.
- 137s—Advanced Volumetric Analysis. 3 cred.; prereq., 131; 2 lect. ar.; lab. ar. Mr. Kolthoff.
- 138s—Advanced Gravimetric Analysis. Course in the formation, properties of and coprecipitation with ionic lattices. 2 to 3 cred.; prereq., Phys. Chem. 103; 2 lect. ar.; lab. ar. Mr. Kolthoff.
- 140w—Water Analysis. Analysis of potable water with interpretation of results. 2 cred.; prereq., 1, 2. Mr. Sandell.
- 201f-202w-203s—Selected Topics in Analytical Chemistry. 3 cred. per qtr.; prereq., 1, 2, and 123. Mr. Kolthoff.
- 204s—Modern Theories of Acidity and Basicity. 2 cred.; prereq., Phys. Chem. 103; ar. Mr. Kolthoff.
- 301f,su-302w-303s—Research in Quantitative Analysis. Cred. ar. Messrs. Kolthoff, Geiger, Sandell, and Sarver.

ORGANIC CHEMISTRY

- 1f,w,su-2w,s,su†—Elementary Organic Chemistry. (Pre-med., pre-dent., pharm.) Discussion of important classes of organic compounds, both aliphatic and aromatic. Laboratory work includes the preparation of typical substances. 4 cred. per qtr.; prereq., Inorg. Chem. 11. Messrs. Koelsch and Arnold.
- 1f-2w Lect. I MWF; 100C
Lab. conference II T; 225C
Quiz I T; ar
Lab. (1) VI-IX T; 390C
(2) VI-IX W; 390C
(3) I-IV S; 390C
- 1w-2s Lect. IV MWF; 100C
Lab. conference V T; 100C
Quiz IV T; ar
Lab. (1) VI-IX W; 390C
(2) VI-IX Th; 390C
(3) I-IV S; 390C
- 51f-52w†-153s—Elementary Organic Chemistry. (All except pre-med., pre-dent., pharm.) Discussion of the important classes of organic compounds, both

* For permissible substitute, see page 71.

† To receive credit for any part of this course a student must complete the parts preceding the dagger.

aliphatic and aromatic, together with some heterocyclic compounds. Laboratory work includes the preparation of typical substances. Course 153 is a prereq. to all other advanced courses in organic chemistry. 5 cred. per qtr.; prereq., 15 cred. in chemistry. Messrs. Smith, Lauer, and Arnold.

Lect. III MWF; 100C

Lab. conference (f,w) III Th, 325C, 410C; III S, 100C—Mr. Arnold

(s) III Th, I S; 100C—Mr. Arnold

Lab. (1) II-IV, VI-VIII T; 390C—Mr. Arnold

(2) VI-VIII TTh; 390C

(3) VI-VIII WF; 390C

54f-55w†-156s—Elementary Organic Chemistry (without laboratory). (All except pre-med., pre-dent., pharm., and chem. majors.) Discussion of the important classes of organic compounds, both aliphatic and aromatic, together with some heterocyclic compounds. General discussion of organic laboratory practice. 3 cred. per qtr.; prereq., 15 cred. of chemistry; III MWThF; 100C. Messrs. Smith and Lauer.

96f-97w-98s—Senior Thesis. 5 cred. per qtr.; sr. May be taken with any member of the Organic Chemistry Division staff.

105f-106w-107s—Advanced Organic Chemistry. Advanced descriptive course covering the field of organic chemistry, together with an introduction to the literature of organic chemistry. Lectures and outside reading. Ability to read German is assumed. 3 cred. per qtr.; prereq., 153 or equiv. I MWF; 225C. Mr. Smith.

110f‡—Organic Qualitative Analysis. Reactions of typical functional groups, identification of pure organic compounds, separation and identification of constituents of mixtures. 5 cred.; prereq., 153 or equiv.; lect. IV T and 1 hr. ar.; 315C; 9 hrs. of lab. work ar. Mr. Arnold.

130s—Organic Quantitative Analysis. Methods of proximate and ultimate analysis of organic compounds, with special attention to semi-micro methods. 2 or 3 cred.; prereq., 153 and Anal. Chem. 1 and 2; ar. One lecture and 3 or 6 hrs. lab. work per week. Mr. Lauer.

139f,w,s—Advanced Organic Chemistry Laboratory Work. Selected laboratory problems of an advanced nature, including some original work. Ability to read German is assumed. Students are advised to take this course during the winter quarter. Permission of instructor is required to take it at any other time. 2 to 5 cred.; prereq., 153. Mr. Koelsch.

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., 153; IV MWF; 315C. Mr. Koelsch.

140f-142w-143s—The Chemistry of Natural Products. Discussion of the organic chemistry of important classes of natural products. 3 cred. per qtr.; prereq., 153; 140f (Terpenes and Alkaloids) IV MWF; 315C. Mr. Koelsch. 142w-143s, I MWF; 315C. Messrs. Lauer and Arnold. (Not offered in 1938-39.)

153s—See 51f-52w-153s.

156s—See 54f-55w-156s.

201f-202w-203s—Organic Chemistry Seminar. 1 hr. per week. 1 cred. per qtr. Required of all graduate students taking major work in organic chemistry. Messrs. Smith, Koelsch, Lauer, and Arnold.

† To receive credit for any part of this course a student must complete the parts preceding the dagger.

‡ A charge of \$10 is made to cover special chemicals in this course.

- 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. I MWF; 315C. Mr. Lauer.
- 212s—Physico-Organic Chemistry. Contributions made to organic chemistry by kinetic and equilibrium studies of organic reactions, including mechanisms of catalytic and ionotropic reactions; and an introduction to the current electronic formulations of organic reactions. Lectures, outside reading, and a term paper are required. 4 cred.; prereq., 107, Phys. Chem. 103, and calc., or permission of the instructor. I MWF; 315C. Mr. Arnold.
- 301f-302w-303s—Research in Organic Chemistry. Cred. ar.; prereq., 110. Messrs. Smith, Koelsch, Lauer, and Arnold.

PHYSICAL CHEMISTRY

- 96f-97w-98s—Senior Thesis. 5 cred. per qtr.; ar.
- 101f-102w-103s—Physical Chemistry. General survey of the subject. 3, 4, or 5 cred. per qtr., depending on the amount of lab. work; prereq., 2 yr. coll. chem., 1 yr. coll. phys. Knowledge of calculus is advisable. Messrs. MacDougall and Hull.
 Lect. IV MWF; 225C
 Rec. IV S; 325C, 410C, 111C
 Lab. conf. (for stud. registered for 5 cred.)
 (1) VI W; 410C
 (2) VI T; 410C
 Lab. (1) VI-VIII M, VII-VIII W; 190C (for Chem.E.)
 (2) VII-VIII T, VI-VIII Th; 190C (for Chem.)
- 107f-108w—Elementary Physical Chemistry (Pre-med.) 4 cred. per qtr.; prereq., 2 yr. coll. chem., 1 yr. coll. physics. Mr. Glockler.
 Lect. III MWF; 225C
 Rec. VIII T; ar.
 Lab. (1) I-III T; 190C
 (2) I-III Th; 190C
- 110su—Survey of Physical Chemistry. General discussion of physical chemistry from the kinetic theory viewpoint, placing special emphasis on the gas laws, chemical equilibria, and the chemistry of solutions. Recent developments in theories of atomic structure. 3 cred.; prereq., 1 year of inorg. chem. and qual. anal., 1 qtr. of quant. anal., 1 yr. of phys., anal. geom.
- 113f—Fundamentals of Reaction Kinetics. Order of reaction, collision theory, activation, chain reactions especially in gaseous systems. 3 cred.; prereq., 103. (Not offered in 1938-39.)
- 114w—Kinetics of Reactions in Liquid Solutions and in Heterogeneous Systems. Effect of solvents and electrolytes on reaction velocity. Homogeneous and heterogeneous catalysis. 3 cred.; prereq., 113. (Not offered in 1938-39.)
- 116f—Advanced Physical Chemistry. Modern theory of the atom and the molecule on the principles of wave mechanics with an introduction based on Bohr theory. 3 cred.; prereq., 103 and calculus. Mr. Glockler.
- 117w—Advanced Physical Chemistry. Application of thermodynamics to chemical problems, free energy calculations by classical methods and by the use of spectroscopic data. 3 cred.; prereq., 103 and calculus. Mr. Glockler.
- 118s—Advanced Physical Chemistry. Physical chemistry of the solid state on the basis of modern concepts. 3 cred.; prereq., 103 and calculus. Mr. Glockler.

- 128f-129w-130s—Colloid Chemistry. General survey of surface chemistry, adsorption, catalysis, electrokinetic phenomena, lyophilic and lyophobic colloids. 2 cred. per qtr.; prereq., 103. Mr. Reyerson.
- 131f-132w-133s—Colloid Chemistry Laboratory. Cred. and hrs. ar. Must be preceded or accompanied by 128, 129, or 130. Mr. Reyerson.
- 161f-162w—Nuclear Chemistry and Radioactivity. The properties of atomic nuclei; radioactive disintegration; properties of radioactive elements and of their radiations; transmutation and artificial radioactivity; modern theories of nuclear structure. 3 cred. per qtr.; prereq., 103; IV MWF; 215C. Mr. Hull.
- 175s—Photochemistry. General survey, including a discussion of spectroscopy, with particular reference to the visible and ultraviolet adsorption spectra of molecular gases. 3 cred.; prereq., 103 and Phys. 33. (Not offered in 1938-39.)
- 180f—General Survey of Colloid Chemistry. 3 cred.; prereq., 103; IV MWF; 115C. Mr. Freundlich.
- 181w—Colloids in Industry. 3 cred.; prereq., 180 or 128-129; IV MWF; 115C. Mr. Freundlich.
- 182s—Colloids in Biology and Medicine. 3 cred.; prereq. 180; IV MWF; 115C. Mr. Freundlich.
- 201f-202w-203s—Thermodynamics and Chemistry. A detailed study of the principles of thermodynamics and their application to physical and chemical phenomena. 4 cred. per qtr.; prereq., 103 and calculus. (Not offered in 1938-39.)
- 204f-205w-206s—Kinetic Theory and Atomistics. Kinetic theory of gases and liquids, crystal structure, structure of atom, quantum theory. 4 cred. per qtr.; prereq., 103 and calculus; II TThS; 115C. Mr. MacDougall.
- 211f-212w-213s—Advanced Physical Chemistry Laboratory. To accompany or follow any of the advanced courses in physical chemistry. Cred. ar.; prereq., 103. Mr. MacDougall.
- 221f-222w-223s—Colloid Seminar. 1 cred. per qtr. Messrs. Freundlich and Reyerson.
- 251f-252w-253s—Physical Chemistry Seminar. For students taking advanced courses in physical chemistry. 1 cred. per qtr.; II M; 215C. Mr. MacDougall and staff.
- 264f,w,s—Radioactivity Laboratory. Use and standardization of electroscopes, radioactive measurements, and quantitative determination of radium in ores, minerals, waters, and plant products. 1 or 2 cred. Must be preceded or accompanied by 161. Mr. Hull.
- 301f,su-302w-303s—Research in Physical Chemistry, including work in electrochemistry, photo- and radio-chemistry, and colloids. Cred. ar. Messrs. MacDougall, Freundlich, Glockler, Kolthoff, Lind, Reyerson, and Hull.

CHEMICAL ENGINEERING

- 1w,s—Power Plant Chemistry. (M.E. and Min.E.) Proximate analysis of coal, determination of calorific power; technical analysis of flue gases and furnace gases. 3 cred.; prereq., Inorg. Chem. 16. Mr. Stoppel.
- 1w Lect. III T; 215C
 Rec. III Th; 215C
 Lab. II-IV MF; 10C
- 1s Lect. and rec. ar.
 Lab. (6 hrs. afternoon) ar.
- 31s—Chemistry of Engineering Materials. Application of general chemistry in engineering practice. Technology and properties of wood, iron, and steel, al-

- loys, fuels, water, cements, coating materials, etc. 3 cred.; prereq., Inorg. Chem. 16; IV MWF; 115C. (Not open to chem. engrs.) Mr. Montonna.
- 76f-77w—Applied Electrochemistry. Application of the electric current to chemical processes. Laws and phenomena of electrochemistry, batteries, electroplating, electric furnace construction and operation, and electrochemical products. Open to engineers who have had one year of chemistry and one year of physics. Class and laboratory work. 3 cred. per qtr. Mr.
- 80s—Chemical Engineering Materials. The technology, physical and chemical properties, and economic considerations of materials used in the construction of chemical engineering equipment and plants. Ferrous and non-ferrous metals and alloys, woods, cement, and ceramic materials, textiles, rubber, protective materials, etc. 1 cred.; prereq., Inorg. Chem. 13; II TS; 325C. Mr. Mann.
- 96f-97w-98s—Senior Thesis. 5 cred. per qtr.; sr.
- 101f,su—Unit Operations. Principles and materials of construction, operation, and uses of the unit operation equipment. Lectures and recitations. 3 cred.; prereq., 80, Anal. Chem. 1, 2; I MTWFS; 325C. Mr. Mann.
- 102s—Unit Operations. Industrial stoichiometry. Problems in combustion of fuels, heat balances. Manufacture of producer gas, industrial gases, and burning of limestone. 3 cred.; prereq., 101. Messrs. Montillon, Rogers, and Grove.
 (1) II MWF; 115C (3) II MWF; 315C
 (2) II MWF; 111C
- 103f—Unit Operations. Problems in fluid flow and heat transfer and their applications including economic balance. 3 cred.; prereq., 101. Messrs. Montillon, Rogers, and Grove.
 (1) II MWF; 111C (3) II MWF; 315C
 (2) II MWF; 115C
- 104w—Unit Operations. Problems in evaporation, humidification and air conditioning, drying, distillation, and filtration. 3 cred.; prereq., 101. Messrs. Montillon, Rogers, and Grove.
 (1) II MWF; 111C (3) II MWF; 115C
 (2) II MWF; 315C
- 105f—Gas and Fuel Analysis. The chemical analysis of solid and gaseous fuels with a determination of their calorific value and methods of testing industrial gases. 3 cred.; prereq., Anal. Chem. 1, 2. Mr. Stoppel.
 Lect. I Th; 325C
 Rec. II S; 225C
 †Lab. (1) VI-IX M; 10C (4) VI-IX W; 10C
 (2) II-V T; 10C (5) VI-IX Th; 10C
 (3) VI-IX T; 10C (6) VI-IX F; 10C
- 106w—Petroleum and Petroleum Products. Technology and testing of petroleum products, principally gasoline, lubricating oils, and fuel oils. 3 cred.; prereq., Org. Chem. 51. Mr. Stoppel.
 Lect. I Th; 225C
 Rec. II S; 225C
 †Lab. (1) VI-IX M; 10C (4) VI-IX W; 10C
 (2) II-V T; 10C (5) VI-IX Th; 10C
 (3) VI-IX T; 10C (6) VI-IX F; 10C
- 107f—Petroleum Refinery Engineering. Unit processes and chemical engineering design principles involved in the manufacture of the principal petroleum products. Production of motor fuel by extraction from natural gas, distillation of crude oil, cracking and reforming, and by polymerization. Other operations

† Each section is limited to fourteen students.

- 141s—Gas Manufacture and Distribution. Fundamental principles of manufacture of coal gas, carbureted water gas, and other industrial fuel gases, and the equipment for manufacture and distribution. Open to chemists and chemical engineers. 3 cred.; prereq., Org. Chem. 52. Mr. Montillon.
- 150s—Unit Operations Laboratory. Operation and testing of chemical engineering equipment. Laboratory work and reports. 1 cred.; prereq., 101. Mr. Rogers.
 Lab. (1) VI-VIII M; 90C (3) II-IV S; 90C
 (2) VI-VIII W; 90C (4) Arranged
- 151f,su*—Chemical Manufacture (Inorganic). Manufacture of technical products on a scale large enough to afford data for the determination of operating conditions and costs of manufacture. Use of semi-plant scale equipment. Technical trade journals used. Laboratory. 3 or more cred.; prereq., 101. Messrs. Montonna and Grove.
- 152w,su*—Chemical Manufacture (Organic). Similar to 151 but covering the unit organic processes. Laboratory. 3 or more cred.; prereq., 101. Messrs. Montonna and Grove.
- 153f-154w-155s-156su—Special Laboratory Problems. Investigations on chemical engineering equipment and its use in the manufacture of special chemical products on a semi-works scale. 3 or more cred. per qtr. Messrs. Mann, Montillon, and Montonna.
- 160f—Intermediates and Dyestuffs Laboratory. Manufacture of intermediates and dyestuffs using semi-works equipment. Operations on sulphonation, hydroxylation, nitration, reduction, alkylation, diazotization, coupling, etc. Laboratory. 3 or more cred.; prereq., 132, 152 and preceded or accompanied by 134. Mr. Montonna.
- 168w—Petroleum and Petroleum Products. (Miners.) Technology and testing of petroleum and petroleum products. 3 cred.; prereq., Anal. Chem. 9. Mr. Stoppel.
 Lect. I M; 115C
 Rec. I W; 115C
 Lab. VI-IX W; 10C
- 176f-177w—Applied Electrochemistry. Application of the electric current to chemical processes. Laws and phenomena of electrochemistry, batteries, electroplating, electric furnace construction and operation, and electrochemical products. 4 cred. per qtr.; prereq., Phys. Chem. 103, or taken simultaneously. Mr. Montillon.
 Lect. III MWF; 115C (f), 111C (w)
 Lab. VI-VIII W or Th; 25C
- 179s—Applied Electro-Organic Chemistry. Theory and practice of the electrochemistry of organic compounds. Lect. and rec., 3 cred.; lab. 1 or 2 cred. optional; prereq., 176-177; III MWF; 115C. Mr. Mann.
- 187s—Inspection Trip. Various industrial plants in the middle west are visited by the class on a trip which lasts about ten days, during the spring vacation period. Written reports covering the plants must be submitted. Required of seniors in Chemical Engineering. 2 cred.; prereq., 131, 132. Mr. Mann.
- 201f-202w-203s—Seminar. Presentation and discussion of papers concerning the newer developments in chemical engineering. 1 cred. per qtr. Mr. Mann.
- 205f-206w-207s—Advanced Problems in Unit Operations. A study of new developments in the unit operations including the theory and practical applications to

* Required for chemical engineers during Summer Session.

equipment and plant process design problems. 2 cred. per qtr.; prereq., 104. Open to graduate students only.

208f-209w-210s—Advanced Chemical Engineering. An extended study of the principles of chemical engineering and their applications to industrial problems, together with surveys of the literature. 2 cred. per qtr.; prereq., 104. Open to graduate students only. Mr. Montillon.

301f, su-302w-303s—Research in Chemical Engineering. Unit operations, applied electrochemistry and electric furnace work, and chemical manufacture. Cred. ar. Messrs. Mann, Montillon, Montonna, Rogers, and Stoppel.

CIVIL ENGINEERING

SURVEYING

11f—Surveying. Lectures and field problems; use of steel tape and transit. Computation and platting of field notes, determination of areas. 3 cred.; prereq., M.&M. 12, Dr. 2. Mr. Boon.

Lect. (1) VII W; 21E (2) I Th; 21E
 Lab. (1) VI-IX M, VI-VIII Th; 1E (3) I-III T, VI-IX T; 1E
 (2) VI-IX F, I-III S; 1E

12w—Surveying. Lectures and drafting room. Platting of profiles and mass diagrams, computation of earthwork volume and overhaul. Public land survey. Mapping and conventional signs. 3 cred.; prereq., 11. Messrs. Cutler, Zelner, and Boon.

Lect. (1) VII W; 21E (2) I Th; 21E
 Lab. (1) VI-IX M, VI-VIII Th; 217E (3) I-III, VI-IX T; 217E
 (2) VI-IX F, I-III S; 217E

13s—Surveying. Lectures and field problems; differential and profile leveling; cross-sections, circular curves, and adjustment of instruments. 3 cred.; prereq., 12. Messrs. Cutler and Boon.

Lect. (1) I Th; 21E (2) III Th; 21E
 Lab. (1) I-IV T, 21E; I-III S, 217E (3) II-IV T, 217E; I-IV S, 4E
 (2) VII-IX M, 217E; VI-IX W, 7E

14f—Surveying. Complete topographical survey, stadia method, is made and plated. 3 cred.; prereq., 13. Mr. Zelner.

(1) VI-IX WF; 21, 217E (3) VI-IX TTh; 21, 217E
 (2) VI-IX M, 21, 217E; I-IV S, 22, 217E

15w—Surveying. Purpose and theory of triangulation, meridian determination, base line measurements, computations. Theory and use of the sextant. Hydrographic surveying. Aerial mapping. Applied problems. 2 cred.; prereq., 14. Mr. Zelner.

(1) II-III T, I W, III F; 21E (2) II MWF, III S; 21E

16s—Surveying. Classroom and field. Field problems with the sextant. Triangulation reading and computations. Plane table theory. Various field solutions of the "three point" problem. Plane table survey based on triangulation control. Topographic map. 2 cred.; prereq., 15. Mr. Zelner.

(1) II-III T, 22E; VI-IX M, 21E (2) II-III F, I-IV S; 22E

17f,s—Surveying. Short course including problems in chaining, transit and tape surveys; differential, trigonometric and profile leveling, computations and platting of notes, etc. Open to students other than civil engineers. 3 cred.; prereq., M.&M. 12. Messrs. Cutler, Zelner, and Boon.

17f I-IV MW; 217E
 17s (1) VI-IX ThF; 21E (3) VI-IX TW; 21E
 (2) I-IV MW; 21E

- 23su—Summer Camp. Six weeks immediately preceding the beginning of the senior year. Extended railroad, topographic, hydrographic, and triangulation surveys. 9 cred.; prereq., 16, 22. Fee, \$25. Messrs. Cutler, Zelner, and Boon.
- 109f,w,s—Cadastral Surveying. Study of the newer methods of accurate surveys of property with geodetic control and with co-ordinates of property monuments. 2 cred.; prereq., 16. Mr. Boon.
 109f IV MF; 7E
 109w I M, 106E; I F, 3E
 109s V MF; 206E
- 110f,w,s—Errors in Surveyings. Studying of the sources, importance, and reduction of errors in surveying. 2 cred.; prereq., 23. Mr. Boon.
 110f IV TS; 7E
 110w IV MF; 7E
 110s Ar.
- 111f,w,s—Methods of Computation. Study of the methods used in various problems in precise and geodetic surveys and distribution of errors. 2 cred.; prereq., 110; ar. Mr. Boon.

RAILWAY ENGINEERING

- 21w—Railway Engineering. General survey of the problems of railway location, including grades, curvature, rise and fall, etc. 2 cred.; prereq., 13. Mr. Boon.
 Lect. III W; 227E
 Lab. (1) I-IV S; 229E (3) VI-IX W; 229E
 (2) I-IV T; 229E
- 22s—Railway Engineering. Study of the construction and maintenance of railway track and structures. Simple, compound, and spiral curves, and turnouts. 2 cred.; prereq., 21. Messrs. Cutler and Boon.
 Lect. II Th; 227E
 Lab. (1) VI-IX F; 229E (2) VI-IX Th; 229E
- 121f—Railway Engineering. Train resistance, ruling and momentum grades, curvature, distance, rise and fall as factors in location and operation of railroads. Train loading, acceleration, retardation; locomotives and equipment. Operating costs governing grade revision. 3 cred.; prereq., 22. Mr. Cutler.
 Lect. III F; 227E
 Lab. (1) VII-IX TTh; 225E (2) I-III TTh; 229E
- 122w—Railway Engineering. Lectures, office work, and field inspection. Design and operation of various types of yards and terminals, and terminal facilities, including the hump, engine house, coal and water station. Signaling and interlocking. 3 cred.; prereq., 22. Mr. Cutler.
- 123s—Railway Engineering. Design and construction of railroad buildings and structures; culverts, wooden trestles, switches, cross-overs, crossing frogs, etc. Earthwork computation, estimates and reports. Distribution of material by mass diagram. 3 cred.; prereq., 22. Mr. Cutler.
- 124w—Transportation. Development of railway and inland waterway transport, railway regulation and control with special reference to the 1920 Railway Transportation Act, geographical, financial, and rate grouping of railways. Interstate Commerce Commission method of accounting, cost and value of service, present systems, and organization. 3 cred.; prereq., 22; II MWF; 227E. Mr. Cutler.
- 125s—Transportation. Specific illustrative problems: Twin City and Mississippi Valley traffic situation, Mississippi River experiment, New York Barge Canal, Great Lakes traffic, Panama Canal status. 3 cred.; prereq., 121. Mr. Cutler.

- 221f-222w-223s—Railway Administration. Analysis of railway organization and methods of management and operation. Special problems. 3 cred. per qtr.; prereq., 122. Mr. Cutler.
- 224f—Railway Terminals and Yards. Continuation of Course 123. 3 cred.; prereq., 122. Mr. Cutler.

STRUCTURAL ENGINEERING

- 31f—Stresses in Structures. Algebraic and graphic analysis of various types of bridge trusses for fixed and moving loads. 2 cred.; prereq., M.&M. 26. Mr. Andersen.
Lect. (1) I TS; 21E (2) III TTh; 21E
Lab. (1) VIII-IX M; 229E (3) VI-VII M; 229E
(2) VII-VIII F; 229E
- 32w—Stresses in Structures. Analysis of simple span bridge trusses. Standard engine loadings and equivalent uniform loads. 3 cred.; prereq., 31, M.&M. 141. Mr. Andersen.
Lect. III M, VI F; 227E
Lab. (1) II-III Th; 229E (2) VI-VII Th; 229E
- 33s—Elementary Structural Design. Designing principles and methods. Complete designs and detail drawings of typical simple structures. 4 cred.; prereq., 32, M.&M. 128, Dr. 23. Mr. Andersen.
Lect. II M, III Th; 227E
Lab. VI-VIII TW; 229E
- 37s—Structural Engineering. (Ag.E., M.E., E.E.) Analysis of stresses in simple structural frames. Design of roof trusses, crane girders, mill building bent. 3 cred.; prereq., M.&M. 26 or 84. Mr. Andersen.
Lect. VI Th; 215E
Lab. VI-IX T, VII-IX Th; 217E
- 38f—Stresses in Structures. (Arch.) Application of laws of equilibrium to simple structures. Special emphasis is placed on graphic methods. 3 cred.; prereq., M.&M. 93; I MWF; 209Ex. Mr. Wise.
- 39w—Structural Design. (Arch.) General principles of structural design. Girders, columns, and roof trusses. 3 cred.; prereq., 38; I MWF; 320E. Mr. Wise.
- 41s—Reinforced Concrete. (Arch.) Brief course in theory and designing methods with special reference to building. 3 cred.; prereq., M.&M. 93; I MWF; 320E. Mr. Wise.
- 131w-132s—Bridge Analysis and Design. Stresses in cantilevers, arches, and continuous bridges. Design and detail of typical bridge structure. 2 cred. per qtr.; prereq., 134. Mr. C. A. Hughes.
131w VI Th, 227E; VII-IX Th, 225E
132s II W, 227E; VII-IX Th, 225E
- 134f—Statically Intermediate Structures. Theory of deflections and statically indeterminate stresses and their application to continuous girders, frames, swing bridges, and redundant members. 3 cred.; prereq., 33, M.&M. 128. Mr. C. A. Hughes.
Lect. VI TF; 227E
Lab. VIII-IX M; 225E
- 135s.—Advanced Reinforced Concrete Design. Analysis of structures as rigid frames. Application to reinforced concrete buildings. Effect of temperature and shrinkage. Effect of settlement of foundations. Rigid frame bridges. 3 cred.; prereq., 142; VI-IX M, I-II S; 225E. Mr. Andersen.

- 137f,s—Structural Laboratory. Theoretical and experimental analysis of structural members and models. 2 cred.; prereq., 134, 141. Mr. C. A. Hughes.
- 137f Lect. II W; 201Ex
Lab. (1) VI-VIII W; Ex
(2) VII-IX F; Ex
- 137s Lect. II M; 201Ex
Lab. (1) VII-VIII M; Ex
(2) II-IV S; Ex
- 141f—Reinforced Concrete. Principles of reinforced concrete. Theory of beams, slabs, and columns and the application to ordinary structures. 3 cred.; prereq., M.&M. 128; I-II S, 225E, 229E; VI MTh, 227E. Mr. Wise.
- 142w—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., 141; VI M, III F, 227E; VI-VII T, 225E. Mr. Wise.
- 143s—Reinforced Concrete Arches. Analysis and design of reinforced concrete arches and rigid frame bridges. 3 cred.; prereq., 134, 142. Mr. C. A. Hughes.
- 146f,s—Plain Concrete. Theory of design and control of concrete mixtures. Practice in control tests of concrete and concrete materials. Lectures and laboratory work. 3 cred.; prereq., M.&M. 141. Mr. Andersen.
- 146f Lect. III MW; 206E Lab. VI-IX W; Ex
146s Lect. I TTh; 227E Lab. VI-IX F; Ex
- 147w—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 site. 2 cred.; prereq., 33, M.&M. 128; IV TS; 206E. Mr. Andersen.
- 148f-149w-150s—Advanced Concrete. Short research problems in concrete. 2 cred. per qtr.; prereq., 146; ar. Mr. C. A. Hughes.
- 180f-181w-182s—Advanced Structural Laboratory. Special problems. 3 to 5 cred. per qtr.; prereq., 137. Mr. C. A. Hughes.
- 234f-235w-236s—Advanced Theory of Structures. Application 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. Mr. Wise.
- 245f-246w-247s—Seminar. Special topics in the higher theory of structures. 3 to 6 cred. per qtr.; prereq., 134, 142. Messrs. C. A. Hughes and Wise.

HIGHWAY ENGINEERING

- 51f-52w—Highways and Pavements. Elementary course with field inspection, relating to the economics, location, construction, and maintenance of highways and pavements. 3 cred. per qtr.; prereq., 12. Mr. Lang.
- 51f Lect. (1) VI MTh; 215Ex (3) VIII MW; 215Ex
(2) VI TF; 215Ex
- Lab. (1) VII-IX Th; 210Ex (3) VII-IX F; 210Ex
(2) VII-IX T; 210Ex
- 52w Lect. VII F; 110Ex
Lab. (1) VI-IX T, VI-VII Th; 210Ex (3) VI-IX M, VIII-IX F; 210Ex
(2) VI-IX W, VIII-IX Th; 210Ex
- 55f—Public Highways. Historical development, administration and legislation pertaining to highways, also general economic problems of highway improvements. 3 cred.; no prereq.; I MWF; 215Ex. Mr. Lang.

- 151f,s—Highway Laboratory. Investigation in co-operation with State Highway Department. 3 to 5 cred.; prereq., 52. Mr. Lang.
- 152s—Highway Design. Preparing of a plan and specifications for short sections of highway and city streets, also making estimates of materials and cost. 3 to 5 cred.; prereq., 52. Mr. Lang.
- 154w—Soils Laboratory. Laboratory study of properties of soils which pertain to their stability. 1 cred.; prereq., jr. or sr.; II-IV F; 210Ex. Mr. Lang.
- 156w—Highway Transport. Development, economic field, relation to other forms of transportation. Highway transport surveys, economics of location, economics of selection of type of surface, effect of vehicle on road and road on vehicle. 3 cred.; prereq., 52; III MW, I F; 215Ex. Mr. Lang.
- 157s—Highway Transport. Motor vehicle as a common carrier, analysis of road legislation, taxation. Principles of successful operation. Selling motor transportation. 3 cred.; prereq., 156. Mr. Lang.

HYDRAULIC ENGINEERING

- 161f—Power. Elementary hydrology; precipitation, evaporation, transpiration, runoff, storage and lake levels, types of water power development; dams, waterways, penstock, turbines, and accessory equipment. 4 cred.; prereq., M.&M. 129. Mr. Bass.
Lect. II MF; 227E
Lab. (1) I-III TTh; 225E (2) VII-IX TTh; 229E
- 164f—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., M.&M. 129. Mr. Bass.
- 263s—Hydraulic Engineering Problems. Special hydraulic problems in laboratory, drafting room, and field. 3 to 5 cred.; prereq., 164.

MUNICIPAL AND SANITARY ENGINEERING

- 162w-163s—Water Supply and Sewerage. Sources of water supply; quality of water. Methods of testing, collection, distribution, and purification of water. Selection of pumping machinery and motive power. Sewer systems and sewage disposal works. 3 cred. per qtr.; prereq., M.&M. 129. Mr. Bass.
162w Lect. IV TS; 136E Lab. VII-VIII M, VIII-IX T; 225E
163s Lect. II TF; 227E Lab. VI-VIII T, II-III Th; 225E
- 165s—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. Lectures, field and laboratory demonstrations. 3 cred.; prereq., P.M.&P.H. 53. Messrs. Whittaker, Pierce, associates, and guest lecturers.
- 167—Industrial Hygiene Engineering. Field and laboratory methods used by the industrial hygiene engineer in the study and control of occupational health hazards. Lectures, field and laboratory demonstrations. 3 cred.; open to sr. Mr. Pierce.

- 171w—Building Sanitation. Location and orientation of buildings; lighting, ventilation, water supply, plumbing, sewerage, and refuse disposal. 2 cred.; prereq., sr. arch. only; II TTh; 227E. Messrs. Bass and Martenis.
- 261f-262w—Water and Sewage Purification. Design of water purification and sewage disposal works. 3 to 5 cred. per qtr.; prereq., 163. Mr. Bass.

GENERAL

- 53s—Civil Engineering Practice. Greater problems of engineering. Interrelations of various branches of engineering in practice. Legal, financial, and business functions of the engineer. Relations of the engineer to government and public affairs. 3 cred.; open to jr. and sr. Mr. Bass.
Lect. III MW; 21E
Rec. (1) III S; 227E (2) III T; 227E
- 172s—City Planning. Physical elements of the city; topography, drainage, geology. Public works and structures. Internal and external transportation. Zoning. Subsurface structures. Esthetic features of the city. 3 to 5 cred.; prereq., 52; I MWF; 7E. Messrs. Bass and R. C. Jones.
- 280f-281w-282s—Civil Engineering Research. Original work in concrete, structural steel, hydraulics, municipal or transportation problems. Investigations, reports, tests, designs. 5 cred. per qtr.; by permission. Messrs. Bass, Cutler, Lang, and Wise.

DAIRY HUSBANDRY

- 52s—The Dairy Industry. Composition of milk; milk constituents and their uses in dairy manufacturing and as food; Babcock test; sanitary handling of milk and dairy products on the farm and in the plant; breeds of dairy cattle, housing and management. (Offered in alternate years, spring quarter 1940, etc. Alternate with Fundamentals of Livestock Production.) 3 cred.; no prereq.; I TThS; 100HH(UF). (For agr. eng. only). Messrs. Fitch, Combs, and Macy.

DRAWING AND DESCRIPTIVE GEOMETRY

- 1f,w,su-2w,s,su—Engineering Drawing. Elements of drafting including an introductory course in methods of representation, and constructive geometry. Graphs and formulas. Sketching, lettering, working drawings, conventions, standards, tracing, and blueprinting. 3 cred. per qtr.; prereq., solid geometry. Messrs. Potter, Schuck, Williams, Cruzen, Quaid, and von Eschen.
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| 1f | (1) VI-VII MTWF; 455C | (6) I-II MTThS; 415C |
| | (2) VI-VII MTWF; 443C | (7) I-II MTThS; 417C |
| | (3) VI-VII MTWF; 445C | (8) I-II MTThS; 443C |
| | (4) VIII-IX MW, VI-VII Th, I-II F; 415C | (9) I-II MTThS; 445C |
| | (5) VIII-IX MW, VI-VII Th, I-II F; 417C | (10) I-II MTThS; 455C |
| 1w | (1) VI-VII MTWF; 101E | (4) I-II MTThS; 415C |
| | (2) VIII-IX MWF, VI-VII Th; 415C | (5) I-II MTThS; 417C |
| | (3) VIII-IX MWF, VI-VII Th; 417C | |
| 2w | (1) VI-VII MTWF; 443C | (6) VIII-IX MWF, VI-VII Th; 1E |
| | (2) VI-VII MTWF; 445C | (7) I-II MTThS; 443C |
| | (3) VI-VII MTWF; 1E | (8) I-II MTThS; 455C |
| | (4) VIII-IX MWF, VI-VII Th; 443C | (9) I-II MTThS; 101E |
| | (5) VIII-IX MWF, VI-VII Th; 445C | |
| 2s | (1) VI-VII MTWF; 455C | (4) I-II MTThS; 415C |
| | (2) VIII-IX MTThF; 415C | (5) I-II MTThS; 417C |
| | (3) VIII-IX MTThF; 417C | |

3f,s,su—Descriptive Geometry. Elementary course in the methods of representation, correlated in part with analytical geometry. Graphical and algebraic solutions. Lectures, demonstrations, and drafting. 3 cred.; prereq., 2, M.&M.

11. Messrs. Eggers, Levens, and Shultz.

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| 3f | (1) VI-VII MTWTh; 101E | (2) VIII-IX MWF, III-IV S; 201E |
| 3s | (1) VI-VII MTWF; 443C | (6) VIII-IX MTThF; 1E |
| | (2) VI-VII MTWF; 445C | (7) I-II MTThS; 443C |
| | (3) VI-VII MTWF; 1E | (8) I-II MTThS; 445C |
| | (4) VIII-IX MTThF; 443C | (9) I-II MTThS; 101E |
| | (5) VIII-IX MTThF; 445C | |

4f,su-5w,su-6s,su*—Engineering Drawing and Descriptive Geometry. (Chem. and chem. engr.) 2 cred. per qtr.; prereq., solid geometry. Messrs. Schuck, Williams, and Cruzen.

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| 4f | (1) III-IV MWF; 417C | (4) III-IV T, VIII-IX ThF; 443C |
| | (2) III-IV MWF; 443C | (5) III-IV T, VIII-IX ThF; 455C |
| | (3) III-IV MWF; 445C | |
| 5w | (1) III-IV MWF; 417C | (3) III-IV MWF; 443C |
| | (2) III-IV MWF; 201E | (4) VIII-IX TTh, III-IV S; 201E |
| 6s | (1) III-IV MWF; 417C | (3) III-IV T, VI-VII ThF; 101E |
| | (2) III-IV MWF; 101E | (4) III-IV T, VI-VII ThF; 417C |

7w,su-8s,su*—Engineering Drawing and Descriptive Geometry. (Chem. and chem. engr.) 3 cred. per qtr.; prereq., solid geometry. Messrs. Myers, Schuck, and Cruzen.

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| 7w | (1) III-IV MWF, VIII-IX Th; 455C | (2) III-IV MWF, VIII-IX Th; 445C |
| 8s | (1) III-IV MWFS; 445C | (2) III-IV MWF, I-II S; 455C |

10f,su—Solid Geometry. Lines and planes in space, dihedral and polyhedral angles, polyhedrons, surfaces, cylinders, cones, spheres. Numerical exercises in areas, volumes, weights. No cred.; no prereq. Messrs. Williams and Shultz.

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| (1) | VI MTWF; 136E | (5) II MTFS; 215E |
| (2) | VII MTWF; 206E | (6) III MTWF; 21E |
| (3) | VII MTWF; 215E | (7) III MTWF; 215E |
| (4) | I MTThS; 5E | |

11f—Engineering Drawing (Mines). 2 cred.; prereq., solid geometry; III-IV MWF; 101E. Mr. Potter.

12w—Engineering Drawing (Mines). 2 cred.; prereq., 11; III-IV MWF; 101E. Mr. Potter.

13s—Topographic Drawing (Mines). 2 cred.; prereq., 12; III-IV MWF; 1E. Messrs. Levens and Potter.

14w—Descriptive Geometry (Mines). Not an engineering elective. 4 cred.; prereq., 13, M.&M. 13. Messrs. Myers, Eggers, Levens, and Shultz.

- Lect. I TThS; 107E
Lab. VII-IX M; 455C

21f,w,s,su—Drafting (C.E.) The application of descriptive geometry to drafting room problems including working drawings. 2 cred.; prereq., 3. Messrs. French, Myers, and Levens.

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| 21f | (1) I-II TThS; 201E | (2) VI-VII MWTh; 201E |
| 21w | III-IV MWF; 217E | |
| 21s | I-II MWF; 1E | |

22w,s,su—Structural Detailing (C.E.). Detail, assembly, and construction drawings of steel members and simple structures. Standards and conventions. 2 cred.; prereq., 21. Messrs. French, Myers, and Levens.

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| 22w | (1) I-II TThS; 201E | (2) VI-VII MWTh; 201E |
| 22s | I-II MWF; 101E | |

* For permissible substitute, see page 71.

- 23f,s,su—Structural Detailing (C.E.). Drafting problems in general construction work including earthwork, wood, steel, and concrete. 2 cred.; prereq., 22 or reg. in 22. Messrs. French, Myers, and Levens.
 23f I-II MWF; 201E
 23s (1) III-IV MWF; 201E (2) VI-VII TThF; 201E
- 26w,s,su*—Drafting (E.E.). Applications of descriptive geometry to drafting room problems. Working drawings and tracing. 2 cred.; prereq., 3. Messrs. Eggers, Quaid, and Shultz.
 26w (1) VIII-IX MWF; 101E (2) I-II TS, VIII-IX T; 1E
 26s VIII-IX MWF; 101E
- 28f,w,su*—Drafting (Aero.E.). Application of descriptive geometry to drafting room problems. Working drawings and tracing. 2 cred.; prereq., 3. Messrs. Potter, Williams, and Shultz.
 28f (1) VIII-IX TWF; 101E (2) III-IV MWF; 201E
 28w VI-VII TThF; 455C
- 29w,s,su—Drafting (Aero.E.) Application of elementary formulas in the proportioning of simple machine parts. Detail and assembly drawings. Machine and structural drafting and graphical methods. 2 cred.; prereq., 28. Messrs. Potter, Williams, and Shultz.
 29w III-IV MFS; 1E
 29s (1) VI-VII MW, VII-VIII T; 101E (3) VIII-IX MThF; 101E
 (2) III-IV TS, I-II Th; 1E
- 34f,w,s—Lettering. Study and analysis of single stroke lettering with particular emphasis on the application to engineering drawing. 1 cred.; prereq., 1. Messrs. Cruzen and Quaid.
 34f (1) IV T; 104E (2) II Th; 227E
 34w,s (1) IV T; 104E (2) II Th; 21E
- 37f,w,s—Lettering for Engineers. Analysis of the alphabets. Exercises in roman and gothic lettering. Design and composition of the paragraph and the title. 2 cred.; prereq., 2; I WF; 1E(f,w), 101E(s). Mr. Schuck.
- 38w,s—Reading Drawings. Calculations and estimates of areas, volumes, and weights, and the tabulation of quantities from working drawings. Problems concerned with fabrication, manufacture, and construction. 2 cred.; prereq., 2; VI TF; 206E. Mr. Potter.
- 41f,w,s-42f,w,s-43f,w,s—Technical Drawing. (a) General course in the theory and practice of freehand drawing. Principles of perspective, sketching, renderings, conventions, lettering, and industrial drawing. (b) Modification of the above course of particular interest to dental, medical, and scientific students. 2 cred. per qtr.; no prereq. Mr. Doseff.
 (1) I-II MWF; 411C (3) VIII-IX MWF; 411C
 (2) VI-VII MWF; 411C
- 44f,w,s—Lettering. Practical course in plain lettering. Not an engineering or architecture elective. 1 cred.; no prereq. Messrs. Levens and Schuck.
 44f (1) IV T; 21E (2) II Th; 215E
 44w (1) IV T; 21E (2) II Th; 205E
 44s (1) IV T; 203E (2) II Th; 138EE
- 45f,w,s—Alphabets. Construction and analysis of various types of letters and their arrangement. Exercises and reference work. Not an engineering or architecture elective. 2 cred.; soph., jr., sr.; no prereq. Messrs. Levens and Schuck.
 45f III TTh; 206E
 45w III T, 206E; III Th, 203E
 45s III T, 205E; III Th, 206E

* For permissible substitute, see page 71.

- 50w,s—Diagrams and Charts. Elementary course dealing with the construction of simple diagrams and charts. 2 cred.; no prereq.; I TTh; 206E. Messrs. Eggers and Cruzen.
- 51f,w—Graphic Representation and Computation. Types of charts and applications to the solution of problems and equations. 3 cred.; prereq., 2, M.&M. 12; III MWF; 7E. Messrs. Eggers and Levens.
- 52w,s—Alignment Charts. Functional scales. Application of geometry to the development of straight line alignment charts for equations of three or more variables. 3 cred.; prereq., 2, M.&M. 12; IV MWF; 139EE(w), 215E(s). Mr. Levens.
- 53s—Design of Diagrams for Formulas and Experimental Data. Empirical equations. 3 cred.; prereq., 3, M.&M. 13; ar. Messrs. Eggers, Levens, and Shultz.
- 64w—Graphic Arts. Introduction. Field, development, and application in art and industry. Design and composition. Discussion of materials, style, and technique. 3 cred.; jr., sr.; prereq., 15 cred. in econ.; IV MWF; 206E. Mr. Doseff.
- 65f—Graphic Arts. Processes. Study of graphic reproduction, including engraving and printing, as it relates to present-day advertising, news illustration, and printing. Emphasis is given to technical information on line engravings, halftones, four-color plates, electrotypes, stereotypes, and the relief, offset, and intaglio methods of printing. 3 cred.; jr., sr.; prereq., permission of adviser in School of Business Administration or in Department of Journalism; IV MWF; 206P. Mr. Barnhart.
- 194s—Advanced Advertising Procedure. An advanced course conducted by means of laboratory work on problems and cases in (1) market research and (2) preparation of copy and layout. 3 cred.; sr., grad.; prereq., B.A. 88, Draw. 64, 65, Jour. 55, or permission of instructor; IV MWF; 206P. Mr. Vaile.
- 81f,w,s-82f,w,s-83f,w,s—Advanced Drawing. Principles of design—traditional and modern. Layouts, composition, and illustration. Black and white and color. Scientific modeling. 3 cred. per qtr.; prereq., 43 or equiv. Mr. Doseff.
- 86f,w,s-87f,w,s—Anatomical Drawing. 3 cred. per qtr.; prereq., 43 or equiv. Mr. Doseff.
- 111f-112w-113s—Advanced Descriptive Geometry. Parallel and central projections. Curves and surfaces. Intersections and tangencies. Shades and shadows. Warped surfaces. The figure plan. 3 cred. per qtr.; prereq., 3, calculus. Messrs. Eggers and Levens.
- 115f-116w-117s—Curve Fitting. Finite differences and their application to curve fitting; graduation of experimental data; interpolation; fitting of data to type forms of curves. 3 cred. per qtr.; prereq., M.&M. 25; ar. Mr. Eggers.
- 152f,w,s-153w-154s—Nomography. Application of geometry to the development of alignment charts involving curved and straight line scales. Networks; combinations of networks and alignment charts. Line co-ordinates. Use of determinants for the construction of alignment charts. Special rules. 3 cred.; prereq., 52 or equiv., M.&M. 25; ar. Mr. Levens.
- 157f-158w-159s—Graphical Mathematics. Graphical calculus. Polar diagram method of stress analysis. 2 cred. per qtr.; prereq., M.&M. 26. Messrs. French, Eggers, and Levens.
- 157f IV MW; 206E
158w IV MF; 21E
159s I TS; 107E

ECONOMICS AND BUSINESS ADMINISTRATION

ECONOMICS

3f,w,s—Elements of Money and Banking. Basic principles of money and a description of the various types of financial institutions, their functions and relations to the whole economic organization. 5 cred.; no prereq. Mr. Stehman and others.

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| 3f | Lect. II TTh; JAud | |
| | Rec. (1) I TThS; 205V | (4) III TThS; 221V |
| | (2) II MWF; 211V | (5) V MWF; 210V |
| | (3) III MWF; 2V | (6) VII MWF; 221V |
| 3w | Lect. III TTh; BuAud | |
| | Rec. (1) I MWF; 210V | (9) IV MWF; 221V |
| | (2) I MWF; 211V | (10) IV MWF; 211V |
| | (3) I TThS; 205V | (11) V MWF; 221V |
| | (4) II MWF; 2V | (12) V MWF; 211V |
| | (5) II TThS; 307V | (13) VI MWF; 205V |
| | (6) II TThS; 210V | (14) VI MWF; 6V |
| | (7) III MWF; 205V | (15) VIII MWF; 211V |
| | (8) III MWF; 221V | |
| 3s | Lect. IV MW; 150Ph | |
| | Rec. (1) I MWF; 211V | (4) V MWF; 112V |
| | (2) III MWF; 221V | (5) VI MWF; 6V |
| | (3) III TThS; 211V | (6) VII MWF; 205V |

5f,w,s†—Elements of Statistics. Elementary concepts in statistical method; averages, ratios, errors, sampling, index numbers, graphic representation, collection of material. 5 cred.; no prereq. Mr. Kozelka and others.

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| 5f | Lect. III M; JAud | |
| | Rec. (1) I MWThF; 301V | (3) IV MTWF; 205V |
| | (2) II MWThF; 301V | (4) V MTWF; 205V |
| 5w | Lect. III M; JAud | |
| | Rec. (1) I MWThF; 221V | (3) IV MTWF; 2V |
| | (2) II MWThF; 205V | (4) V MTWF; 205V |
| 5s | Lect. III T; BuAud | |
| | Rec. (1) I MWThF; 115V | (10) IV MTWF; 211V |
| | (2) I MWThF; 112V | (11) V MTWF; 211V |
| | (3) II MWThF; 115V | (12) V MTWF; 115V |
| | (4) II MWThF; 211V | (13) VI MWThF; 115V |
| | (5) II MWThF; 2V | (14) VI MWThF; 2V |
| | (6) III MWThF; 115V | (15) VI MWThF; 113V |
| | (7) III MWThF; 112V | (16) VII MWThF; 112V |
| | (8) III MWThF; 205V | (17) VII MWThF; 115V |
| | (9) IV MTWF; 6V | |

8f-9w—General Economics. (Eng., arch., chem.) Principles of economics with special emphasis upon their application to current problems such as money, banking, conservation, insurance, international commerce, monopolies, transportation, labor, socialism, and public ownership, and finance. 3 cred. per qtr.; no prereq. Mr. Filipetti and others.

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| (1) I MWF; 2V | (4) III MWF; 210V |
| (2) I MWF; 211V (fall only) | (5) III TThS; 113V |
| (3) II MWF; 210V | (6) IV MWF; 307V |

20f,w,s—Elements of Accounting. Fundamental principles underlying bookkeeping and accounting. Sufficient practice in technical processes will be given to serve as a background for more advanced work. Preparation and analysis of state-

† Not open to students who have received credit in Econ. 14 or B.A. 70.

ments. Open only to Engineering Pre-Business students. Other engineering students register in 29. 3 cred.; no prereq. Mr. Heilman and others.

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| 20f | (1) I MWF; 210V | (7) III TThS; 30V |
| | (2) I MWF; 307V | (8) IV MWF; 221V |
| | (3) I TThS; 210V | (9) V MWF; 211V |
| | (4) II MWF; 307V | (10) VI MWF; 210V |
| | (5) II TThS; 210V | (11) VI MWF; 221V |
| | (6) III MWF; 221V | (12) VII MWF; 210V |
| 20w | (1) I MWF; 301V | (4) V MWF; 210V |
| | (2) II MWF; 307V | (5) VII MWF; 2V |
| | (3) III TThS; 221V | |
| 20s | (1) I MWF; 221V | (5) III TThS; 221V |
| | (2) I TThS; 221V | (6) VI MWF; 221V |
| | (3) II MWF; 210V | (7) VII MWF; 210V |
| | (4) III MWF; 210V | |

25f,w,s-26f,w,s—Principles of Accounting. Course following Econ. 20 presenting the principles underlying the accounting statements, the accounts, principles of valuation, depreciation, preparation and analysis of statements. 3 cred. per qtr.; prereq., 20. Mr. Heilman and others.

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| 25f-26w | (1) I TThS; 307V | (4) V MWF; 307V |
| | (2) III MWF; 112V | (5) VI MWF; 307V |
| | (3) III TThS; 205V | |
| 25w-26s | (1) I TThS; 301V | (5) III MWF; 301V |
| | (2) I TThS; 210V | (6) III TThS; 301V |
| | (3) II MWF; 301V | (7) III TThS; 210V (winter only) |
| | (4) II TThS; 301V | (8) VI MWF; 210V |
| 25s | (1) I MWF; 210V | (3) III MWF; 307V |
| | (2) II TThS; 210V | (4) IV MWF; 307V |
| 26f | (1) II TThS; 307V | (3) VII MWF; 307V |
| | (2) III MWF; 301V | |

28f,s—Business Law. Business law arranged for engineers, including the law of contracts, suretyship, agency, partnership, corporations, negotiable instruments, conveyance patents, and riparian rights. 3 cred.; soph., jr., sr. with 6 cred. in econ. or sr. without econ. cred.; I MWF; 135E(f), 335EE(s). Mr. Palmer.

29f,s—Principles of Accounting. (Eng., arch., chem.) Purpose and principles of account classification; capital and revenue; accruals; valuation; depreciation; preparation and interpretation of balance sheets, income accounts, and other statements. 3 hrs. of lect. a week. 3 cred.; no prereq. Mr. Lund.

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| 29f | (1) I MWF; 205V | (2) IV MWF; 112V |
| 29s | I MWF; 307V | |

149f,w,s—Business Cycles. Analysis of factors involved in business fluctuations. Comparison of theories of the cause of prosperity and depression. Introduction to the statistical data and methods of business forecasting. 3 cred.; sr., grad.; prereq., 141 or B.A. 142. Mr. Marget and others.

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| 149f | III TThS; 1V | |
| 149w | (1) I MWF; 6V | (2) VI MWF; 2V |
| 149s | (1) II TThS; 6V | (2) VI MWF; 207V |

161f,w,s—Labor Problems and Trade Unionism. Discussion of employment; hours; wages; extent and strongholds of unionism; open and closed shops; collective bargaining; industrial unrest; government regulation of labor disputes. 3 cred.; prereq., 8, 9. Messrs. Yoder and Schmidt.

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| 161f | (1) III MWF; 1V | (2) IV MWF; 4V |
| 161w | (1) I TThS; 1V | (2) II MWF; 4V |
| 161s | (1) I TThS; 207V | (2) IV MWF; 105V |

BUSINESS ADMINISTRATION

51f-52w-53s—Business Law.* 51. Contracts. 52. Agency, Partnership, Corporations. 53. Negotiable Instruments. 3 cred. per qtr.; jr., sr.; prereq., for 51, Econ. 8 and 9, for 52 and 53, B.A. 51. Messrs. Gray and Wattson.

Lect. IV T; BuAud

Rec. (1) I ThS; 4V

(2) II ThS; 4V

(3) II ThS; 105V(f), 113V(w,s)

(4) III ThS; 4V

(5) V Th, IV S; 4V

58f,w,s§—Elements of Public Finance. Public expenditures, revenues, and debts. Special attention is given to tax principles, practices, and burdens. Condensed course given especially for business administration students. 3 cred.; jr., sr.; prereq., Econ. 8, 9. Messrs. Blakey and Borak.

58f IV MWF; 113V

58w (1) IV MWF; 113V

58s (1) IV MWF; 113V

(2) VI MWF; 113V

(2) VI MWF; 205V

70f†—Statistics Survey Course. Tools and devices which facilitate the use of business data. Statistical information is collected by questionnaires, consolidated into tables, summarized in averages, and illustrated by graphic devices. Current index numbers are compared in form and application. Interpretation and limitations of statistical data. 3 cred.; prereq., Econ. 8, 9. Messrs. Kozelka and Graves.

(1) I MWF; 6V

(2) VII MWF; 6V

71f,w,s—Transportation: Services and Charges I. Survey of rail, highway, and water transportation facilities, services, and rates. Current transportation problems. 3 cred.; prereq., Econ. 8, 9. Mr. Nightingale.

71f (1) I MWF; 1V

(2) II MWF; 1V

71w (1) III TThS; 1V

71s (1) II MWF; 1V

(3) IV MWF; 1V

(2) VI MWF; 1V

(2) VI MWF; 1V

72w—Transportation: Services and Charges II. Principles, construction, interpretation, and use of rail, highway, and water classifications, rates, and tariffs for handling freight, express, and mail shipments. Audit of transportation charges. Adjustment of rates, rules, and regulations. 3 cred.; prereq., 71; VIII MWF; 1V. Mr. Nightingale.

77f,s—Survey in Marketing. (An introductory course.) The principles of production economics and of price as illustrated in marketing. Commodity classifications, market functions, description of market organizations. 3 cred.; jr., sr.; no prereq. Mr. Chute.

77f (1) I TThS; 1V

77w (1) I MWF; 1V

77s (1) IV MWF; 1V

(2) VII MWF; 4V

(2) IV MWF; 1V

(2) I TThS; 1V

87f,w,s—Report Writing. Lectures on source of data on business conditions and industry, methods of gathering business data. Types, importance, and organization of business reports. Reports written by students are discussed in conference with staff members. 1 cred.; jr., sr.; no prereq. Mr. Heilman.

87f,s VI T; 4V

87w IV S; 6V

* No credit will be given for 51, 52, or 53 until all three are completed.

† Not open to students who have received credit in Econ. 5.

§ Credit may not be received for both Econ. 191-192 and B.A. 58.

- 89f,w,s—Production Management. Analysis of the procedure and methods of production in industrial plants, the factors involved in production management, the means of effecting control. 3 cred.; prereq., Econ. 8, 9. Mr. Filipetti.
- 89f II MWF; 4V
 89w (1) II MWF; 6V (2) III MWF; 1V
 89s (1) I MWF; 6V (2) II MWF; 207V
- 91f,w,s—Tabulating Equipment Laboratory. Use of tabulating equipment in preparation of sales analyses and the laying out of production programs, in the keeping of perpetual inventory records and in making distributions of labor and overhead costs in cost accounting. 1 cred.; jr., sr.; prereq., Econ. 26 and either 5 or 14 or B.A. 70. Mr. Boddy.
- 91f VIII-IX F; 2V
 91w IV-V T; 6V
 91s (1) IV-V T; 1V (2) VIII-IX M; 2V
- 101f,w-102w,s§—Advanced General Economics. A study of some of the more important theoretical problems of economics; competitive and monopoly prices; equilibrium prices and costs; theories of valuation of producers' goods; capital earnings and interest rates; profits. 3 cred. per qtr.; sr.; prereq., Econ. 8, 9. Messrs. Garver, Mudgett, and Boddy.
- 101f-102w (1) I TThS; 105V (3) III MWF; 105V
 (2) II TThS; 207V (4) IV MWF; 105V
 101w-102s (1) I TThS; 6V (2) VII MWF; 6V
 101s III TThS; 1V
- 112f,w,s‡—Business Statistics. Survey and criticism of methods used in analyzing time series, with special applications to the study of cyclical fluctuations of economic phenomena. 3 cred.; jr., sr., grad.; prereq., Econ. 5 or B.A. 70. Messrs. Mudgett and Kozelka.
- 112f (1) I TThS; 207V (3) VI MWF; 6V
 (2) III TThS; 207V
 112w (1) I TThS; 207V (3) III TThS; 211V
 (2) II MWF; 1V
 112s (1) II MWF; 6V (2) II TThS; 221V
- 130f,s—Cost Accounting. (General survey.) 3 cred.; prereq., Econ. 26 or 29. Mr. Ostlund.
- 130f I MWF; 105V
 130s I TThS; 105V
- 139f,w,s‡—Advanced General Accounting. A course intended particularly for the general student of business. Interpretation of accounts and statements, statement preparation, and analysis. Utilization of the statements by the executive. The use of budgets in business. Accounting methods and statements in a number of business fields. 3 cred.; jr., sr., grad.; prereq., Econ. 25, 26. Mr. Heilman and others.
- 139f (1) IV MWF; 207V (2) VI MWF; 4V
 139w (1) I MWF; 4V (2) VI MWF; 207V
 139s (1) IV MWF; 4V (2) VI MWF; 4V
- 142f,w,s—Advanced Money and Banking. 3 cred.; jr., sr., grad.; prereq., Econ. 8, 9. Messrs. Marget and Myers.
- 142f (1) II MWF; 6V (2) VI MWF; 207V
 142w (1) II TThS; 105V (2) IV MWF; 6V
 142s (1) I MWF; 105V (2) III TThS; 105V

‡ A fee of \$1 per quarter is charged for this course.

§ The entire course must be completed before credit is received for any quarter.

- 155f,w,s—Corporation Finance. 3 cred.; prereq., Econ. 8, 9. Messrs. Stehman and Uppgren.
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|------|-----------------|-------------------|
| 155f | (1) III MWF; 4V | (2) VII MWF; 207V |
| 155w | (1) III MWF; 4V | (2) VI MWF; 4V |
| 155s | (1) III MWF; 4V | (2) VII MWF; 4V |
- 165f,w,s—Economics of Public Utilities. Economic and legal bases of classification. Relative advantages of public ownership and regulation. Central and municipal regulation. Basis of rates; relative rates; rates and service. Theories of valuation. 3 cred.; prereq., 8, 9. Messrs. Garver and Schmidt.
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|------|----------------|--------------------|
| 165f | (1) I TThS; 2V | (2) III TThS; 105V |
| 165w | III TThS; 207V | |
| 165s | (1) I MWF; 4V | (2) III TThS; 6V |
- 167f,w—Personnel Administration. Managerial policy for various types of organization of labor. Job analysis, employment, incentives, and regulation of employment. 3 cred.; prereq., Econ. 161; III TThS; 6V. Mr. Yoder.
- 180f-181w§-182sG—Senior Topics: Production Management. Selected problems in management; technique of executive control in manufacturing enterprises; field research and surveys in organization and management of Northwest industrial concerns. 9 cred.; prereq., B.A. 89, 130; VII MWF; 301V. Mr. Filipetti.
- 184s§—Scientific Management in Industry. 3 cred.; prereq., 8, 9; VI MWF; 301V. Mr. Filipetti.

(For other courses see Combined Class Schedule for 1938-39, School of Business Administration section.)

ELECTRICAL ENGINEERING†

- 11f-13w-15s—Elements of Electrical Engineering. Introduction to the development, principles, materials, safety, and general applications of electrical engineering. 3 cred. per qtr.; prereq., reg. in Phys., and M.&M. 24 for 11; reg. in M.&M. 25 for 13. Messrs. W. T. Ryan and Todd.
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|-----|---------------------------|---------------------|
| 11f | Lect. (1) III TThS; 138EE | (3) I TThS; 138EE |
| | (2) I TThS; 238EE | |
| 13w | Lect. (1) I TThS; 238EE | (3) III TThS; 138EE |
| | (2) I TThS; 339EE | |
| 15s | Lect. (1) III TThS; 237EE | (3) I TThS; 339EE |
| | (2) I TThS; 238EE | |
- 14w-16s—Elements of Electrical Engineering Laboratory. Taken with courses E.E. 13, 15. 1 cred.; prereq., for 14, 13 or reg. in 13, for 16, 14 or reg. in 15. Messrs. W. T. Ryan and Todd.
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|-----|----------------------|---------------------|
| 14w | (1) VI-VII M; 21EE | (4) VIII-IX T; 21EE |
| | (2) VIII-IX Th; 21EE | (5) VI-VII Th; 21EE |
| | (3) V-VI T; 21EE | (6) VIII-IX F; 21EE |
| 16s | (1) VIII-IX M; 21EE | (4) VIII-IX Th; 21E |
| | (2) VI-VII W; 21EE | (5) VI-VII M; 21E |
| | (3) VIII-IX T; 21EE | (6) VI-VII T; 21E |
- 111f—Junior Electrical Engineering. Alternating-current circuits and machinery. 5 cred.; prereq., 15.
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|------|--------------------|---------------------|
| 111f | (1) I MTWFS; 237EE | (2) II MTWFS; 237EE |
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† In courses continuing through three quarters, the work of each quarter is prerequisite for the following quarters.

§ Credit may not be received for both B.A. 181G and B.A. 184.

- 112f—Junior Electrical Engineering Laboratory. Taken with Course 111. Experiment study of alternating-current circuits and machinery. 2 cred.; prereq., reg. in 111.
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|--------------------|---------------------|
| (1) VI-IX M; 107EE | (3) VI-IX W; 107EE |
| (2) VI-IX T; 107EE | (4) VI-IX Th; 107EE |
- 113w-115s—Junior Electrical Engineering. Alternating-current circuits and machinery. 3 cred. per qtr.; prereq., 111, 112 for 113; and 113, 114 for 115.
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|------------------|-------------------|
| (1) I MWF; 237EE | (2) II MWF; 237EE |
|------------------|-------------------|
- 114w-116s—Junior Electrical Engineering Laboratory. Taken with Courses 113, 115. Experimental study of alternating-current circuits and machinery. 1 cred. per qtr.; prereq., reg. in 113, 115.
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|---------------------|----------------------|
| (1) VI-VII M; 107EE | (3) VI-VII W; 107EE |
| (2) VI-VII T; 107EE | (4) VI-VII Th; 107EE |
- 117w-119s—Engineering Electronics. Fundamental theory of electronic devices. 3 cred. per qtr.; prereq., 111, 112 for 158, and 158 for 159.
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|---------------------------|-----------------------|
| Lect. (1) I TTh; 237EE | (2) II TTh; 237EE |
| Lab. (1) VIII-IX M; 227EE | (3) VIII-IX W; 227EE |
| (2) VIII-IX T; 227EE | (4) VIII-IX Th; 227EE |
- 121f-123w-125s—Senior Electrical Engineering. Theory of alternating and direct current machinery. 3 cred. per qtr.; prereq., 115, 116, 159.
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|--------------------|-------------------|
| (1) III MWF; 237EE | (2) IV MWF; 237EE |
|--------------------|-------------------|
- 122f-124w-126s—Senior Electrical Engineering Laboratory. Operating characteristics of alternating and direct current machinery. 2 cred. per qtr.; prereq., 116 and reg. in 121, 123, 125.
- | | |
|--------------------|---------------------|
| (1) VI-IX T; 107EE | (3) VI-IX Th; 107EE |
| (2) VI-IX W; 107EE | (4) VI-IX F; 107EE |
- 127f-128w-129s—Transient Electrical Phenomena. Mathematical study of electric circuits during sudden changes of conditions. Classical and operational 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., reg. in 121, 123, 125; I TTh, 139EE; VI-VIII W, 129EE. Messrs. Bryant and Johnson.
- 138f-139w-140s—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., reg. in 121, 123, or 125; II MWF; 339EE. Messrs. Bryant, Johnson, and Caverley.
- 227f-228w-229s—Transients in Electrical Machinery and Transmission Lines. Theoretical and laboratory study of transients in electrical power machinery and of lightning surges and lightning protection. 3 cred. per qtr.; prereq., 127, 128, and 129. Mr. Bryant.
- 255f-256w-257s—Electrical Engineering Applications. Investigation of electrical engineering applications. Laboratory study, library study, and research both in residence and in the field, followed by complete written reports with oral presentation and discussion. 1 to 3 cred. per qtr.; prereq., graduate students only. Messrs. Bryant, W. T. Ryan, and Johnson.

DESIGN

- 132f-134w-136s—Electrical Design. The design of direct current generators and motors, alternating current transformers, generators and synchronous motors. 2 cred. per qtr.; prereq., for 132, reg. in 121; 134, reg. in 123; 136, reg. in 125; II TS; 335EE. Mr. Kuhlmann.

137s—Power Transmission Line Design. Preparation of detailed plans and specifications for construction of high voltage transmission lines and distributing systems. 3 cred.; prereq., 134, 142. Mr. W. T. Ryan.

197f-198w-199s—Electrical Design. Special problems. 2 cred. per qtr.; prereq., 132, 134, 136. Mr. Kuhlmann.

ELECTRIC POWER

36f-37w-38s—Electric Power. Similar to 43-44-45. 3 cred. per qtr.; sr. M.E.; prereq., Phys. 43, 44.

36f Lect. III MF; 335EE

Lab. (1) II-III Th; 107EE
(2) III-IV S; 107EE

(3) III-IV W; 107EE
(4) VI-VII F; 107EE

37w Lect. III MF; 335EE

Lab. (1) II-III W; 107EE
(2) III-IV S; 107EE

(3) VIII-IX M; 107EE
(4) VIII-IX W; 107EE

38s Lect. II MF; 335EE

Lab. (1) II-III W; 107EE
(2) III-IV M; 107EE

(3) I-II Th; 107EE
(4) III-IV S; 107EE

40f—Electric Wiring and Equipment. Elements of direct and alternating current circuits. Interior wiring and electrical equipment of buildings. Elements of illumination. 2 cred.; sr. arch.; prereq., Phys. 43; I MW; 139EE.

41f,s—Electric Power. Elementary principles of continuous and alternating currents, generators, and motors, transmission and distribution. Measurement of power. 3 cred.; jr. mines; prereq., Phys. 9 or 43.

41f Lect. II TTh; 138EE

Lab. I-III F; 107EE

41s Lect. I TTh; 138EE

Lab. VII-IX F; 107EE

42s—Electric Power. Similar to 41. Sr. C.E. 3 cred.; prereq., Phys. 9 or 43, 44.

Lect. III MWF; 138EE

Lab. III-IV T; 107EE

43f-44w-45s—Electric Power. Elementary study of the generation, distribution, measurement, and utilization of electric power. 3 cred. per qtr.; sr. Ch.E.; prereq., Phys. 9 or 43, 44.

Lect. III TTh; 335EE

43f Lab. (1) I-II T; 107EE

(3) I-II S; 107EE

(2) IV-V T; 107EE

44w Lab. (1) I-II T; 107EE

(3) I-II S; 107EE

(2) VIII-IX T; 107EE

45s Lab. (1) I-II T; 107EE

(3) I-II S; 107EE

(2) II-III F; 107EE

46f-47w-48s—Electric Power. Similar to 43-44-45. 3 cred. per qtr.; sr. Aero.E.; prereq., Phys. 43, 44.

Lect. VI MF(f,s); TF(w); 237EE

46f Lab. (1) VIII-IX F; 107EE

(3) I-II M; 107EE

(2) III-IV M; 107EE

47w Lab. (1) II-III M; 107E

(3) VIII-IX F; 107EE

(2) I-II Th; 107EE

48s Lab. VIII-IX M; 335EE

141f—Central Stations. Electric power generating stations and distribution systems. Economic considerations. Costs, load curves, plant location, selection of prime movers, station equipment. 3 cred.; prereq., reg. in 121; III TThS; 237EE. Mr. W. T. Ryan.

142w—Electrical Transmission. Considerations involved in the designing and building of transmission lines. Mechanical, electrical, and economic consid-

- erations. Lightning protection, underground lines, high-voltage d.c. transmission. 3 cred.; prereq., reg. in 123; III TThS; 237EE. Mr. W. T. Ryan.
- 144w—Railway Electrical Engineering. Principles of mechanics applied to electric train movements. 2 cred.; prereq., 42 or 45 or 48 or 115; IV TS; 237EE. Mr. Johnson.
- 145s—Railroad Electrification. Reasons for electrification. Study of European and American systems. Results of electrification. 2 cred.; prereq., 144; IV TS; 339EE. Mr. Johnson.

ILLUMINATING ENGINEERING

- 151f—Illuminating Engineering. Nature of light. Laws of vision. Principles of illumination. Photometry. Sources of light and their characteristics. Lighting equipment. Illumination requirements and calculation for various fields of use. 2 cred.; prereq., Phys. 43; IV TS; 237EE. Mr. Johnson.
- 152f—Photometric Laboratory. Photometer practice. Distribution curves of lamps and reflectors. Measurement of lighting installations. 1 cred.; prereq., reg. in 151; VI-VII Th; ar. Mr. Johnson.
- 153w-154s—Illumination Problems. Illumination design and specifications applied to problems in street, residence, industrial, commercial, and other kinds of lighting. 2 cred. per qtr.; prereq., 151. Mr. Johnson.
- 251w-253s—Illuminating Engineering. Lectures and laboratory work. Methods of determining locations, kind and quality of lights for obtaining desired illumination. 2 cred. per qtr.; prereq., 151. Mr. Johnson.

TELEPHONE AND TELEGRAPH ENGINEERING

- 64f-65w-66s—Elements of Communication. Theoretical and laboratory study of communication circuits and apparatus. Simplex, duplex, multiplex telegraph systems. Speed of transmission. Magneto, common battery, manual, automatic telephone systems. 2 cred. per qtr.; prereq., reg. in 111, 113, 115. Messrs. Hartig and Melloh.
- Lect. III; 238EE
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| Lab. (1) VI-VII T; 307EE | (3) VI-VII W; 307EE |
| (2) VIII-IX T; 307EE | (4) VIII-IX W; 307EE |
- 164f-165w-166s—Electric Communication. Telephone circuits at audio and carrier frequencies. Theoretical and laboratory study of circuits having distributed constants. Use of hyperbolic functions. Wave filters, balancing networks, equalizers, repeaters. 4 cred. per qtr.; prereq., 66. Mr. Hartig.
- Lect. I MW; 138EE
- Lab. (1) VI-IX Th; 307EE
- (2) VI-IX F; 307EE
- 267f-268w-269s—Telephone Transmission. Advanced transmission theory at communication frequencies. Class and laboratory. 2 or 3 cred.; reg. by permission. Mr. Hartig.
- 272f-273w-274s—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.; open to grad. and sr. by permission; prereq., M.&M. 151. Mr. Hartig.
- 287f-288w-289s—Advanced Communication Laboratory and Seminar. Special problems in communication. Study and discussion of current articles on communication. 2 or 3 cred.; reg. by permission. Mr. Hartig.

RADIO ENGINEERING

- 161f-162w-163s—Radio Communication. Theoretical and laboratory study of radio transmitting and receiving circuits and apparatus. Amplifiers, detectors, oscillators. Electromagnetic waves in free space and on antenna systems. 3 cred. per qtr.; prereq., reg. in 121, 123, 125. Mr. Webb.
- Lect. II MW; 335EE(f,w), 238EE(s)
 Lab. (1) VI-VII M; 308EE (4) VIII-IX T; 308EE
 (2) VIII-IX M; 308EE (5) VI-VII W; 308EE
 (3) VI-VII T; 308EE
- 167f—Radio Transmission. Design and operation of modern transmitting equipment, with special emphasis on broadcast transmission. Registration by permission of instructor. 2 or 3 cred.; II TTh; 339EE. Mr. Webb.
- 168w-169s—Radio Receiver Design. Detailed study of the problems arising in broadcast receiver design. Registration by permission of instructor. 2 or 3 cred.; II TTh; 339EE. Mr. Webb.
- 176f-177w-178s—Electronics. Theoretical and laboratory study of the following subjects with aspects of their engineering applications. Electron emission from hot bodies, Richardson's equation, Langmuir-Childs equation, secondary electron emission, ionization and resonance potentials, external and internal photoelectric effect, positive ion emission, shot effect, discharge of electricity through gases, "getter" action, Barkhausen-Kurtz effect, ionization due to radio-activities, etc., Heaviside layer as a reflecting and a refracting medium, long period echo effect, electron waves, vacuum gages, vacuum technic, etc. 2 cred. per qtr.; graduate course, open to seniors by permission of instructor. Mr. Webb.
- 261f-263w-265s—Advanced Radio Communication. Theoretical study of the transmission of electromagnetic waves. Design and testing of radio transmitting and receiving apparatus. Theory of electron tubes and their use in radio circuits. High frequency measurements. Taken with 262-264-266. 2 cred. per qtr.; reg. by permission. Mr. Webb.
- 262f-264w-266s—Advanced Radio Laboratory. Special problems in radio laboratory and station, usually taken in connection with Course 261-263-265. For students specializing in electrical communication. 1 or more cred. per qtr.; reg. by permission. Mr. Webb.

RESEARCH

- 171w-172s—Undergraduate Thesis. Investigation of some approved problem in electrical engineering. 3 to 6 cred. per qtr.; prereq., 121.
- 275f-276w-277s—Electrical Engineering Research. Investigation of special problems in laboratory or library. 2 to 6 cred. per qtr.; grad.

MEASUREMENT

- 81w—Electrical Engineering Measurements. Principles of electrical measuring instruments, construction, limitations, sources of error, methods of calibration. Methods of measuring voltage, current, watts, watt hours, resistance inductance, mutual inductance, capacity. 3 cred.; prereq., 111. Mr. Todd.
- Lect. IV MW; 339EE
 Lab. VI-VII M; 107EE
- 173f-174w-175s—High Voltage Engineering. Study of insulation and generating equipment for high voltage; measurements of electrical quantities at high

- voltage; surges, and surge proof equipment. Lecture and laboratory. 2 or 3 cred.; sr. or grad. Mr. Caverley.
- 181s—Communication Frequency Measurements. Vector treatment of network. Bridge circuits for measuring of resistance, inductance, and capacity of audio and radio frequencies. 2 cred.; prereq., 126. Mr. Hartig.
- 183f-184w-185s—Special Electrical Laboratory. Efficiency tests and special problems. 1 to 3 cred. per qtr.; prereq., jr., sr., grad. by permission.
- 187f-188w-189s—Special Communication Laboratory. Special problems in electrical communication. Includes a weekly seminar meeting. 1 to 3 cred. per qtr.; jr., sr., grad. by permission. Mr. Hartig.
- 281w-282s—Advanced High Frequency Measurements. Vector treatment of circuit networks. Bridge circuits for the measurement of resistance, inductance, and capacity of audio and radio frequencies. 2 cred. per qtr.; prereq., 126.
- 284f-285w-286s—Precise Electrical Engineering Measurements. Measurements of resistance, voltage, current, energy, self-induction, and capacity; standardization of measuring instruments. 2 cred. per qtr.; prereq., 122.

GENERAL

- 93s—Seminar. Weekly discussion of current engineering periodicals and reports on assigned topics. 1 cred.; no prereq.; jr. EE. (Not offered in 1938-39.)
- 156s—Vacuum Tube and Control Devices. Two, three, four, and five electrode vacuum tubes. Thyatron, kenotron, grid glow, photoelectric tubes, etc. Theoretical study of apparatus and circuits with demonstrations. 2 cred.; sr. only; not open to students having credit in 161; IV MW; 139EE. Mr. Webb.
- 191f-192w-193s—Seminar. Weekly discussion of current electrical periodicals. 1 or 2 cred. per qtr.; prereq., 111.
- 194f-195w-196s—Vacuum Tube Applications. Study of commercial thermionic vacuum, vapor, and gas discharge tubes including an extensive survey and detailed study of their scientific and industrial applications. 3 cred. per qtr.; open to grad. and sr. in EE. by permission of instructor. Mr. Hartig.
- 211f-212w-213s—Advanced Circuit Analysis. Circuit analysis using Heaviside's *Operational Calculus*. 2 cred. per qtr.; grad.; prereq., M.&M. 151.
- 291f-292w-293s—Graduate Seminar. Discussion problems and results of research work. 1 cred. per qtr.
- 294f-295w-296s—Vacuum Tube Circuit Analysis. Continuation of 196. Mathematical and experimental analysis of circuits associated commonly with vacuum tubes. 3 cred. per qtr.; grad. only; prereq., 196.

ENGINEERING ENGLISH

- 4f,w-5w,s-6f,s—Composition. Review of grammar; principles of composition; constant practice in elementary technical exposition. Reading. 3 cred. per qtr.; no prereq. Messrs. Richardson, Becklund, Fitch, Guthrie, Haga, and Lefevre.
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| 4f (1) IV MWF; 107E | (11) VI TThF; 7E |
| (2) IV MWF; 22E | (12) VI TThF; 5E |
| (3) IV MWF; 104E | (13) VII MW, VIII F; 107E |
| (4) III MFS; 107E | (14) VII MW, VIII F; 203E |
| (5) III MFS; 3E | (15) VII MW, VIII F; 3E |
| (6) III MFS; 4E | (16) VII MW, VIII F; 5E |
| (7) III MFS; 5E | (17) I MWF; 21E |
| (8) VII TThF; 107E | (18) I MWF; 7E |
| (9) VII TThF; 203E | (19) II TThS; 107E |
| (10) VI TThF; 107E | (20) II TThS; 135E |

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| 4w | (1) I MWF; 5E
(2) V MWF; 107E | (3) V MWF; 206E |
| 5w | (1) IV MWF; 107E
(2) IV MWF; 215E
(3) IV MWF; 135E
(4) IV MWF; 104E
(5) III MTF; 4E
(6) III MTF; 107E
(7) III MTF; 203E
(8) VI TTh, III S; 107E
(9) VI TTh, III S; 203E | (10) VI TTh, III S; 215E
(11) VII MWF; 107E
(12) VII MWF; 203E
(13) VII TTh, VIII F; 107E
(14) VII TTh, VIII F; 203E
(15) VIII MW, II S; 203E
(16) II TThS; 135E
(17) II TThS; 206E |
| 5s | (1) VIII MWF; 107E
(2) III MTF; 206E | (3) V MWF; 107E |
| 6f | I MWF; 107E | |
| 6s | (1) IV MWF; 107E
(2) IV MWF; 104E
(3) IV MWF; 135E
(4) IV MWF; 206E
(5) III MTF; 107E
(6) III MTF; 215E
(7) III MTF; 7E
(8) VI MWF; 215E | (9) VI MWF; 107E
(10) VI MWF; 203E
(11) VII MWF; 107E
(12) VII MWF; 215E
(13) VII MWF; 205E
(14) I MWF; 135E
(15) I MWF; 107E
(16) II TTh, III S; 107E |

7w-8s—Explorations in Literature. An attempt to introduce world literature to the student through a study of books and their authors. 3 cred. per qtr.; credit given for either qtr.; prereq., 6; I MWF; 107E(w), 139EE(s). Mr. Richardson.

36s—The Technical Article. Practice in writing technical articles for both professional and lay readers. 3 cred.; prereq., 6; IV MWF; 227E. Mr. Haga.

37f,w,s—Technical Discussions. (M.E.) Oral presentation of technical papers for the purpose of developing speaking ability. Class criticism. Extemporaneous discussion. Limited to twenty-five students. 3 cred.; prereq., 6. Mr. Richardson.

37f II MWF; 135E

37w (1) II MWF; 135E

(2) III TThS; 135E

37s (1) III MWF; 135E

(2) I TThS; 135E

FORESTRY

10w—Farm Woodlots and Windbreaks. Trees and their relation to the farm. Planning and planting farm windbreaks and shelter belts. Utilization and marketing of farm grove or woodlot products. 3 cred.; no prereq.; VI MWF; 301Hr(UF). Mr. Cheyney.

GENERAL ENGINEERING

11f-12w-13s—Orientation. General lectures by members of the university staff covering the various branches of engineering and allied professions. Illustrated by lantern slides and motion pictures. No cred.; no prereq.; required of freshmen in Engineering and Architecture. 13s is required of freshmen in Chemistry. Mr. Zelner.

11f IX Th; 100C

12w IX Th; 100C

13s IX W; BuAud

- 70f,w,s—The Slide Rule. Theory, construction, and use. Computation practice. Design of special rules. 1 cred.; prereq., M.&M. 12 or reg. in M.&M. 12. Mr. French.
 70f I F; 104E
 70w I F; 206E
 70s I W; 22E
- 81w—Estimating. Plan reading and quantity surveying. Study of costs of concrete, brick, timber, and steel construction. Analysis of material and labor costs. 3 cred.; jr., sr., only. I MW; 2 hrs. ar.; 206E. Mr. French.
- 101w,s—Contracts and Specifications. Engineering contracts. Specification essentials; approved methods of handling construction projects; trade practices. Powers and duties of engineer executive. 3 cred.; jr. and sr. only. Mr. Fixen.
 101w IV MWF; 238EE
 101s VI WTh, I S; 227E
- 111s—Valuation of Public Utility Properties. Factors affecting value, depreciation, taxation, and regulation of public utility properties. Elements of engineering economics; cost analysis, economic investigations, rate making. 3 cred.; sr. and grad. only; III TThS; 339EE. Mr. W. T. Ryan.
- 112f-113w-114s—Rates for Public Utility Properties. Determination of the rate base and depreciation amount for transportation, gas, water, electric power, and telephone utilities operating expenses, the rate structure for particular utilities, service and discrimination. 3 cred. per qtr.; sr. and grad. in engineering, economics and business administration. Mr. Bryant.
- 193s—Engineering Practice. Engineering relations, personal and ethical; business relations, letters and employment; legal relations, and interpretation; patents, rights of invention; engineering specifications and salesmanship. Engineering reports and discussions. 2 cred.; sr. only. Mr. Martenis.
 (1) VI M, III Th; 254ME (2) III Th, I S; 254ME

GEOLOGY AND MINERALOGY

- 1f,w,s,su-2f,w,s—General Geology (Dynamic and Historical). A synoptical treatment of the materials of the earth and of geologic processes, together with a study of the history of the earth and its inhabitants as recorded in the rocks. 6 cred.; no prereq. Messrs. Thiel and Hanley.
 1f Lect. II TThS; 210P Rec. II F; 210P
 1w Lect. IV MWF; 110P Rec. IV T; 110P
 1s Lect. (1) III MWF; 110P Rec. (1) III Th; 110P
 (2) VII MWF; 110P Rec. (2) VIII M; 110P
 2f Lect. III MWF; 208P Rec. III Th; 208P
 2w Lect. II TThS; 210P Rec. II F; 210P
 2s Lect. IV MWF; 110P Rec. IV T; 110P
- Af,w,s‡-Bf,w,s‡—General Geology Laboratory (General and Historical). 4 cred.; no prereq.
 Af (1) I-II MW; 220P (2) VI-VII MW; 220P
 Aw VI-VII WF; 220P
 As (1) III-IV TS; 220P (2) VIII-IX WF; 220P
 Bf III-IV TS; 216P
 Bw (1) I-II MW; 220P (2) VI-VII TTh; 220P
 Bs VI-VII WF; 220P

‡ A fee of \$1 per quarter is charged for this course.

1f,w,s,su-3w,s—General Geology (Dynamic and Economic). A synoptical treatment of the materials of the earth and the origin, distribution, and occurrence of metals, non-metals, coal, and petroleum. 6 cred.; no prereq. Mr. Emmons.

1f Lect. III TThS; 110P

Rec. III F; 110P

1w Lect. II MWF; 110P

Rec. II S; 110P

1s Lect. (1) III MWF; 110P

Rec. (1) III Th; 110P

(2) VII MWF; 110P

(2) VIII M; 110P

3w Lect. III TThS; 110P

Rec. III F; 110P

3s Lect. II MWF; 110P

Rec. II S; 110P

Af,w,s‡-Cw,s‡—General Geology Laboratory (General and Economic). 4 cred.; no prereq.

Af (1) III-IV MW; 220P

(2) VI-VII TTh; 220P

Aw I-II TTh; 216P

As (1) III-IV TS

(2) VIII-IX WF; 220P

Cw III-IV MW; 220P

Cs I-II TTh; 216P

5f,6w—Engineering Geology. Materials of the earth and geologic processes. Application of geology to engineering problems. Lectures, rock study, and reference work. 3 cred.; no prereq.; I MWF; 110P. Mr. Schwartz.

7s—Applied Geology for Engineers. Occurrence, properties, production, and uses of building stones, cements, clay, fuels, and road materials. Lectures and reference work. 3 cred.; prereq., 5; I MWF; 110P. Mr. Schwartz.

11f-12w-13s—General Geology (Dynamic and Historical). Materials of the earth and geological processes. Physiographic, dynamic, and structural geology. The sequence of events in geologic history. Must be completed for credit. Primarily for students in the School of Mines and Metallurgy. 2 cred. per qtr.; no prereq. Mr. Hanley.

11f II WF; 110P

12w-13s II MW; 210P

23f‡-24w‡—Elements of Mineralogy. The crystal systems; morphological, physical, and chemical characters of minerals; occurrence, genesis, and use of minerals; classification and description of common minerals, rock minerals, and common rocks. Determinative work in laboratory, blowpipe analysis, sight identification. 8 cred.; prereq., Inorg. Chem. 10 or equiv. Mr. Gruner.

23f Lect. I TThS; 206P

Rec. IV W; 208P

Lab. (1) III-IV T, VI-VII Th; 100P

(2) VI-VII T, III-IV S; 100P

24w Lect. I TThS; 206P

Rec. VIII M; 208P

Lab. (1) III-IV T, VI-VII W; 100P

(2) VI-VII M, III-IV S; 100P

61f—Blowpipe Analysis. The determination of minerals by systematic blowpipe analysis. 3 cred.; prereq., 24. Mr. Gruner.

85—Field Work.—About two weeks, approximately July 15 to 30, are spent in geologic mapping of selected areas in the iron district of Minnesota. Involves preparation of geologic maps and written reports. 3 cred.; prereq., 105. Messrs. Gruner and Thiel.

91f-92w-93s—Index Fossils of North America. A study of fossil forms with special reference to those of geologic importance; faunas and their correlation. 9 cred.; prereq., 12 or 13. Mr. Stauffer.

Lect. I F; 208P

Lab. VI-VII MW; 105P

101f-102w—Sedimentation. Origin and structure of sedimentary deposits; the

‡ A fee of \$1 per quarter is charged for this course.

- interpretation of these in relation to paleogeography. Lectures, assigned readings, and laboratory work. 6 cred.; prereq., 24. Mr. Thiel.
 101f IV MWF; 210P
 102w VI Th, VII-VIII TTh; 216P
- 103w-104s—Micropaleontology. A study and classification of Foraminifera, diatoms, and other small fossil organisms, and their use for purposes of correlation. 6 cred.; prereq., 51 or 91; II-III TThS; 103P. Mr. Stauffer.
- 105s—Rock Study. The occurrence and genesis of igneous, sedimentary, and metamorphic rocks; their mineral and chemical composition; their structure, texture, and alteration. The classification and methods of identification and description of rocks. 2 cred.; prereq., 1 or 7 or 13 and 24. Mr. Grout.
 Lect. I TS; 110P
 Lab. (Sec. A) III-IV T; 200P (Sec. B) III-IV S; 200P
- 106f—Petrography. The identification and study of minerals and rocks by optical methods; the study of igneous rocks, crystalline schists, and metamorphic rocks. The origin and classification of rocks. 2 cred.; prereq., 105. Mr. Grout.
 Lect. I-II Th; ar
 Lab. VI-VII M; 200P
- 110f—Economic Geology. Study of non-metallic minerals of economic value, and discussions of geologic guides to prospecting for these deposits. 3 cred.; prereq., 105. (Not offered in 1938-39.)
- 111f—Ore Deposits. The nature, distribution, and genesis of ore deposits of the United States; relations of ore deposits to geologic structure; the deformation and superficial alteration of ore deposits. 3 cred.; prereq., 105; I TThS; 110P. Mr. Emmons.
- 112w—Geology of Petroleum. The nature, origin, and accumulation of petroleum, discussion of the various oil fields of the world. 3 cred.; prereq., 105; I TThS; 110P. Mr. Emmons.
- 113s—Problems in Ore Deposits. Field excursions, map work, lectures on field and laboratory methods. 3 cred.; prereq., 111. Mr. Emmons.
- 115w—Applied Geology. The application of methods to laboratory, library, and field problems in geology. 3 cred.; prereq., 111; II MWF; 208P. Mr. Thiel.
- 118w—Principles of Geomorphology. Principles of physiography of the lands, or geomorphology. A study of the form and structure of plains, plateaus, volcanoes, and the different types of mountains. The normal or fluvial, glacial, marine, and arid cycles of erosion and the resulting land forms. Geology 145 is recommended as a desirable companion course. 3 cred.; prereq., 2 or 3 or 13; III TThS; 206P. Mr. Hanley.
- 119s—Geomorphology of the United States. A regional study of the United States by geomorphic or physiographic units. The development of the surface features as affected by rock structure and geologic history. Discussion of the principal problems presented by each area. 3 cred.; prereq., 2 or 3 or 13; III TThS; 206P. Mr. Hanley.
- 120s—Glacial Geology. Nature and process of glacial action. Landforms resulting from alpine and continental glaciers. Character and distribution of Pleistocene and earlier glacial deposits. 3 cred.; prereq., 2 or 3 or 13; I TThS; 206P. Mr. Hanley.
- 121f—Crystallography. Study of crystal models and space groups. Crystal drawings and measurements. Projections and mathematical calculations. 3 cred.; prereq., M.M. 12 and Inorg. Chem. 10 or equiv. Mr. Gruner.

- 124w—Metamorphic Geology. The conditions, processes, and results of weathering and metamorphism. 3 cred.; prereq., 105; II MWF; 110P. Mr. Schwartz.
- 125s—Structural Geology. A study of the principles and applications of geologic structures. 3 cred.; prereq., 105; III TThS; 110P. Mr. Schwartz.
- 131w-132s—Advanced Petrology. Advanced optical methods. Criteria for rapid identification of minerals and rocks. The uses of schedules and tables. Standard rock types. Regional and genetic studies. Petrographic reports. 8 cred.; prereq., 106. Mr. Grout.
 131w Lect. III TThS; 200P
 Rec. VI M; 200P
 Lab. VI-VII Th; 200P
- 132s Lect. II MTWF; 200P
 Lab. VI-VII Th; 200P
- 137f—Testing Economic Minerals. Methods of determining quality of mineral deposits, described and illustrated by laboratory tests of coal, clay, oil, building stone, and metallic ores. 3 cred.; prereq., 24; ar. Mr. Gruner.
- 140w-141s—Applied Petrography. Determination of ores and gangue minerals. Microscopic studies of paragenesis of ores and other mineral associations. Practical problems in mining and geology settled by microscopic and optical examinations. 6 cred.; prereq., 131. Mr. Grout.
 Lect. II F; 200P
 Lab. I-II MW; ar
- 144f—Interpretation of Geologic Maps. Study and problems in construction and interpretation of various types of geologic maps. Recognition of structural and stratigraphic relations. 4 cred.; prereq., 105; VI-IX WF; 206P. Mr. Hanley.
- 145w—Interpretation of Topographic Maps. Application of the principles of geomorphology to the interpretation of topographic maps. Practice in the recognition of landforms. Determination of underground structures and evolution of topography from surface contours. Geology 118 is a desirable companion course. 2 cred.; prereq., 2 or 3 or 13; VI-IX W; 206P. Mr. Hanley.
- 150—Field Geology. Detailed, systematic work conforming with standards of official surveys. Preparation of geologic maps, structure sections, reports; paragenesis of ores and their relations to geologic structures. Field, Black Hills, South Dakota. 6 cred.; prereq., 124. Approximately from September 1 to 28. Mr. Schwartz.
- 151f-152w-153s—Advanced General Geology. Geologic processes and their results; development of the North American continent. 9 cred.; prereq., 2 or 3 or 13; III MWF; 210P. Mr. Stauffer.
- 161w—Crystal Structure. Study of point groups and space groups. Diffraction of X-rays by crystals. Interpretation of powder and Laue diagrams. 3 cred.; prereq., 121, Phys. 23, 43, M.&M. 13. Mr. Gruner.
- 165f—Ore Dressing Microscopy. Methods of studying opaque ore minerals and the application of metallurgical problems. 1 cred.; prereq., 105; VI-VIII Th. Mr. Schwartz.
- 166w-167s—Mineralography. Methods of studying opaque minerals and the application of the methods to problems in ore genesis and history. 6 cred.; prereq., 111 or reg. in 111, 131; II-III TThS; 207P. Mr. Schwartz.

GERMAN

- 24f-25w-26s—Chemical German. Pronunciation, reading, sentence analysis, and translation. 4 cred. per qtr.; no prereq.
 (1) IV MTWF; 113F (2) V MTWF; 207F

27f-28w-29s†—Chemical German. Chemical prose. 3 cred. per qtr.; prereq., two years high school German or one year college German; IV MWF; 209F.

HORTICULTURE

6f—Fruit Growing. Fundamental principles of fruit growing. Sites, soils, nursery stock, planting and planting plans, tillage, fertilization, cover crops, pollination, frost avoidance, pruning and thinning. Lectures, recitations, references, and laboratory. 3 cred.; no prereq.; II MWF; 102Hr(UF). Mr. Angelo.

MATHEMATICS AND MECHANICS

MATHEMATICS

9f—Higher Algebra. (High School.) Fundamental rules, fractions, linear simultaneous equations, graphs, theory of exponents, surds, complex quantities, quadratic equations, numerical exercises. No cred.; no prereq.

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| (1) VIII MTWTh, III S; 106E | (4) VII MTWThF; 205E |
| (2) I MTWThS; 106E | (5) V MTWThF; 205E |
| (3) I MTWThS; 136E | |

11f,w,su—College Algebra. Review of fundamental operations, factoring, fractions, linear simultaneous equations, exponents, surds, complex numbers, and quadratic equations. Theory of quadratic equations, ratio, proportion, variation, determinants, binomial theorem, progressions, theory of equations, higher numerical equations, partial fractions, and infinite series.

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| 11f (1) II MWThFS; 3E | (11) VII MTWThF; 136E |
| (2) II MWThFS; 4E | (12) VII MTWThF; 227E |
| (3) II MWThFS; 5E | (13) VI MTWF, IV S; 4E |
| (4) I MTWThS; 4E | (14) VI MTWThF; 3E |
| (5) I MTWThS; 104E | (15) VI MTWThF; 106E |
| (6) I MTWThS; 227E | (16) VI MTWThF; 203E |
| (7) I MTWThS; 111M | (17) V MTWThF; 203E |
| (8) VIII MTWTh, III S; 136E | (18) V MTWThF; 107E |
| (9) VIII MTWTh; 205E; III S; 215E | (19) V MTWThF; 104E |
| (10) VIII MTWTh; 203E; III S; 206E | |

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| 11w (1) II MWThFS; 3E | (5) VIII MWThF, III S; 4E |
| (2) II MWThFS; 104E | (6) V MTWThF; 3E |
| (3) I MTWThS; 3E | (7) VI MTWThF; 3E |
| (4) VIII MWThF, III S; 3E | |

12w,s,su—Trigonometry. Graphical representation of functions, computation by logarithms and slide rule. Trigonometric functions, plane right triangles, reduction formulas, fundamental relations, addition formulas, double angles, half angles, identities and equations, inverse functions, oblique triangles, De Moivre's theorem, spherical right triangles. 5 cred.; prereq., 11.

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| 12w (1) II MWThFS; 4E | (9) VII MTWThF; 3E |
| (2) II MWThFS; 7E | (10) VII MTWThF; 205E |
| (3) II MWThFS; 215E | (11) VII MTWThF; 215E |
| (4) II MWThFS; 107E | (12) VI MTWF, IV S; 4E |
| (5) I MTWThS; 4E | (13) VI MTWF, IV S; 21E |
| (6) I MTWThS; 203E | (14) V MTWThF; 136E |
| (7) I MTWThS; 136E | (15) V MTWThF; 106E |
| (8) I MTWThS; 111M | (16) IV MTWF; 205E; VI Th; 206E |
| 12s (1) II MWThFS; 22E | (5) VIII MWThF; 4E; III S; 3E |
| (2) II MWThFS; 4E | (6) VIII MWThF, III S; 136E |
| (3) I MTWThF; 4E | (7) V MTWThF; 4E |
| (4) I MTWThF; 206E | (8) V MTWThF; 205E |

† Membership in the class is determined by a placement test at the beginning of the fall quarter.

13f,s,su—Analytical Geometry. Co-ordinate systems, locus and equation, straight line, circle, parabola, ellipse, hyperbola. Transformation of co-ordinates and simplification of equations. Polar co-ordinates, higher plane curves, tangents, normals. Empirical equations, solid analytic geometry. 5 cred.; prereq., 11 and 12.

13f (1) V MTWThF; 136E (4) VIII MTWTh; 107E; VIII F; 136E
(2) I MTWThF; 203E (5) III MTWThF; 136E
(3) I MTWThF; 3E

13s (1) II MWThFS; 3E (8) VII MWThF, VIII T; 136E
(2) II MWThFS; 104E (9) VII MWThF, VIII T; 4E
(3) II MWThFS; 7E (10) IV MWFS, V T; 3E
(4) I MTWThF; 3E (11) IV MWFS, V T; 203E
(5) I MTWThF; 203E (12) VI MTWThF; 3E
(6) I MTWThF; 111M (13) VI MTWThF; 5E
(7) VII MWThF, VIII T; 227E (14) VI MTWF, V Th; 136E

24f,w,su—Differential Calculus. Limit, derivative, simple applications of derivative, maxima and minima, differentials, rates, change of variables, radius of curvature, mean value, indeterminate forms, partial differentiation, series. 5 cred.; prereq., 13.

24f (1) V MTWThF; 4E (7) VIII MTWThF; 215E
(2) IV MTWFS; 106E (8) VIII MTWThF; 104E
(3) IV MWFS, V Th; 227E (9) VII MTWThF; 106E
(4) IV MWFS, V Th; 21E (10) I MTWThF; 22E
(5) II TWThFS; 106E (11) III MTWThF; 106E
(6) II TWThFS; 206E (12) III MTWThF; 104E

24w (1) V MTWThF; 203E (4) VI MTWF, IV S; 104E
(2) V MTWThF; 205E (5) III MTWThF; 104E
(3) VII MTWThF; 136E (6) III MTWThF; 22E

25w,s,su—Integral Calculus. Expansion of functions, Taylor's theorem. Standard elementary forms, definite integral, rational fractions, integration by substitution, by parts, reduction formulas, integration a process of summation, successive and partial integration, elementary ordinary differential equations. 5 cred.; prereq., 24.

25w (1) V MTWThF; 215E (6) VII MTWThF; 227E
(2) III MTWThF; 106E (7) VII MTWThF; 106E
(3) III MTWThF; 215E (8) VI MTWF, IV S; 106E
(4) III MTWThF; 3E (9) I MTWThF; 205E
(5) IV MTWF, II S; 106E

25s (1) VII MTWThF; 106E (4) V MTWThF; 215E
(2) II MTWThF; 203E (5) III MTWThF; 104E
(3) II MTWThF; 206E (6) III MTWThF; 106E

31f-32w-33s—Differential and Integral Calculus. Three-quarter course in calculus for students in the School of Mines and Metallurgy. 9 cred.; prereq., 13.

31f II TS, III Th; 111M

32w-33s IV MWF; 111M

91f*—Calculus (Arch., Pre-bus.). Short course, derivatives, maxima and minima, integration of simple forms, definite integrals, areas. 4 cred.; prereq., 13; I MWFS; 206E.

151f—Differential Equations. Differential equations and their solutions. First order and first degree, first order and higher degree, singular solutions; total differential equations, linear differential equations, miscellaneous methods, system of simultaneous equations, integration in series. 3 cred.; prereq., 25; I MWF; 215E.

152w-153s—Advanced Calculus with Applications. 3 cred. per qtr.; prereq., 151; I MWF; 215E.

* For permissible substitute, see page 71.

- 154f-155w-156s—Vector Analysis and Applications. 3 cred. per qtr.; prereq., 26; IV MWF; 138EE.
- 164f-165w-166s—Operational Methods and the Operational Calculus. 3 cred. per qtr.; prereq., 151 or by permission; ar.
- 167f-168w-169s—Mathematics of Modern Engineering. 3 cred. per qtr.; prereq., 26; IV MWF; 4E(f,w), 7E(s).
- 254f-255w-256s—Modern Analysis. Based on Whittaker and Watson's text. 3 cred. per qtr.; prereq., 153.
- 261f-262w-263s—Functions of a Complex Variable. Elliptic functions and integrals with applications. 3 cred. per qtr.; prereq., 153.

For other courses see Combined Class Schedule Bulletin.

MECHANICS

- 26f,s,su—Technical Mechanics: Statics. Concurrent force systems, parallel forces, couples, center of gravity, statics of rigid bodies, graphical methods, friction, work, theory of moment of inertia. 5 cred.; prereq., 25.
- 26f (1) II MTWThF; 136E (3) IV MTWFS; 205E
(2) V MTWThF; 106E
- 26s (1) VII MTWThF; 104E (5) IV MTWFS; 106E
(2) VII MTWThF; 203E (6) IV MTWFS; 4E
(3) II MTWThF; 106E (7) III MTWThF; 136E
(4) II MTWThF; 215E
- 84f,s*—Technical Mechanics. (Chem., Ch.E., Ag.E., and Pre-bus.) Statics, resolution of forces, conditions of equilibrium, center of gravity, moment of inertia, stresses in framed structures and machines, kinematics, dynamics of a particle. Newton's laws of motion, work, energy, power, impulse, and momentum. 5 cred.; prereq., 25 or 91.
- 84f IV MTWFS; 203E
84s (1) III MWThFS; 203E (3) I MTThFS; 22E
(2) III MWThFS; 4E
- 92w*—Mechanics for Architects. Statics, resolution of forces, conditions of equilibrium, center of gravity, moment of inertia of plane sections, stresses in framed structures. 4 cred.; prereq., 91; I MWFS; 7E.
- 127f,w,s—Technical Mechanics: 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.
- 127f (1) III MTThFS; 203E (3) II MTWFS; 203E
(2) I MTWFS; 205E (4) IV MTWFS; 3E
- 127w (1) II MTWThF; 203E (3) IV MTWFS; 203E
(2) III TWThFS; 205E
- 127s (1) IV MTWFS; 136E (4) II MTWThF; 205E
(2) IV MTW, V F; 21E; IV S; 22E (5) VI MTWThF; 205E
(3) I MTWThF; 106E
- 161f-162w-163s—Advanced Technical Mechanics. Moving axes, Eulerian angles, Lagrange's equations, generalized co-ordinates, dynamical problems soluble in terms of circular and elliptic functions, dynamical specifications of bodies, motion of a top, theory of vibrations, Hamilton's principle. Special problems. 3 cred. per qtr.; prereq., 127; ar.
- 267f-268w-269s—Advanced Dynamics. Text, Routh's *Rigid Dynamics*, Vol. I. 3 cred. per qtr.; prereq., 153.

* For permissible substitute, see page 71.

- 274f-275w-276s—Advanced Dynamics of a Particle. 3 cred. per qtr.; prereq., 127.
 277f-278w-279s—Advanced Statics. Text, Routh's *Analytical Statics*. 3 cred. per qtr.; prereq., 127. (Not offered in 1938-39.)
 297w-298s—Vibration—Problems. 3 cred. per qtr.; prereq., 127.

MATERIALS

- 85f,s*—Strength of Materials. (Ch.E. and Pre-bus.) Mechanical and elastic properties of materials of construction, beams, shafts, columns, combined stresses, dynamic stresses. 3 cred.; prereq., 84.
 85f (1) VI MWF; 205E (2) IV TS, 5E; II Th, 203E
 85s VI MWF; 106E
- 87f,s—Materials Testing Laboratory. (Ch.E. and Pre-bus.) Investigation of the physical properties of various metals and engineering materials (steel, cast iron, wood, brick, etc.). Standard methods of testing. 1 cred.; prereq., 85 or reg. in 85.
 87f (1) VIII-IX M; Ex (3) VI-VII M; Ex
 (2) VIII-IX W; Ex (4) VII-VIII F; Ex
 87s VIII-IX M; Ex
- 93s*—Strength of Materials. (Arch.) Mechanical and elastic properties of materials of construction, design of riveted joints, beam theory, columns, arches. 4 cred.; prereq., 91 and 92; I MWFS; 5E.
- 128f,w,s—Strength of Materials. Mechanical and elastic properties of materials of construction, beams, shafts, columns, combined stresses, hollow cylinder rollers, plates, curved bars, springs, dynamic stresses, true stresses. 5 cred.; prereq., 26.
 128f (1) III MTWFS; 205E (3) IV MTWFS; 136E
 (2) II MTWThF; 104E
- 128w (1) IV MTWFS; 3E (4) III MTWThF; 136E
 (2) II MTWThF; 136E (5) I TWThFS; 106E
 (3) VI MTWThF; 205E (6) IV MTWFS; 315M
- 128s (1) II MTWFS; 110Ex (3) III MWThFS; 205E
 (2) IV MTWFS; 205E
- 141f,w,s—Materials Testing Laboratory. Investigation of the physical properties of various metals and engineering materials (steel, cast iron, wood, cement, brick, etc.) Standard methods of testing. 2 cred.; prereq., 128 or reg. in 128.
 141f Lect. (1) VI T; 110Ex (2) III M; 110Ex
 Lab. (1) VIII-IX T; Ex (3) I-II T; Ex
 (2) VI-VII Th; Ex (4) VI-VII W; Ex
- 141w Lect. (1) VI Th; 110Ex (3) VII W; 110Ex
 (2) VI W; 110Ex
 Lab. (1) I-II W; Ex (7) VI-VII F; Ex
 (2) VIII-IX M; Ex (8) II-III M; Ex
 (3) I-II S; Ex (9) VIII-IX Th; Ex
 (4) VIII-IX T; Ex (10) III-IV S; Ex
 (5) II-III Th; Ex (11) VIII-IX W; Ex
 (6) VIII-IX F; Ex
- 141s Lect. (1) VI T; 110Ex (2) VI F; 110Ex
 Lab. (1) VIII-IX T; Ex (4) VI-VII W; Ex
 (2) VI-VII Th; Ex (5) VIII-IX Th; Ex
 (3) VIII-IX F; Ex
- 144w—Materials Testing Laboratory. (Mines.) 2 cred.; prereq., 128; VI-IX Th; Ex.
- 180w—Advanced Strength of Materials. Stress analysis in statically indeterminate

* For permissible substitute, see page 71.

- structures. Theory of superposition. Energy of strain. Elastic stability. 3 cred.; prereq., M.&M. 128; ar.
- 181f-182w-183s—Applied Elasticity. Special problems in stress analysis. 3 cred. per qtr.; prereq., M.&M. 128; 5E.
- 184f-185w-186s—Advanced Testing Materials Laboratory. Special problems relating to the physical properties of engineering materials. 2 cred. per qtr.; prereq., 141.
- 294f-295w-296s—Mathematical Theory of Elasticity. 3 cred. per qtr.; prereq., 128, 153.

HYDRAULICS

- 86w*—Hydraulics. (Ch.E. and Ag.E.) Hydrostatics, Bernoulli's theorem, flow through orifices, pipes, and over weirs, dynamic action of jets and streams, flow of gases through pipes. 2 cred.; prereq., 84.
- (1) II MF; 22E (3) VI MW; 206E
(2) II TTh; 22E
- 129f,w,s—Hydraulics. Laws of equilibrium of fluids, flow through orifices and over weirs, pressure and flow through tubes and pipes, flow in conduits and rivers, dynamic pressure of water, elementary principles of turbines and pumps. 4 cred.; prereq., 26.
- 129f Lect. (all sections) I Th; HL
Rec. (1) VI TWF; 215E (4) IV TS, VII W; 215E
(2) IV MWF; 215E (5) II MWF; 110Ex
(3) III MWF; 22E
- 129w Lect. (all sections) I Th; HL
Rec. (1) I MTF; 222E (2) IV MFS; 136E
- 129s Lect. (all sections) I Th; HL
Rec. (1) I MWF; 136E (3) II TThS; 136E
(2) II MWF; 136E
- 130f—Open Channel Flow. Theory of uniform and varied flow in open channels, with practical applications to the design of hydraulic structures; computations for drawdown curves, backwater curves, hydraulic jump, measuring flumes, submerged weirs, etc. 3 cred.; prereq., 129 and 143; I MWF; 110Ex.
- 132f-133w-134s—Advanced Hydraulic Problems. Special problems in hydraulic design. 2 cred. per qtr.; prereq., 130 or reg. in 130.
- 143f,w,s—Hydraulics Laboratory. Experimental and demonstrational work. Pressure head, Piezometer tubes, gages, stability of flotation, Bernoulli's theorem. Venturi meter, flow through orifices, over weirs, and through pipes. Open channels, gaging, impact on vanes, pumps, and hydraulic machines. 1 cred.; prereq., 86 or 129 or reg. in 86 or 129.
- 143f (1) VI-VII M; Ex (6) I-II S; Ex
(2) VIII-IX T; Ex (7) VIII-IX W; Ex
(3) III-IV M; Ex (8) VIII-IX M; Ex
(4) VIII-IX F; Ex (9) VI-VII Th; Ex
(5) III-IV W; Ex (10) VIII-IX Th; Ex
- 143w (1) VI-VII M; Ex (6) VI-VII Th; Ex
(2) VIII-IX T; Ex (7) VIII-IX F; Ex
(3) VIII-IX Th; Ex (8) VI-VII T; Ex
(4) VIII-IX M; Ex (9) III-IV T; Ex
(5) VIII-IX W; Ex (10) VI-VII F; Ex
- 143s (1) VI-VII M; Ex (5) III-IV F; Ex
(2) I-II T; Ex (6) VIII-IX F; Ex
(3) VIII-IX M; Ex (7) VI-VII W; Ex
(4) VIII-IX W; Ex (8) VIII-IX Th; Ex

- 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., 127, 128, and 129; ar.
- 191w—Hydraulic Motors and Pumps. Study of the hydraulic theory of the ram, impulse wheel, reaction turbine, and centrifugal pump. 3 cred.; prereq., 129; III MTh, 203E; III S, 106E.
- 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., 129 and preferably 130; I TS, VI Th; 136E.
- 193w—Hydraulic Measurements. Detailed study of the current meter. Venturi meter, weir, orifice. Parshall flume, traveling screen, chemical method of gaging, etc. 3 cred.; prereq., 129; I MWF; 104E.
- 194f-195w-196s—Advanced Hydraulics Laboratory. Special experimental studies concerning the characteristic of turbines, pumps, etc. Hydraulic models. 2 cred. per qtr.; prereq., 129 and 143; ar.
- 197f-198w-199s—Mechanics of Soils. 2 cred. per qtr.; prereq., 129, 143; ar.
- 281f-282w-283s—Hydrodynamics. 3 cred. per qtr.; prereq., 129, 153.
- 284f-285w-286s—Advanced Hydrodynamics. 3 cred. per qtr.; prereq., 283.

MECHANICAL ENGINEERING

WOOD CONSTRUCTION LABORATORY

- 1f,w,s,su—Elementary Woodworking. Unit bench operations, manipulation and care of hand tools, layout construction of projects, elementary wood turning. 2 to 4 cred.; no prereq.; VI-IX MW. Mr. Richards.
- 2f,w,s,su—Machine Woodworking. Operation and setting up of woodworking machinery, including care and maintenance of the cutting tools, belts, and various machines. Advanced wood turning. 2 to 4 cred.; prereq., 1; VI-IX MW. Mr. Richards.
- 3f,w,s,su—Wood Finishing. Methods of preparing wood surfaces for finishes, various types of finishes such as stains, fillers, varnishes, lacquers, paints, and waxes applied by hand or machine methods. Blending of colors and color effects on design. 2 to 4 cred.; no prereq. Mr. Richards.
3f,s Ar
3w II-III MWF
- 4f,w,s,su—Furniture Construction. Evaluation of the various types of furniture construction, details of design of construction of upholstered and other furniture. Inspection trips to furniture plants. 2 to 4 cred.; prereq., 2. Mr. Richards.
- 4af,w,s,su—Furniture Construction. Similar to 4 except arranged for School of Architecture. Mr. Richards.
4af,w Ar
4as I-III WF
- 5f,w,s,su—Pattern Practice and General Woodwork. Study of the principles involved in the construction and use of patterns and core boxes, manipulation

and care of hand and machine tools. Inspection trips and reports. 2 cred.; no prereq. Mr. Richards.

5f Lect. III T; 202ME
Lab. II-V W

5w Ar

5s Lect. III Th; 202ME

Lab. (1) I-IV W

(2) VI-IX Th

6f,w,s,su—Pattern Practice and General Woodwork. Study of the principles involved in the construction and use of patterns, core boxes, and sweeps. Study of paints, varnishes, stains, and preservatives of wood. Use of machines in producing general wood products. Inspection trips and reports. 2 cred.; prereq., Chem. 5, Draw. 2. Mr. Richards.

6f Lect. (1) I Th; 202ME
(2) III S; 202ME

(3) II M; 202ME

(4) I S; 202ME

Lab. (1) VI-IX Th

(3) I-IV F

(2) VI-IX F

(4) VI-IX T

6w Lect. (1) I Th; 202ME
(2) IV T; 202ME

(3) I T; 202ME

(4) II T; 202ME

Lab. (1) I-IV S

(3) VI-IX Th

(2) VI-IX T

(4) VI-IX F

6s Lect. II T; 202ME

Lab. VI-IX T

7f,w,s,su—Advanced General Woodwork. Problems in mass production of furniture and other things made from wood. 2 cred.; prereq., 6; ar. Messrs. Richards and Koepke.

FOUNDRY LABORATORY

8f,w,s,su—Foundry Practice. Theory and practice in melting and casting ferrous and non-ferrous metals. Practice in making cores, bench and floor molds. Problems and reports. 2 cred.; no prereq. Mr. Holtby.

8f Lect. (1) VIII T; 153ME

(2) III F; 153ME

Lab. (1) I-IV T

(2) VI-IX M

8w Lect. (1) VIII W; 153ME
(2) I M; 153ME

(3) VII W; 153ME

Lab. (1) VI-IX Th

(5) VI-IX T

(2) I-IV T

(6) VI-IX F

(3) I-IV S

(7) I-IV W

(4) VI-IX M

8s Lect. IX Th; 153ME

Lab. (1) I-IV T

(2) I-IV W

9f,w,s,su—Foundry Practice. Theory and practice in melting, alloying, and casting ferrous and non-ferrous metals. Theory of foundry control methods, risers, feeders, gates, and pattern design. Practice in making cores and molds in relation to part design. Problems and reports. 2 cred.; prereq., Chem. 5, Draw. 2. Mr. Holtby.

9f Lect. (1) I Th; 153ME

(3) VII W; 153ME

(2) IV F; 153ME

(4) VII M; 153ME

Lab. (1) VI-IX T

(5) I-IV M

(2) I-IV S

(6) VI-IX Th

(3) VI-IX F

(7) VI-IX W

(4) I-IV W

9w Ar

9s Lect. I Th; 153ME

Lab. (1) VI-IX M

(2) I-IV S

10f,w,s,su—Advanced Foundry Practice. Foundry control methods, X-ray analysis of castings. Laboratory practice in sand and metal analysis, permanent mold design and operation. Steel and malleable iron castings. Problems and reports. 2 cred.; prereq., 9, Chem. 16; ar. Mr. Holtby.

FORGING, HEAT TREATING, AND WELDING LABORATORY

11f,w,s,su—Forging and Metal Working. Theory and practice of forging, pipe fitting, soldering, brazing, welding, and heat treatment of metals. 2 cred.; no prereq. Mr. Hughes.

11f Lect. (1) I M; 153ME (2) II T; 153ME
 Lab. (1) VI-IX Th (3) VI-IX M
 (2) I-IV T (4) VI-IX W

11w Lect. VII T; 153ME
 Lab. I-IV T

11s Lect. I F; 153ME
 Lab. VI-IX Th

12f,w,s,su—Forging, Heat Treating, and Welding. Forging and heat treatment of metals, operation of furnaces, thermit, electric arc, oxyacetylene, and spot welding. Theory and practice. 2 cred.; prereq., Chem. 5, Draw. 2. Mr. Hughes.

12f Lect. (1) VIII Th; 153ME (2) III Th; 153ME
 Lab. (1) VI-IX F (3) II-V S
 (2) VI-IX T (4) I-IV F

12w Lect. (1) III Th; 153ME (3) III S; 153ME
 (2) VIII M; 153ME (4) VII M; 153ME
 Lab. (1) I-IV M (4) I-IV W
 (2) VI-IX W (5) VI-IX T
 (3) VI-IX F (6) VI-IX Th

12s Lect. (1) VIII F; 153ME (2) VII F; 153ME
 Lab. (1) I-IV W (4) VI-IX T
 (2) VI-IX M (5) II-V S
 (3) I-IV S

13f,w,s,su—Advanced Welding. Course in theory, design, and testing of gas and electric arc welds. 2 to 4 cred.; prereq., 12; ar. Mr. Hughes.

14f,w,s,su—General Metal Work. Course in working various metals, to meet the needs of teachers of elementary forging for art metal courses. Project designed for individual needs. 2 to 4 cred.; no prereq.; ar. Mr. Hughes.

METAL MACHINING LABORATORY

15f,w,s,su—Machine Shop Practice. Fundamental operation on lathes, shaper, drill press, milling machine, and grinder. Bench work. Job analysis based on unit operations. 2 cred.; no prereq. Not for E.E. Mr.

15f Lect. IV W; 202ME
 Lab. II-V S

15w Lect. VI Th; 202ME
 Lab. I-IV S

15s Lect. (1) I M; 202ME (4) I S; 202ME
 (2) III M; 202ME (5) II Th; 202ME
 (3) III W; 202ME

Lab. (1) I-IV T (4) VI-IX Th
 (2) VI-IX M (5) I-IV F
 (3) VI-IX T

- 16s,su—Machine Shop Practice. Fundamental operation on lathes, drill press, milling machine, and grinder. Turret lathe operation and gear cutter. 2 cred.; no prereq. Not for Chem.E. Mr.
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|------------------------|-----------------|
| Lect. (1) VII M; 202ME | (3) I Th; 202ME |
| (2) I W; 202ME | |
| Lab. (1) VI-IX; F | (3) VI-IX W |
| (2) II-V S | |
- 17f,w—Machine Shop Practice. Fundamental operations on lathes, shaper, drill press, milling machine, boring machine, and grinder, turret lathe operation, polishing and buffing, gear cutting and tool grinding, production methods, routing, and machine selection. 3 cred.; prereq., 6, 9, 12. Mr.
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|-----------------------------|----------------------|
| 17f Lect. (1) II Th; 202ME | (3) VII M; 202ME |
| (2) II F; 202ME | |
| Lab. (1) VI-IX T, I-III W | (4) II-IV, VI-IX M |
| (2) VI-IX W, I-III Th | (5) I-IV T, VII-IX F |
| (3) VI-IX Th, III-V F | |
| 17w Lect. (1) III W; 202ME | (3) VII T; 202ME |
| (2) VI F; 202ME | |
| Lab. (1) VI-IX T, VII-IX Th | (4) VI-IX M, I-III F |
| (2) VI-IX W, VII-IX F | (5) I-IV T, I-III Th |
| (3) I-IV M, II-IV W | |
| 17s Lect. VII T; 202ME | |
| Lab. II-V M, II-IV W | |
- 18w,s—Advanced Machine Shop Practice. Shop practice to suit individual needs. Setting up of turret lathes, production lathes, and milling machines for quantity production. Machinability. Writing of manufacturing operation sheets for complete units. Inspection trips. 3 cred.; prereq. 15, 16, or 17; ar.

MACHINE DESIGN

- 20f,w—Elementary Machine Design. Technique and knowledge necessary to convey information from engineering department to shop. Drawing room and shop standards; fits, limits, and tolerances; heat treating; welding; material specifications; records and changes. 2 cred.; prereq., Draw. 2. Messrs. Martenis and Palmer.
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| 20f (1) VIII-IX MWTh; 151ME | (4) III-IV MFS; 151ME |
| (2) I-II T, VIII-IX TF; 151ME | (5) I-II ThFS; 151ME |
| (3) VI-VII MTTh; 151ME | |
| 20w I-II, VII-VIII Th, VIII-IX F; 151ME | |
- 21w,s—Kinematics. Instant centers, centroids, point paths, gear tooth profiles, cam construction, velocity diagrams. Lectures and drafting. 2 cred.; prereq., 20. Messrs. Martenis and Palmer.
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| 21w V-VI MTh, VI-VII F; 151ME | |
| 21s (1) I-II MF, II-III Th; 151ME | (4) VIII-IX MF, III-IV S; 151ME |
| (2) I-II TS, VI-VII Th; 151ME | (5) VIII-IX TThF; 151ME |
| (3) VI-VII MWF; 151ME | |
- 22f—Mechanism. Motion studies. Revolving and oscillating bodies, linkages, chains, flexible connectors, gearing, wheels in trains, epicyclic gear trains, worm and wheel, screws, straight line motions, hoists, pulley blocks, ratchets, intermittent motions. Recitations and problems. 3 cred.; prereq., 21 and M.&M. 24. Mr. Martenis.
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| (1) I TThS; 252ME | (3) IV MWS; 252ME |
| (2) III MWF; 252ME | (4) III TThS; 252ME |
- 23w—Dynamics of Machine Design. Valve mechanism; governors; static, dy-

- namic, and reciprocating balance; crank effect diagrams; gyroscopic action; critical speeds. 3 cred.; prereq., M.&M. 127. Messrs. J. J. Ryan and Palmer.
- Lect. (1) III TTh; 254ME (3) I TTh; 254ME
(2) III MW; 254ME (4) II MF; 254ME
- Lab. (1) I-III MF; 151ME (3) VII-IX MW; 151ME
(2) VI-VIII T, II-IV S; 151ME (4) I-III TW; 151ME
- 24s—Elements of Machine Design. Design of beams, shafting, columns, screw fastenings, springs, friction clutches, and brakes. Factor of safety. Stresses due to sudden applied, repeated, and reversed loads. 3 cred.; prereq., M.&M. 128. Mr. J. J. Ryan.
- (1) II MWF; 252ME (3) III TThS; 252ME
(2) VI MThF; 252ME (4) III MWF; 252ME
- 26w—Mechanism and Kinematics. (E.E., Aero.E., and Ag.E.) Kinematics of machines. Levers, linkwork, flexible connections, gearing, screws, cams, epicyclic trains. Graphical studies of velocities. Motion; intermittent, parallel, quick return, and escapements. 3 cred.; prereq., M.&M. 24. Messrs. Martenis and Palmer.
- (1) III WThS; 252ME (4) I MWF; 252ME
(2) IV MWF; 252ME (5) I TThS; 252ME
(3) IV TS, VI Th; 252ME (6) II TThS; 254ME
- 27s—Machine Design. (Aero.E. and Ag.E.) Fundamental principles of design of machine elements; lubrication, theory and application; friction drives, shafts, screws, gears, belt connectors, springs, flywheels, machine frames, shrink fits. 3 cred.; prereq., M.&M. 128. Messrs. J. J. Ryan and Palmer.
- Lect. (1) III W; 254ME (3) II Th; 254ME
(2) II T; 254ME
- Lab. (1) III-V T, II-IV S; 255ME (3) VII-IX TTh; 255ME
(2) VII-IX MF; 255ME
- 28f,s—Machine Design. (Ch.E.) Kinematic analysis of machine parts. Screw fastenings, riveted and welded joints, piping, shafting, belting, gearing, cams, bearings, pressure vessels, and stresses in machine parts. 3 cred.; prereq., M.&M. 85. Mr. Martenis.
- 28f VII TF, II Th; 252ME
28s (1) VII MWF; 252ME (2) II TThS; 252ME
- 121f—Machine Design. Spur, bevel, and worm gears; flywheels and pulleys; rotating discs; belt and rope transmission; force and shrink fits; critical speeds; lubrication. 2 cred.; prereq., 24. Mr. J. J. Ryan.
- (1) VII-IX WF; 255ME (3) I-III TTh; 255ME
(2) VII-IX MTh; 225ME
- 122w-123s—Mechanical Engineering Design. Machine elements as applied to complete machines. Mathematical theory of lubrication; vibration analysis; stress analysis by photoelastic methods. Study of materials for special purposes, high temperatures, etc. 2 cred. per qtr.; prereq., 121. Mr. J. J. Ryan.
- 122w VII-IX MTh; 255ME
123s VI-IX W, I-II Th; 255ME
- 125w—Machine Design Laboratory. Experimental studies of critical speeds, vibration, balancing, and noise in high speed machinery; complex stresses in machine parts; the use of vibrograph, oscillograph, stroboscope, photoelastic polariscope, and noise meter. 2 cred.; prereq., 121; VI M; 252ME; VI-VIII F; 50ME. Mr. J. J. Ryan.
- 127w—Lubrication. Hydrodynamic theory of lubrication and applications to the design and construction of thrust and journal bearings. Pressure distribution, end leakage, film thickness, temperatures, and heat losses. 3 cred.; prereq., 121; IV MWF; 254ME. Mr. J. J. Ryan.

- 128f—Photoelastic Stress Analysis. Fundamentals of stress analysis; optics of the polariscope; studies in tension, bending, and shear; combined stresses; concentrated stresses; auxiliary equipment; Mohr's diagrams; complex stress analysis. 3 cred.; prereq., M.&M. 128. Mr. J. J. Ryan.
- 129s—Vibration Engineering. Fundamental analysis; factors influencing vibration, critical speeds; rotating, reciprocating, torsional vibration; balancing; instruments for measuring and recording vibration. 3 cred.; prereq., 121; I MWF; 252ME. Mr. J. J. Ryan.
- 221f-222w-223s—Advanced Mechanical Engineering Design. 3 cred. per qtr.; prereq., 121 and grad. Messrs. DuPriest, Martenis, and J. J. Ryan.

STEAM ENGINEERING

- 30f—Steam Engineering. (A.E.) Elementary study of the steam power plant, including boilers, stokers, furnaces, fuels, combustion, steam generation, and prime movers. 3 cred.; prereq., Phys. 23. Messrs. DuPriest and Easton.
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| (1) II TThS; 154ME | (3) IV MWF; 154ME |
| (2) III MWF; 154ME | (4) VII MWF; 154ME |
- 31w—Thermodynamics. (A.E.) Heat and mechanical energy and the laws governing the operation of machines used to convert heat energy into mechanical energy. Steam, gas, and oil engines, air compressors, refrigeration machines, and turbines. 3 cred. per qtr.; prereq., 30. Messrs. DuPriest and Easton.
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| Lect. (1) VI T; 254ME | (2) VIII Th; 254ME |
| Rec. (1) III TS; 154ME | (3) IV MW; 154ME |
| (2) VI WF; 154ME | (4) III WF; 154ME |
| Lab. (1) VIII-IX T; 154ME | (3) VI-VII M; 154ME |
| (2) VIII-IX F; 154ME | (4) VIII-IX W; 154ME |
- 33f—Elementary Mechanical Laboratory. Calibration of pressure gages, anemometers, indicator springs. Use of steam calorimeters, planimeters, indicators. Calculations from indicator cards. Tests of mechanical appliances, lubricating oils. 2 cred.; prereq., reg. in 30. Messrs. Campbell and Cobb.
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| (1) VI-IX W; Ex | (6) VI-IX F; Ex |
| (2) VI-IX W; Ex | (7) VI-IX T; Ex |
| (3) VI-IX Th; Ex | (8) VI-IX T; Ex |
| (4) VI-IX Th; Ex | (9) I-IV S; Ex |
| (5) VI-IX M; Ex | (10) II-V M; Ex |
- 34w—Mechanical Laboratory. Calibration of tachometers, pyrometers, steam flow meters. Valve setting. Flow of steam through orifices. Test of steam trap, surface condenser, simple steam engines. Inspection trips. 2 cred.; prereq., 33. Messrs. Campbell and Cobb.
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| (1) VI-IX F; Ex | (4) I-IV S; Ex |
| (2) VI-IX W; Ex | (5) VI-IX M; Ex |
| (3) VI-IX Th; Ex | (6) VI-IX T; Ex |
- 35s—Elementary Steam and Power Laboratory. Friction test of oils. Test of hot air engine, centrifugal fan, injector, steam pump, steam boiler. Calibration of transmission dynamometer. Power study of industrial machines. Approximate analysis of fuels. Use of Mahler, Bomb, and Junkers calorimeters. 2 cred.; prereq., 34 and reg. in 45. Messrs. Campbell and Cobb.
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| (1) I-IV S; Ex | (4) VI-IX M; Ex |
| (2) VI-IX T; Ex | (5) VI-IX Th; Ex |
| (3) VI-IX W; Ex | |
- 38w-39s—Heat Engines. (Ch.E.) Study of steam properties, steam calorimetry, elementary thermodynamics, fuels, and combustion; calibration and use of instruments; valve setting; operation and testing of steam engines, boilers, com-

pressors, water heaters and purifiers, gas engines, etc. Selection of equipment for power plants. 3 cred. per qtr.; prereq., Phys. 23. Mr. Cobb.

38w (1) VI MWF; 215Ex (3) IV MWF; 110Ex
(2) II MWF; 110Ex

39s Rec. (1) IV MF; 110Ex (2) III TS; 110Ex

Lab. (1) VI-IX Th; Ex (3) VI-IX M; Ex
(2) VI-IX F; Ex

40f-41w—Heat Engines. (E.E.) Properties of steam; principle of operation of steam machinery; fuels, combustion, and smoke prevention; construction, operation, and testing of engines, turbines, boilers, condensers, pumps, and power plant equipment. Selection of equipment for different types of plants. 3 cred. per qtr.; prereq., Phys. 23. Mr. Cobb.

40f Rec. (1) IV TS; 110Ex (2) III WF; 110Ex
Lab. (1) VI-VIII Th; Ex (2) I-III Th; Ex

41w Rec. (1) IV TS; 110Ex (2) III WF; 201Ex
Lab. (1) VII-IX T; Ex (2) I-III Th; Ex

42w—Heat Engines. (C.E.) Steam generation and properties. Fuels and combustion. Construction and operation of boilers and auxiliaries. Elementary thermodynamics. Use and calibration of engine-room instruments. Types, details, and tests of steam engines, steam turbines, gas engines, and air compressors. Performance and adaptability of power equipment. 4 cred.; prereq., Phys. 23. Mr. Cobb.

(1) I TThS, VI W; 201Ex (2) II TThS, VII W; 201Ex

43f—Steam Engineering. (M.E.) An introductory course dealing with power plant equipment and steam generation. 3 cred.; prereq., Chem. 5 and Phys. 23. Messrs. DuPriest and Easton.

(1) IV TS, VI Th; 154ME (4) I TThS; 154ME

(2) I MF, VI W; 154ME (5) III TThS; 154ME

(3) VI MTF; 154ME (6) II MWF; 154ME

44f-45s—Thermodynamics. A critical study of the properties of gases and vapors and the fundamental laws for conversion of heat energy into mechanical energy in steam engines, gas engines, air compressors, refrigeration machines, steam turbines, etc. 3 cred. per qtr.; prereq., 43, M.&M. 25. Messrs. DuPriest and Easton.

44w Lect. (1) II T; 252ME (2) VII M; 254ME

Rec. (1) II TS; 154ME (4) III MTh; 154ME

(2) I TS; 154ME (5) II WF; 154ME

(3) I WF; 154ME (6) IV TS; 154ME

Lab. (1) VIII-IX M; 154ME (4) I-II Th; 154ME

(2) VIII-IX Th; 154ME (5) I-II M; 154ME

(3) VI-VII T; 154ME (6) VI-VII Th; 154ME

45s Lect. VI F; 254ME (2) VII F; 254ME

Rec. (1) III MW; 154ME (4) III TTh; 154ME

(2) II TTh; 154ME (5) IV TS; 154ME

(3) I TS; 154ME

Lab. (1) VI-VII T; 154ME (4) VI-VIII Th; 154ME

(2) II-III S; 154ME (5) VIII-IX F; 154ME

(3) VIII-IX M; 154ME

138w*—General Laboratory. Calibration of pressure gages and anemometers. Use of steam calorimeters. Steam indicator practice, card calculation, valve

* For 1938 the following course will be offered in place of the one described above:

138w—Advanced General Laboratory (Mines). (a) Tests of air compressors, steam turbine, compound steam engine, centrifugal fan, gas engine. (b) The use of hydraulic measuring devices, weirs, differential gages, etc. in the tests of centrifugal pumps, hydraulic turbines, and rams. 4 hrs.; prereq., 36; VI-IX Th; Ex. Messrs. Shoop and Straub.

- setting. Tests of steam engines, steam turbines, gas engines, air compressors, and pumps. Physical tests of lubricating oils. 2 cred.; prereq., Min.E. 122; VI-IX Th; Ex. Mr. Shoop.
- 141f,w—Power Plant Engineering. Theory, practice, and economics relating to prime movers and steam generating equipment of the modern power plant, including auxiliary units such as condensers, heaters, purifiers, pumps, fans, piping, etc. 3 cred.; prereq., 32. Mr. Shoop.
- 141f (1) II MWF; 252ME (2) I MWF; 252ME
141w (1) I MWF; 110Ex (2) II MWF; 201Ex
- 144w—Steam Turbines. Theory and practice applied to various types. Thermodynamics and mechanical analysis of problems involved in the design of nozzles, blades, rotors, etc. Condition of operation; systems of transmission; lubrication; economy; field of service. Laboratory investigation. 3 cred.; prereq., 32; IV MWF; 201Ex. Mr. Shoop.
- 145w—Applied Thermodynamics. Laws of heat transmission, mean temperature difference, in condensers, boilers, brine coils, feed water heaters. Treatment of cooling towers, accumulators, multiple stills, stage evaporators, vapor refrigeration; air compressors, multi staging, intercooling, etc. 3 cred.; prereq., 32, 35; II TThS; 110Ex. Mr. Shoop.
- 146s—Fuels and Combustion. Fuels: classification and analyses. Hand and stoker treatment; regulation. Pulverized and liquid fuels. Types of burners, controls. Combustion: generation of heat; furnace gases; stratification; flame way; smoke prevention. Furnaces. Lectures and recitations. 3 cred.; prereq., 141; I MWF; 215Ex. Mr. Shoop.
- 147w—Design of Steam Machinery. Piping systems, furnace and gas passage dimensions, stokers, oil, gas, and pulverized fuel burners, superheaters, feed water heaters, and pumps, air pre-heaters, automatic controls, chimneys, etc. 2 cred.; prereq., 141 or reg. in 141; VII-IX MTh; 251ME. Mr. Shoop.
- 148s—Design of Power Plant Units. Treatment of condensers, air pumps, cooling towers, stage evaporators, reheaters, etc. 2 cred.; prereq., 147; VI-VIII TW; 255ME. Mr. Shoop.
- 149f,w,s—Advanced Steam Laboratory. Tests of steam turbines, uniflow and compound steam engines, condensers, evaporators, and vacuum pumps. Tests of compound steam pump. Air compressor, boiler, superheater, and power plant. Studies of fluid flow meters and air-conditioning apparatus. 2 cred.; prereq., 32 and 35, 141 or reg. in 141. Mr. Shoop.
- 149f,w (1) I-IV T; Ex (2) VI-IX T; Ex
149s (1) I-IV T; Ex (2) VI-IX F; Ex
- 241s—Advanced Thermodynamics. Reversible changes of state and efflux of wet and superheated vapors. Flow of compressible fluids in mains, moving channels, into receivers, and communicating vessels. Gas mixtures, critical points, liquefaction. Power plant cycles: regenerative, reheating, and bleeding. 3 cred.; prereq., 145. Mr. Shoop.
- 242f-243w—Power Plant Design. Problems, designs, and estimates for power plants and central stations. Selection of motive powers, relative advantages of steam, producers, and gas plants. Choice of engines and boilers; pumps, piping, and accessories. 2 cred. per qtr.; prereq., 148. Mr. Shoop.
- 244s—Power Plant Management. Operation and maintenance of boilers engines, steam turbines, and accessory apparatus. Smoke prevention, lubricants and lubrication. Power plant finance. Daily logs and power costs. Study of recent power researches. 3 cred.; prereq., 141. Mr. Shoop.

INTERNAL COMBUSTION ENGINES

- 50f,w,s—Auto and Airplane Engines. Principles and types. Electrical systems. Lubrication and cooling. Carburetors. Accessories. 3 cred.; soph. Messrs. Robertson and Ford.
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| 50f | (1) I TThS; 110Ex | (2) III TFS; 110Ex |
| 50w | (1) I TThS; 110Ex | (2) III MWF; 110Ex |
| 50s | (1) I TThS; 110Ex | (2) I MWF; 110Ex |
- 55s—Internal Combustion Engines. (E.E.) Brief course in theory and laboratory, including real gas cycles, combustion, fuels and lubrication; construction and performance of gasoline, Diesel, and compression-ignition engines. 3 cred.; prereq., 41. Messrs. Robertson and Ford.
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| Rec. | (1) III TS; 201Ex | (2) III WF; 110Ex |
| Lab. | (1) VI-VIII Th; Ex | (2) I-III Th; Ex |
- 150f,w—Internal Combustion Engines. Study of real gas cycles, combustion, fuels. Construction and performance. Characters of Otto, Diesel, and compression-ignition engines. Carburetion, fuel injection, cooling, lubrication. Auxiliary systems. 3 cred.; prereq., 31. Mr. Robertson.
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| 150f | (1) II MWF; 254ME | (3) I MWF; 254ME |
| | (2) III TThS; 254ME | (4) II TThS; 254ME |
| 150w | (1) II MThF; 252ME | (2) I MWF; 254ME |
- 151w—Advanced Internal Combustion Engines. Special reference to automobile, truck, and airplane engines. Theoretical consideration of fuels, combustion, detonation, lubrication, etc. 3 cred.; prereq., 150; VI MTh, I S; 135E. Mr. Robertson.
- 152w,s—Diesel Engines. An advanced course in the theory, design, operation, and economics of the Diesel engine. Lectures and assigned readings. 3 cred.; prereq., 150. Mr. Robertson.
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| 152w | I MWF; 110Ex |
| 152s | Ar |
- 153s—Automobile Fleet Maintenance. Study of available types of motor coaches and trucks, their design features from a maintenance viewpoint, a survey of service depot requirements with a study of fleet service methods and maintenance practice. 3 cred.; seniors only; prereq., 150; I MWF; 201Ex. Mr. Robertson.
- 154w—Design of Airplane Engines. Study of the designs of radial and in-line aircraft engines. Drawing room problems, including graphical and analytical calculations of stresses in moving parts. Combined polar diagrams of bearing loads, etc. 2 cred.; prereq., 27, 150; I-III T, VII-IX W; OSL. Messrs. Robertson and Ford.
- 155s—High Speed Engine Testing. Use of modern research instruments and methods for testing. Experiments showing effect of fuel mixture, distribution, spark timing, etc., upon general engine performance. 2 cred.; prereq., 159; VI-VIII M, VII-IX T; Ex. Mr. Robertson.
- 156w,s-157s—Design of Internal Combustion Engines. Detailed study of design of automotive and stationary engines. Problems, including calculation of cylinders, bearing loads, stresses in moving parts, and valve mechanisms. 2 cred.; prereq., 121, 150 for 156, 154 or 156 for 157. Messrs. Robertson and Ford.
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| 156w | II-IV W, I-III Th; OSL |
| 156s-157s | II-IV W, VII-IX F; OSL |
- 158f,s—Aero Engine Testing. The use of modern instruments for testing gasoline, Diesel, and aircraft engines. The use of dynamometers and torque stands

- in determining engine performance. 2 cred.; prereq., 150 or reg. in 150. Mr. Robertson.
- 158f VII-VIII M, 201Ex; VI-IX Th, Ex
 158s (1) VI-IX T, Ex; I-II S, 201Ex (3) VI-IX Th, Ex; VIII-IX W, 201Ex
 (2) VI-IX W, Ex; VII-VIII F, 201Ex
- 159f,w,s—Internal Combustion Engine Laboratory. Tests of gasoline, semi-Diesel, and Diesel engines. Power plant units and automotive engines. 2 cred.; prereq., 150 or reg. in 150. Messrs. Robertson and Ford.
- 159f (1) VI-IX T; Ex (2) VI-IX W; Ex
 159w (1) VI-IX T; Ex (2) VI-IX F; Ex
 159s (1) I-IV T; Ex (2) VI-IX W; Ex
- 250f,w,s—Dynamics of High Speed Engines. Advanced study of inertia forces; balancing high speed multi-cylinder engines; engine torque analysis; torsional vibration, etc. Conferences, assigned readings, and problems. 3 cred.; prereq., 121, 150. Mr. Ford.
- 251f-252w-253s—Automotive Vehicles. A study of transmission systems, running gears, chassis, bodies, riding qualities of vehicles, and current developments; lecture and problems. Grad. only. Cred. ar. Messrs. Robertson and Ford.
- 254w,s—Engine Service Management. Instruments and methods used in servicing or reconditioning automobile and airplane engines. Causes of mechanical failure and wear. Permissible tolerance in worn parts. Lubrication and ignition service. 3 cred.; prereq., 151. Messrs. Robertson and Ford.
- 255f-256w-257s—Automobile Testing and Research. Dynamometer and road tests including over-all efficiency of cars at various speeds, fuel consumption, effect of road surface on traction, efficiencies, and general performances. Special research problems. 2 cred. per qtr.; prereq., 55 or 159. Mr. Robertson.
- 258s—Motor Truck and Bus Transportation. Problems involving motor truck transportation, capacity of trucks, trailers, drawbar pull. Efficiencies. Effect of road surface. Freight handling. Analysis of costs of truck operation and maintenance. Relative costs of transportation. 3 cred.; prereq., 152. Mr. Robertson.

HEATING, VENTILATION, AND REFRIGERATION

- 160f—Heating and Ventilation. Principles of heating, ventilation, and air conditioning. Warm air, steam, hot water, vapor, vacuum, and fan systems of heating; pipe systems; heat regulation. Ventilation and air conditioning, central station heating. 3 cred.; prereq., 31, M.&M. 127, 129. Mr. Rowley.
- Lect. (1) III W; 110Ex (2) VI M; 201Ex
 Rec. (1) I ThS; 201Ex (3) IV TS; 215Ex
 (2) II ThS; 110Ex (4) III ThS; 215Ex
- 161w-162s—Heating, Ventilation, and Air Conditioning Design. Calculations of heating and cooling loads; selection and arrangement of equipment; design of complete heating, ventilating, and air conditioning systems for various types of buildings. 2 cred. per qtr.; prereq., 160. Mr. Algren.
- 161w II-IV T, I-III Th; 255ME
 162s I-IV T, I-II Th; 229E
- 164s—Heating and Ventilation. (Arch.) Principles of heating, ventilation, and air conditioning. Heating systems; furnaces, steam, hot water, vapor, vacuum and fan blast. Piping systems. Ventilation, air conditioning, and methods of control. 2 cred.; prereq., M.&M. 92; I TTh; 215Ex. Mr. Rowley.
- 165w—Advanced Heating, Ventilation, and Air Conditioning. Requirements for comfort, health, and industrial processes. Thermodynamics of air vapor mix-

- tures. Heating, cooling, humidification, dehumidification. Atmospheric impurities, sources, classifications, methods of elimination. Air supply and distribution. Methods of control and application. 3 cred.; prereq., 160; IV MWF; 215Ex. Mr. Rowley.
- 166s—Refrigeration. Principles of refrigeration. Various types of refrigerating machines, refrigerants, applications to ice making, cold storage, and air conditioning. 3 cred.; prereq., 32; IV MWF; 201Ex. Messrs. Rowley and Algren.
- 167s—Advanced Heating, Ventilation, and Air Conditioning. Special problems including air conditioning, heat transfer, heating and cooling loads, solar radiation, etc. Equipment and test methods. 3 cred.; prereq., 160; I MWF; 227E. Mr. Rowley.
- 169f,w,s—Heating and Ventilation Laboratory. Tests of heating, ventilating, and air conditioning equipment. The determination of air qualities as required for comfort and for specific industries. Tests and studies of complete installation. 2 cred.; prereq., 35, 160 or reg. in 160. Mr. Algren.
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| 169f | (1) I-IV T; Ex | (3) VI-IX W; Ex |
| | (2) VI-IX T; Ex | |
| 169w | (1) I-IV T; Ex | (2) VI-IX F; Ex |
| 169s | VI-IX F; Ex | |
- 197w—Mechanical Equipment of Buildings. Investigation of heating, ventilating, refrigerating, power, elevator, fire protection, and special equipment for large buildings. Disposal of wastes, light distribution, communication, and plumbing. Lectures, inspection trips, reports with equipment layouts. 3 cred.; prereq., 160, Phys. 9. Mr. Martenis.
- 265f,w,s—Advanced Heating, Ventilation, and Air Conditioning. Taken in connection with research work in the laboratory. Cred. ar.; grad. only; prereq., 160. Mr. Rowley.

INDUSTRIAL ENGINEERING

- 70f—Mechanical Technology. Study of mechanical processes involved in various manufacturing industries and in the development and utilization of power. Lectures by various specialists. 1 cred.; open only to soph., jr., and sr.; IV T, III Th; 305E. Mr. Richards.
- 73s—Non-Metal Manufacturing. Methods and processes of manufacturing goods from materials such as wood, wood and metal substitutes, asbestos, hard rubber, bakelite, and other synthetic substances. 3 cred.; prereq., 18, 20; 2 lect.; 6 hr. of lab. Messrs. Koepke and Richards.
- 74s—Safety Engineering. Safety of the worker; fire and other hazards; prevention of industrial accidents. Compensation laws. Fire prevention; construction; automatic sprinkler systems. Effect of safety on production. Factory sanitation. Safety organization. Lectures, assigned reading, factory inspections, and reports. 3 cred.; prereq., 17. Mr. Koepke.
- 77s—Manufacturing Costs. Determination of factory costs as applied to quantity production. Collection, analysis, and distribution of the costs of labor, materials, and overhead, together with the factors which control costs. 3 cred.; prereq., 17. Mr. Koepke.
- 83s—Elementary Industrial Engineering. Evolution of modern manufacturing methods and resulting changes in factory costs, labor relationships, and management problems. 3 cred.; prereq., 17, Econ. 9. Mr. DuPriest.
- 170s—Tool Design and Construction. Tools, jigs, dies, and fixtures for manufacturing interchangeable parts. 3 cred.; prereq., 17, 171. Mr. Koepke.

171f,w—Production Control. Principles and practice involved in economical production. Standardization. Requirements for uniformity and interchangeability. Jigs, fixtures, and special equipment; gages and inspection systems. Divisions of labor. Conveying, handling, and stores control. Fatigue elimination. 3 cred.; prereq., 17. Mr. Koepke.

171f I MWF; 205ME

171w (1) I MWF; 205ME

(2) II MWF; 205ME

172w—Industrial Plants. Factory organization and construction for economical manufacture. Organization of the industry. Location and type of buildings, power development. Layout of plant. Routing systems and machine layout. Heating and ventilating requirements. Lighting. Sanitation. Distribution of power. Welfare features. Lectures, recitations, and laboratory. 3 cred.; prereq., 171. Mr. Koepke.

173s—Industrial Management. General principles. Taylor system; wage, bonus, and profit sharing systems. Maintenance and depreciation. Purchasing. Allocation of cost, overhead, and machine burden. Graphical representation. 3 cred.; prereq., 172. Mr. Koepke.

174f,w,s—Industrial Management Laboratory. Planning department. Time and motion studies; rate setting. Instruction cards. Production control. Shop practice with investigations in local factories. Lectures, assigned reading, practice, and reports. 2 cred.; prereq., 71, 171 or B.A. 89 or reg. in 171. Mr. Koepke.

174f (1) VI-VIII T; 205ME

(2) VI-VIII W; 205ME

174w (1) I-III T; 205ME

(2) VI-VIII T; 205ME

174s (1) II-IV T; 205ME

(2) VI-VIII Th; 205ME

175w—Materials Handling. Equipment and facilities necessary for economical transportation and storage of materials and parts during the process of manufacture; factors affecting capital invested in inventory, hand and power trucks, conveyors, elevators, hoists, cranes, arrangement of stores, checking and issuing materials. 2 cred.; prereq., 172 or reg. in 172. Mr. Koepke.

179s—Industrial Relations. Labor administration. Foreman training. Training the worker; job analysis. Employment and turnover; the human element, service departments. Stabilization of labor. Lectures, reading, shop visits, and reports. 3 cred.; prereq., 171; IV MWF; 205ME. Mr. Koepke.

277f-278w-279s—Industrial Engineering Problems. Special investigations of practical problems and suggested methods of procedure. Lectures, assigned reading, shop visits, and reports. 3 cred. per qtr.; grad.; prereq., 173, 174. Mr. Koepke.

GENERAL

189s—Hydraulic Machinery. Theory of operation, design, construction, and regulation of water turbines. Turbine testing; characteristics, selection of type. Cost of turbines and water power. 3 cred.; sr.; prereq., M.&M. 129.

190f-191w-192s—Seminar. Reading of assigned articles in current technical press. Classroom presentation of principal features of assigned articles. 1 cred. per qtr.; sr. Mr. DuPriest.

190f (1) VII Th; 154ME

(3) I S; 254ME

(2) I Th; 154ME

191w (1) VI W; 252ME

(3) VII W; 154ME

(2) I S; 254ME

192s (1) I S; 252ME

(3) IV S; 254ME

(2) II S; 254ME

- 193s—Engineering Economics. The cost factor in engineering problems as affected by plant location, kinds of products, size of industry transportation, marketing, class of labor, etc. Allocation of costs, sunk costs, excess production costs, break even cost, ultimate economy, estimating, specifications, and contracts. 3 cred.; prereq., jr. or sr. in engineering; III MFS; 254ME. Mr. DuPriest.
- 194w,s—Advanced Engineering Problems. Opportunity will be offered for carrying on special investigations in the various fields of mechanical engineering. 2 cred; registration by permission of the division chief in charge of work. Open only to sr. M.E.
- 281f—Railway Technology. Systematic course of visits to the various railroad shops in the vicinity to study locomotive details and classifications. Locomotive practice. 1 cred.; prereq., M.&M. 127, 128, 129. Mr. Martenis.
- 282f-283w-284s—Locomotive Design and Construction. Locomotive details. Design of boiler, cylinders, frame, springs, trucks, axles, wheels, running gear, equalizing arrangements, valve gears, lubrication. Lectures, assigned reading, and drafting. 3 cred. per qtr.; prereq., 281. Mr. Martenis.
- 290f-291w-292s—Mechanical Engineering Research. Investigations in connection with lubrication, fuels, furnaces, boilers, steam engines, turbines, gas engines, heating and ventilation, industrial and other engineering problems. Cred. as ar. per qtr.; grad. Messrs. DuPriest, Koepke, Rowley, Shoop, Martenis, and Robertson.

METALLURGY

- 1f—Assaying. Fire assaying of ores and metallurgical products. Balance manipulation, furnaces, slag calculations, oxidation, reduction and special methods. Determination of gold, silver, and lead. 3 and 5 cred. depending upon lab. work. Prereq., Chem. 5 or equiv. Messrs. Pease and Griswold.
Lect. I MWF; 108M
(1) Lab. VI-IX W; 7M (Miners)
(2) Lab. VI-IX WF; 7M (Metallurgists)
- 11w—Metallurgy of Pig Iron. Raw materials, construction, and basic principles of the blast furnace process. Chemistry of the process. Fluxes and slags. Principles for controlling operation and products. 3 cred.; prereq., Chem. 5 or equiv.; I MWF, III Th; 108M. Mr. Joseph.
- 12s—Metallurgy of Steel. Steel producing processes and various types of steel. Modern furnace construction. Chemistry of refining processes. The application of protective coatings to steel products. 3 cred.; prereq., 11; III MWF, I Th; 108M. Mr. Scott.
- 13s—General Ferrous Metallurgy. Short course for mining, petroleum, mechanical, electrical, or chemical engineers. The basic principles of the production of pig iron and its refining into steel. Construction of blast furnaces and steel furnaces. Chemistry of iron and steel processes. 2 cred.; prereq., Inorg. Chem. 16 or equiv.; I MWF; 108M. Messrs. Joseph and Scott.
- 14w—Metallurgy of Copper, Lead, and Zinc. Short course for mechanical, electrical, or chemical engineers. Methods of extraction, recovery, smelting, and refining. 3 cred.; prereq., Inorg. Chem. 8 or equiv.; IV MWF; 108M. Mr. Pease.
- 106f—Metallurgy of Base Metals. Consideration of principles, methods, and appliances used in beneficiation, smelting, and refining of lead, copper, zinc, and other non-ferrous metals. Lectures and recitations. 2 cred.; prereq., 11; III TThS; 108M. Mr. Pease.

- 107w—Metallurgy of Base Metals. Continuation of Course 106. 2 cred.; prereq., 106; III TThS; 108M. Mr. Pease.
- 108s—Metallurgy of Precious Metals. Principles, methods, and appliances used in amalgamation, concentration, cyanidation, smelting, and refining of gold, silver, and other precious metals. 2 cred.; prereq., 107; III TThS; 108M. Mr. Pease.
- 110f—Ore Dressing. A study of jaw and gyratory crushers, ball mills, rod mills, tube mills, volumetric sizing, gravimetric sizing. Concentration by tables, jigs, bowl classifiers, log washers, and miscellaneous devices used in ore dressing. 2 cred.; prereq., 12; III MWF; 202M. Mr. Searles.
- 111f—Ore Dressing Laboratory. A practical examination of ores and use of ore dressing machinery as outlined in Course 110. 1 cred.; prereq., with 110; 203M. Mr. Searles.
- 112w—Ore Dressing. A study of the principles involving flotation. Special attention to chemical and physical action of the different reagents used, such as frothing, collecting, depressing, activating, conditioning, etc. Also a study of liberation and particle size, grinding circuits, and flotation machinery. 2 cred.; prereq., 110; III MWF; 202M. Mr. Searles.
- 113w—Ore Dressing Laboratory. A practical examination of ores by flotation. This course involves the grinding, use of proper reagents, and examination of products. 1 cred.; prereq., reg. in 112; VI-IX F; 203M. Mr. Searles.
- 114s—Ore Dressing. An advanced course designed primarily for Group A metallurgists. A continuation of Course 112 giving more detailed study of ore dressing problems. 2 cred.; prereq., 113; III MWF; 202M. Mr. Searles.
- 115s—Ore Dressing Laboratory. Special problems in ore dressing involving the use of the microscope. A study of polished sections to determine the minerals present, grain size, and association of minerals. 1 cred.; prereq., 114, Geol. 165; VI-IX F; 203M. Mr. Searles.
- 116s—Ore Dressing Laboratory. A course designed for students of mining and geology. The course incorporates a part of Course 111 and Course 113. 1 cred.; prereq., 112; VI-IX Th; 203M. Mr. Searles.
- 121f—Ore Testing (Iron Ores). Methods of beneficiation, principles, methods and machines, concentration formulae, metallurgical and economic considerations. 2 cred.; prereq., 112; Mines Ex. Mr. Davis.
- 122w—Ore Testing. Determination of methods for metallurgical and economic extraction of non-ferrous metals from ores. Involves amalgamation, concentration, and cyanidation. Lecture and laboratory. 4 cred.; prereq., 121; 7M. Mr. Pease.
- 123s—Ore Testing. Continuation of Course 122. Consideration of factors affecting extraction. Study of distribution of values in mill and metallurgical products. 4 cred.; prereq., 122; 108M, 7M. Mr. Pease.
- 124—Special Problems in Ore Testing. Detailed study of ore testing problems. Causes of non-extraction. Methods of correction. Relation of values. Cred. and hr. ar.; prereq., 112. Mr. Pease.
- 125—Special Problems in Ore Testing. Continuation of Course 124. Cred. and hrs. ar.; prereq., 124. Mr. Pease.
- 126s—Special Problems in Metallurgy for Miners. Study of metallurgical problem in relation to mine development. Conferences, together with laboratory work. 3 cred.; prereq., 121; 108M, 7M. Mr. Pease.
- 130-131-132—Special Problems in Metallurgy. Seminar work on metallurgical

- problems. Cred. and hrs. ar.; prereq., sr. Met.E. or grad. Messrs. Joseph and Pease.
- 133w—Electrometallurgy. Application of electricity to thermometallurgy. Design and operation of electric furnaces and their use in smelting of metals and in the production of ferro alloys. 3 cred.; prereq., 12. Mr. Scott.
Lect. I TThS; 108M
Lab. VI-IX W; 7M
- 134f—Advanced General Metallurgy. Refractories, fuels, and principles of combustion. Thermochemistry of important reactions in process metallurgy. 4 cred.; prereq., 12; 108M. Mr. Joseph.
- 135w—Advanced Metallurgy of Iron and Steel. Detailed study of the blast furnace process. Economics of raw materials, their size, preparation, and physical properties. Control of slag-metal reactions. Trend in furnace design and practice. 4 cred.; prereq., 134; 108M. Mr. Joseph.
- 136s—Advanced Metallurgy of Iron and Steel. A detailed study of steel processes and current problems in controlling quality of product. The physical chemistry of steel making and its application to production problems. 4 cred.; prereq., 135; 108M. Mr. Scott.
- 137w—Metallurgical Problems (Non-ferrous). Conferences, lectures, and laboratory on selected problems. 4 cred.; prereq., 108; 108M, 7M. Mr. Pease.
- 138s—Metallurgical Problems (Non-ferrous). Continuation of Course 137. 4 cred.; prereq., 137; 108M, 7M. Mr. Pease.
- 139—Field Work in Metallurgy. Study of metallurgical operations at mills, smelters, and refineries. Detail reports are required covering plants visited. 6 cred.; September 5 to 26. Mr. Pease.
- 141f-142w-143s—Special Problems. Special problems in the production of iron and steel. Conferences, lectures, laboratory work. 3 cred. per qtr.; prereq., sr. Met.E. or grad. Messrs. Joseph and Scott.
- 171—Field Trip. Study of metallurgical operations in important iron and steel centers. 6 cred.; prereq., jr. year. Mr. Joseph or alternate.
- 204-205-206—Special Problems in Advanced Metallurgy. Intended primarily for research work for graduate students. Cred. and hrs. ar. Messrs. Joseph and Pease.

METALLOGRAPHY

- 150f—Metallography for Electrical Engineers. Principles of metallography, including pyrometry, thermal analysis, constitution diagrams, microscopic and photomicrographic technique; study of typical alloys with special reference to electrical resistance, conductivity, magnets, etc. Laboratory work and demonstrations. 3 cred.; jr., sr. E.E. Mr. Forsyth.
Lect. I MW; 304M
Lab. VI-VIII M; 17M
- 152f—Metallography for Aeronautical Engineers. Principles; metallography of iron and steel with special reference to alloy steels, and light alloys used in airplane construction. Laboratory work and demonstrations. 3 cred.; prereq., sr. Aero.E. Messrs. Dowdell and Jerabek.
Lect. I TS; 109M
Lab. (1) VII-IX M; 17M (2) VII-IX W; 17M
- 153f-154w-155s—Metallography. (Long course for metallurgical engineers). Theory of metallic alloys. Metallographic technique. Properties of metals and alloys. Metallography of iron and steel and commercial alloys. Technical metallog-

- raphy. Laboratory work. 4 cred. per qtr.; prereq., Met.E. 12 or equiv. Mr. Forsyth.
- 153f-154w Lect. I MWF; 315M
Lab. VI-IX T; 307M
- 155s Lect. I MWS; 315M
Lab. VI-IX T; 307M
- 156w—Metallography for Mechanical, Mining, and Petroleum Engineers. Principles of metallography, including pyrometry, thermal analysis, constitution diagrams, microscopic and photomicrographic technique; metallography and heat treatment of iron and steel. Laboratory work. 3 cred.; prereq., jr., sr. M.E., Min.E., or Pet.E. Mr. Dowdell.
- Lect. III ThS; 315M
Lab. (1) VII-IX W; 307M (2) VII-IX F; 307M
- 157s—Advanced Metallography for Mechanical, Mining, and Petroleum Engineers. Metallography of alloy steels, tool steels, high speed tool steels, and important non-ferrous alloys; metallography applied to engineering practice and specifications. Outside reading and special reports. Laboratory work. 3 cred.; prereq., 156. Mr. Dowdell.
- Lect. I MW; 305M
Lab. (1) VII-IX W; 307M (2) VII-IX F; 307M
- 160f,w—Metallography. (Chem.) Principles of metallography, including constitution diagrams, preparation and standardization of thermocouples, preparation and thermal analysis of alloys, their microscopic examination and photomicrographs; typical alloy systems such as iron carbon (steel, cast iron), and some non-ferrous alloys. Lab. work; 3 cred.; prereq., Anal. Chem. 1, 2. Mr. Jerabek.
- 160f Lect. III MF; 111M
Lab. (1) VI-VIII Th; 17M (3) I-III S; 17M
(2) VI-VIII F; 17M
- 160w Lect. III MF; 111M
Lab. (1) VI-VIII T; 17M (3) VII-IX F; 17M
(2) VII-IX W; 17M
- 161w—Advanced Metallography. (Chem.) Metallography and heat treatment of iron and steel, including alloy steels, commercial uses of various steels, and engineering specifications. 2 or 3 cred. depending on lab.; prereq., 160. Mr. Jerabek.
- Lect. I MF; 306M
Lab. (1) VI-VIII Th; 307M (2) Ar
- 162s—Advanced Metallography. (Chem.) Metallography of the non-ferrous metals with a study of the constitution diagrams, properties, and uses of important commercial alloys. 2 or 3 cred. depending on lab.; prereq., 160. Mr. Jerabek.
- Lect. III MF; 306M
Lab. (1) VI-VIII Th; 307M (2) Ar
- 163f—Advanced Metallography. Seminar work on recent advances in metallography. Lectures and recitations, with outside reading and special reports. May be accompanied by laboratory work. 3 cred.; prereq., 6 cred. in metallography. Mr. Dowdell.
- 164w—Advanced Metallography. Advanced consideration of the structures, properties, and uses of metals and alloys. May be accompanied by laboratory work. 3 cred.; prereq., 6 cred. in metallography. Mr. Dowdell.
- 165s—Advanced Metallography. Technical metallography as applied to the automotive industry. Lectures and special reports. May be accompanied by laboratory work. 3 cred.; prereq., 6 cred. in metallography. Mr. Dowdell.

- 166f-167w-168s—Laboratory. Laboratory work on special problems in ferrous, non-ferrous, and X-ray metallography. 3 cred. per qtr.; prereq., 155. Mr. Dowdell.
- 201f-202w-203s—Advanced Metallography for Graduate Students. Intended primarily for research work. Mr. Dowdell.
- 210f-211w-212s—Thesis Courses for Graduate Students. Intended primarily for research work. Cred. and hrs. ar. Mr. Dowdell.

MILITARY SCIENCE AND TACTICS

All physically fit male students in the Institute of Technology may take instruction in military science for three hours each week as prescribed for the Basic Course, Senior Division, R.O.T.C. Students registered in Electrical Engineering are assigned to the Signal Corps, all others in Engineering, Architecture, Chemistry, and Mines are assigned to the Coast Artillery (anti-aircraft), except that students whose programs will render them eligible for the Advanced Course of Signal Corps in the cryptographic, photographic, or supply specialties may be assigned to that unit by arrangement.

The University allows six credits for the two years' Basic Course. These credits may be applied as elective credits in qualifying for a degree.

Students who have completed the Basic Course, may be selected for advanced work by the professor of military science and tactics. Those who pursue the Advanced Course are required to sign an agreement with the government to continue the two years' course to completion. This includes attendance at a six weeks' training camp, normally held during the summer following the first year of advanced work. The camp is conducted free of cost to the student, and in addition, while actually in camp, the student receives pay. Students pursuing the Advanced Course are also furnished a special uniform and receive a fixed allowance per day. The total government compensation for the two years' advanced work amounts to something over \$200. Students who satisfactorily complete the Advanced Course will be commissioned in the Officers' Reserve Corps of the United States Army.

The University allows 18 credits for the two years' Advanced Course of the Coast Artillery Corps (5 hrs. per week) and 15 credits for the Advanced Course of the Signal Corps (4 hrs. per week). These credits may be applied towards graduation.

1f-2w-3s—First Year Basic Course, R.O.T.C.

Coast Artillery. Duties of the coast artillery soldier, with special reference to anti-aircraft equipment and methods; organization; leadership; military history; current international situation; obligations of citizenship; courtesies and customs of the service; marksmanship; relationship of the citizen to his government. 1 cred. per qtr.; prereq., M.&M. 9 and Draw. 10. Captain Zimmer.

1f (1) III MWF; A (3) VIII MWTh; A

(2) VI MWF; A

2w (1) III MWF; A (3) IX MWF; A

(2) VI MWF; A

3s I M, I T or VI T, V and IX T; A

Signal Corps. Duties of the signal corps soldier; relationship of the citizen to his government; military history; field telephone and telegraph systems; equipment and operation; discipline and courtesies; sanitation and first

aid; army organization; map reading; leadership. 1 cred. per qtr.; prereq., reg. in E.E. or by arrangement with instructor. Captain Maddocks.

- 1f (1) III MWF; A (3) VIII MWTh; A
(2) VI MWF; A

2w III, VI or IX MWF, A and V or IX MWF, 321EE†

3s I M, I T, or VII T; V and IX T; A

4f-5w-6s—Second Year Basic Course, R.O.T.C.

Coast Artillery. Duties of non-commissioned officer of Coast Artillery; defense against chemical warfare; map sketching; signal communication; aircraft identification and characteristics; position finding and fire control for anti-aircraft artillery. 1 cred. per qtr.; prereq., 1-2-3, M.&M., 11, 12 or equiv. Captain Zimmer.

- 4f (1) II TThS; A (3) VIII MWTh; A
(2) IV MWF; A

5w (1) II TThS; A (3) IX MWF; A
(2) IV MWF; A

6s (1) I M, V, IX T; A (2) I, V, IX T; A

Signal Corps. Duties of the signal corps non-commissioned officer; field radio telegraph and telephone systems and equipment; code practice, radio procedure and table nets; signal communication for all arms; leadership. 1 cred. per qtr.; prereq., 1-2-3. Captain Maddocks.

4f-5w III MWF; 321EE

6s I M, I T, or VII T; V and IX T; A

151f-152w-153s—First Year Advanced Course, R.O.T.C.

Coast Artillery. Duties of the coast artillery officer; aerial photographic reading; combat orders; instructional methods; leadership; basic gunnery, methods of adjusting fire principles of probability; position finding, gunnery and fire control for anti-aircraft artillery. 3 cred. per qtr.; prereq., 4-5-6. Major Berry.

- 151f-152w (1) II MWF, VI-VII M (3) VI MWF, VII MW; A
or W; A
(2) IV MWF; VI-VII M or W; A

153s (1) II MWF, V, IX T; A (3) VI MWF, V, IX T; A
(2) IV MWF, V, IX T; A

Signal Corps. Duties of signal corps officer; message center procedure; homing pigeons; aerial photograph reading; defense against chemical warfare; administration; division organization; installation and operation of field telephone, telegraph, and radio sets; signal communication tactics and transmission of decisions in form of orders to subordinates; leadership. 4 class and lab. hrs. per week. 2 cred. per qtr.; prereq., 4-5-6 and reg. in E.E. 64-65-66 or by arrangement with instructor. Captain Maddocks.

151f-152w IV MWF, III T; 321EE

153s V, VII-IX T; A

154f-155w-156s—Second Year Advanced Course, R.O.T.C.

Coast Artillery. Duties of coast artillery officer; command and leadership; military history and policy; military law, surveying and orientation, field engineering; motor transport; instructional methods; artillery tactics. 3 cred. per qtr.; prereq., 151-152-153. Lieut. Col. Potts.

- 154f (1) I MWF, VIII-IX W or F; A (3) VI MWF, VIII-IX W or F; A
(2) IV MWF, VIII-IX W or F; A

155w (1) IV MWF, VIII-IX W or F; A (3) VI TTh, II S, VIII-IX W or F; A
(2) III MWF, VIII-IX W or F; A

156s (1) I MWF, V, IX T; A (3) VI MWF, V, IX T; A
(2) IV MWF, V, IX T; A

† A total of three hours per week.

Signal Corps. Duties of the signal corps officer; military law; training management; handling of property and funds; orientation as a reserve officer; common battery telephony; military history and policy; leadership; military cryptography; motor transport. 4 class and lab. hrs. per week. 3 cred. per qtr.; prereq., 151-152-153, E.E. 64-65-66 or equiv. Captain Maddocks.

- 154f (1) I MWF; A; VI T; 321EE
 (2) IV MWF; A; VI T; 321EE
 (3) VI MWF; A; VI T; 321EE
 155w VI-VII MW; 321EE
 156s IV-VI, IX T; A

MINING AND PETROLEUM ENGINEERING

MINING

- 11f-12w-13s—Mine Surveying. Theory and problems in mine surveying, including U. S. land subdivision, foreign methods of land description, stadia measurements, triangulation, railroad curves and cross sections, earthwork computations, areas by co-ordinates, differential and trigonometric leveling, plane-table surveying, topographic map reading, solar and stellar observations for latitude and meridian, surveying of mining claims and bore holes, shaft plumbing and underground traversing and leveling. 3 cred. per qtr. fall, winter; 2 cred. spring qtr.; prereq., Dr. 13, M.&M. 12, 13. Messrs. Lambert, Heilig, and Griswold.
- 11f Lect. III MWF; 315M
 Quiz IV M; 315M
- 12w Lect. III MWF; 315M
 Quiz II S; 315M
- 13s Lect. III MW; 315M
 Quiz III F; 315M
- 14f—Field Work. General work in plane surveying and adjustment of instruments. 5 cred.; prereq., 11, 12; VI-IX MTWThF. Messrs. Lambert, Heilig, Trenslove, and Griswold.
- 15—Field Trip. Field work on the iron ranges of Minnesota. Surveying of an underground mine, including shaft plumbing. Survey of open pit mine including an estimate of the surface stripping. Solar and stellar observations for latitude and meridian. 8 cred.; prereq., soph. year; 4 weeks beginning about June 15. Messrs. Lambert, Heilig, and Griswold.
- 106f—Mine Mapping. Mine mapping in accordance with prevalent practice in various mining districts including a map of the mine surveyed during the sophomore field trip. Ore estimating, based on current practice. 2 cred.; prereq., 15; VI-IX TTh; 205M.
- 107w—Mine Mapping. Mapping mine surveyed during field trip. 1 cred.; prereq., 15; VI-VIII T; 205M.
- 111f—Exploration. Prospecting and filing on mineral lands, boring, drill steel, drill bits. 3 cred.; prereq., 21; I MWFS; 202M.
- 112w—Exploration and Development. Explosives and blasting; timbering and timber treating; tunneling and drifting. 3 cred.; prereq., 111; I MWF, II S; 202M. Mr. Parker.
- 113s—Development and Production. Shaft sinking, raising, stoping, mining meth-

- ods; support of excavations. 3 cred.; prereq., 112; I MWF, II S; 202M. Mr. Parker.
- 121f-122w-123s—Mine Plant. Discussion of the machinery and appurtenances employed in the equipment of mines. Air compression, rock drills, mechanical features of hoisting, pumping, ventilation, underground transportation. Electricity applied to mining. 3 cred. per qtr.; prereq., M.&M. 33, Phys. 9. Mr. Comstock.
- 121f II MTWFS; 202M
122w-123s II MTWThF; 202M
- 125f—Mining and Metallurgical Hydraulics. Application of hydraulic principles of mining and metallurgical problems. Flow measurements and stream gaging. Diversion dams, flumes, and laws of flow. Transporting power of water. Handling of slimes, sands, etc. 4 cred.; prereq., M.&M. 127; 111M. Mr. Heilig.
- 126f—Engineering Construction. Theory of structures, loading, analytic and graphic resolution of stresses in frame structures, stresses in ore bins, head frames, etc. 3 cred.; prereq., M.&M. 127; 303M. Mr. Heilig.
- 127w—Engineering Construction. Design of structures for mining and petroleum plant. 3 cred.; prereq., 126; 303M. Mr. Heilig.
- 138—The Stone Industries. Monumental and building stones, crushed stone, sand and gravel plants and operations. 2 cred.; prereq., 112; 202M. Mr. Parker.
- 139—Practical Mining (Field Trip). Study of mining operations, mine plant, and mining in one or more mining camps. 6 cred.; prereq., jr. year. September 5 to 26. Mr. Parker.
- 141f—Mine Examination and Administration. Examinations and mining reports; valuation and amortization; depletion and depreciation; taxation; corporations; capitalization; stocks and bonds; contracts and specifications. 3 cred.; prereq., 113; 202M. Mr. Parker.
- 142w—Coal Mining and Mining Law. Coal mining methods. Mechanization and coal preparation. Mine gases. Accident prevention. State mining codes. Compensation laws. Mining law and court interpretation. 3 cred.; prereq., 141; 202M. Mr. Parker.
- 143s.—Placer Mining, Quarries, and Open Pits. Dredging and hydraulic mining of placers. Quarries and open pit mining. 3 cred.; prereq., 142; 202M. Mr. Parker.
- 144w-145s—Advanced Mining. Preparation of a report on a mining property or some phase of the mineral industry. 3 cred. per qtr.; prereq., 113; 303M. Mr. Parker.
- 146—Non-Metallic Minerals. Mining and preparation of cement, lime, gypsum, refractories, ceramic materials, fillers, pigments. 2 cred.; prereq., 112; 112M. Mr. Parker.
- 147—Earth Handling and Excavation. Excavation by shovels, draglines, dredges; handling materials by railroad, trucks, conveyors, and sluices. 2 cred.; prereq., 112; 205M. Mr. Trengove.
- 151f-152w-153s—Special Problems in Mining. Seminar work on mining problems. Cred. and hr. ar.; prereq., reg. in Min.E. 141-142-143. Mr. Parker.

PETROLEUM ENGINEERING

- 111f—Exploration. Prospecting and filing on oil lands, drilling methods, drill steel and bits. 3 cred.; prereq., Min.E. 21; I MWF; 202M. Mr. Trengove.

- 112w—Oil Field Development. Explosives, blasting, timber preservation, aerial surveys, geophysical prospecting, oil and gas production. 3 cred.; prereq., Pet.E. 111; I MWF, II S; 112M.
- 131s—Petroleum Refining. Distillation and purification processes used in making commercial products from crude petroleum. 2 cred.; prereq., Inorg. Chem. 16, Phys. 23; III MW; 112M.
- 134s—Petroleum Plant. Mechanical features of drilling equipment, gas lift, pumping, natural gasoline extraction. Special devices for abnormal conditions. Oil emulsions. Mechanical features of transmission lines for oil and gas. Flow formulas, soil corrosion and prevention. 2 cred.; prereq., Min.E. 122; I MWF; 112M. Mr. Comstock.
- 135—Field Work. Study of equipment and operations in one or more oil fields. 6 cred.; prereq., jr. year. September 5 to 26.
- 138s—Oil Field Mapping. Oil and gas well logs, peg models, records, contour and subsurface maps, cross sections. 2 cred.; prereq., Min.E. 107; VI-IX M, VI-VII Th; 205M.
- 141f—Oil Field Examination and Administration. Reports, amortization, corporations, capitalization, stocks and bonds, leases, contracts, and specifications. 3 cred.; prereq., Pet.E. 112; 202M. Mr. Parker.
- 144-145—Advanced Petroleum Engineering. Preparation of a report on an oil property or on some phase of the oil industry. 5 cred. per qtr.; prereq., Pet.E. 141; 303M. Mr. Parker.
- 152-153-154—Petroleum Production Technology. Special problems in oil and gas production. Mud fluids, formation correlations, electric coring, and miscellaneous production problems. 3 cred. per qtr.; prereq., Pet.E. 112. Messrs. Comstock and Parker.
- 155-156-157—Special Problems in Petroleum Engineering. Seminar in petroleum problems. Cred. and hrs. ar.; prereq., reg. in Pet.E. 141 or Pet.E. 144-145. Mr. Parker.

PHYSICAL EDUCATION FOR MEN

The courses in sports education are offered by the Department of Physical Education to men students of the University for the purpose of providing instruction and practice in sports of a recreational nature in which men may participate in future years as a means of obtaining recreation, regular exercise, and social intercourse.

A towel and locker fee of \$1.25 per quarter is charged all students taking exercise courses.

The University furnishes uniforms to students for class work or recreational play for \$1 per quarter.

The facilities of the Department of Physical Education including the golf course, tennis courts, gymnasium, swimming pools, handball and squash courts, golf gymnasium, ping-pong room and playing fields, are available for use by the general student body. All men are invited to participate in some form of physical activity. For information regarding the intramural and intercollegiate athletic programs see the physical education handbook published by the Department of Physical Education for Men or inquire at the offices in the Cooke Hall.

SPORTS EDUCATION

Supervisor of Sports Education: Mr. Piper.

1f,2w,3s†—Sports Education.

Survey Course	III MWF	
	IV MWF	
Fall: Touchball, Swimming, Volleyball		
Winter: Boxing, Wrestling, Basketball, Golf		
Spring: Soft Ball, Tennis, Handball, Squash Racquets		
Beginning Swimming	II MWF	
Intermediate Swimming	II TThS	
Advanced Swimming	III MWF (w,s)	
Lifesaving	III TThS	
Miscellaneous Swimming	VI MWF	
Boxing	VIII MWF	} Fall and } winter only
	IX MWF	
Tennis	VII MWF	} Spring only
Individual Physical Education Activities	III MWF	
(by special permission)	IV MWF	
	VIII MWF (f,w)	
	VII MWF (s)	

Substitution of athletic team practice may be allowed by the department to men who rank sufficiently high on the introductory test.

PHYSICAL EDUCATION FOR WOMEN

Women students registering in any curricula in the Institute of Technology requiring G.E. 13, Orientation, will substitute one quarter of Phys. Ed. 1, 2, 3, 4, 5, or 6, General Course in Physical Education for this course.

Consult the Combined Class Schedule for hours and statement of fees.

PHYSICS

1f‡-2w‡-3s‡—Introduction to Physical Science. Lectures and experimental demonstrations of the principles underlying physical phenomena. Open to students in architecture. 3 cred. per qtr., all; prereq., M.&M. 9 or equiv.; IV MWF; 166Ph. Mr. Buchta.

7f,w‡-8w,s‡-9f,s‡—General Physics. Mechanics, heat, sound, light, and electricity. Laboratory work an integral part of the course: 5 cred. per qtr.; all; prereq., M.&M. 12.

7f	Lect. (1) III MTWF; 150Ph	(3) VI MWThF; 150Ph
	(2) II MWThF; 150Ph	
Quiz*	(1) VI W; 166Ph	(3) IX T or Th; 150Ph
	(2) IX M; 150Ph	
Lab.	(1) I-II M; ar	(11) VI-VII W; ar
	(2) III-IV M; ar	(12) I-II Th; ar
	(3) VI-VII M; ar	(13) VI-VII Th; ar
	(4) VIII-IX M; ar	(14) VIII-IX Th; ar
	(5) I-II T; ar	(15) I-II F; ar
	(6) III-IV T; ar	(16) VI-VII F; ar
	(7) VI-VII T; ar	(17) VIII-IX F; ar
	(8) VIII-IX T; ar	(18) I-II S; ar
	(9) I-II W; ar	(19) III-IV S; ar
	(10) III-IV W; ar	

* The quiz section must correspond to the lecture section.

† Three credits are given when three quarters are completed.

‡ A fee of \$2 per quarter is charged for this course.

- 7w Lect. II MWThF; 166Ph
 Quiz II S; 150Ph
 Lab. (1) VI-VII M; ar (4) VIII-IX T; ar
 (2) VI-VII W; ar (5) III-IV S; ar
 (3) VI-VII F; ar
- 8w Lect. (1) III MWFS; 150Ph (3) VI MWThF; 150Ph
 (2) II MWThF; 150Ph
 Quiz* (1) IX T; 150Ph (3) IX Th; 150Ph
 (2) VII T; 305E or IX M; 150Ph
 Lab. (1) I-II M; ar (11) VI-VII W; ar
 (2) III-IV M; ar (12) I-II Th; ar
 (3) VI-VII M; ar (13) VI-VII Th; ar
 (4) VIII-IX M; ar (14) VIII-IX Th; ar
 (5) I-II T; ar (15) I-II F; ar
 (6) III-IV T; ar (16) III-IV F; ar
 (7) VI-VII T; ar (17) VI-VII F; ar
 (8) VIII-IX T; ar (18) VIII-IX F; ar
 (9) I-II W; ar (19) I-II S; ar
 (10) III-IV W; ar (20) III-IV S; ar
- 8s Lect. II MWThF; 166Ph
 Quiz IX T; 150Ph
 Lab. (1) VI-VII M; ar (4) VIII-IX T; ar
 (2) VI-VII W; ar (5) III-IV S; ar
 (3) VI-VII F; ar
- 9f Lect. II MWThF; 166Ph
 Quiz II S; 150Ph
 Lab. (1) VI-VII M; ar (4) VIII-IX T; ar
 (2) VI-VII W; ar (5) III-IV S; ar
 (3) VI-VII F; ar
- 9s Lect. (1) III MTWF; 150Ph (3) VI MWThF; 150Ph
 (2) II MWThF; 150Ph
 Quiz* (1) III Th; 150Ph (3) VI T; 150Ph
 (2) II S or VIII Th; 150Ph
 Lab. (1) I-II M; ar (11) I-II Th; ar
 (2) III-IV M; ar (12) VI-VII Th; ar
 (3) VI-VII M; ar (13) VIII-IX Th; ar
 (4) VIII-IX M; ar (14) I-II F; ar
 (5) I-II T; ar (15) III-IV F; ar
 (6) III-IV T; ar (16) VI-VII F; ar
 (7) VI-VII T; ar (17) VIII-IX F; ar
 (8) VIII-IX T; ar (18) I-II S; ar
 (9) I-II W; ar (19) III-IV S; ar
 (10) VI-VII W; ar
- 13f§—Acoustics. 3 cred.; prereq., old number 3 (Mechanics). Mr. Buchta.
 Lect. III TThS; 133Ph
 Quiz IX M; 133Ph
- 23w§—Heat. 3 cred.; prereq., old number 3 (Mechanics). Mr. Miller.
 Lect. IV MWF; 133Ph
 Quiz IX F; 166Ph
- 24w‡§—Heat Laboratory. 1 cred.; prereq., old number 4 (Mech. Lab.), 23 or
 reg. in 23; ar. Mr. Miller.
- 29f—Introduction to Meteorology. A presentation of the fundamental physical
 principles underlying meteorological phenomena, accompanied by instrumental
 observations and weather map study. 3 cred. per qtr.; all; prereq., high
 school phys. or equiv.; VI MWF; 133Ph. Mr. Miller.

* The quiz section must correspond to the lecture section.

‡ A fee of \$2 is charged for this course.

§ Not offered after 1938-39.

- 33f,s§—Optics. 3 cred.; prereq., old number 3 (Mechanics). Mr. Valasek.
 33f Lect. II MWF; 133Ph
 Quiz IX F; 166Ph
 33s Lect. III TThS; 166Ph
 Quiz IX F; 166Ph
- 34f,s†§—Optics Laboratory. 1 cred.; prereq., old number 4 (Mech. Lab.), 33 or reg. in 33. Mr. Valasek.
 34f (1) VI-VII M; 352Ph (3) VI-VII Th; 352Ph
 (2) VIII-IX M; 352Ph
 34s Ar
- 43w,s§—Electricity. 3 cred.; prereq., old number 3 (Mechanics). Mr. Rumbaugh.
 43w Lect. III TThS; 133Ph
 Quiz IX T; 166Ph
 43s Lect. VI MWF; 133Ph
 Quiz IX T; 150Ph
- 44w,s†§—Electricity Laboratory. 1 cred.; prereq., old number 4 (Mech. Lab.). Mr. Rumbaugh.
 44w (1) VI-VII Th; 231Ph (2) VIII-IX Th; 321Ph
 44s Ar
- 52f,w,s†—Laboratory Arts. 3 cred.; prereq., 15 cred. in phys. and approval of dept.; VI-VIII TTh; 39Ph. Mr. Haliday.
- 61w—Introduction to Geophysical Prospecting. Qualitative discussions of the application of physical measurements to the location of petroleum and mineral deposits together with some applications of geophysical methods to problems of shallow geologic structure. 3 cred.; jr., sr.; prereq., general course in physics, M.&M. 12; ar. Mr. Wetzel.
- 71f-73w-75s—Intermediate Physics. 4 cred. per qtr.; all; prereq., Calculus and 12 cred. in phys.; II TThFS; 342Ph. Mr. Rumbaugh.
- 101f-103w-105s—Theoretical Physics. An analytical survey of fundamental principles of mechanics, sound, heat, light, electricity, and magnetism, designed to supplement the general course and to prepare students for more specialized graduate courses. 5 cred. per qtr.; jr., sr., grad.; prereq., 12 cred. in phys., M.&M. 25; III MTWThF; 145Ph. Mr. Williams.
- 107f-109w-111s—Modern Physics. 3 cred. per qtr.; prereq., 12 cred. in phys.; I MWF; 145Ph. Mr. Williams.
- 108f†-110w†-112s*†—Modern Experimental Physics. 4 cred. per qtr.; prereq., 144; VI-IX TTh; 145Ph. Mr. Williams.
- 113w—Intermediate Acoustics. 3 cred.; prereq., M.&M. 25, 15 cred. in phys., including 13. (Not offered in 1938-39.)
- 114f-116w-118s—Elementary Physical Investigation. 3 cred. per qtr.; prereq., 15 cred. in phys. Staff.
- 117w-119s—History of Physics. 3 cred. per qtr.; prereq., a general course in phys.; jr., sr.; I TThS; 145Ph. (Not offered in 1938-39.)
- 124s†—Pyrometry. Experimental study of the principles underlying temperature. One lecture, two three-hour sessions in the laboratory a week. 3 cred.; prereq., 23, 24; VII-IX MW, or ar.; 245Ph. Mr. Miller.
- 126f,s†—Advanced Heat. Temperature standards, expansion, calorimetry. Kinetic theory of matter. Change of state and heat transfer. Lecture and laboratory. 3 cred.; prereq., 23, 24; VII-IX MW, or ar.; 245Ph. Mr. Miller.

* Students may enter any quarter.

† A fee of \$2 is charged for this course.

§ Not offered after 1938-39.

- 134f,w,‡—Experimental Optics. 3 cred.; prereq., 33, 34; VII-IX MF; 348Ph. Mr. Valasek.
- 136w,s,‡—Spectrum Analysis. 3 cred.; prereq., 33, 34; VII-IX MF; 348Ph. Mr. Valasek.
- 137s—Electrical Properties of Crystals. 3 cred.; jr., sr., grad.; prereq., 12 cred. in phys., M.&M. 25; ar. Mr. Valasek.
- 144f,‡—Electricity Measurements. Devoted mainly to the study of potentiometer methods, capacitance, inductance, magnetic flux. One lecture, one quiz hour and two two-hour laboratory periods a week. 3 cred.; prereq., 43, 44. Mr. Rumbaugh.
Lect. III S; 166Ph
Quiz III Th; 166Ph
Lab. (1) VIII-IX TF; 231Ph (3) VI-VII MF; 231Ph
(2) VI-VII TTh; 231Ph
- 146w,‡—Advanced Electricity Measurements. 3 cred.; prereq., 144 and permission of instructor; ar.; 232Ph. Mr. Rumbaugh.
- 152f—X-Rays. Study of the nature and production of X-ray. 3 cred.; prereq., 43; I TThS; 133Ph. Mr. Valasek.
- 154w,‡—X-Ray Spectroscopy. 3 cred.; prereq., 44, 152, M.&M. 25 and permission of instructor; ar. Mr. Valasek.
- 161f-162w—Principles of Geophysical Prospecting. Quantitative discussions of theory, instruments and interpretation of data for seismic, electric, gravitational, and magnetic geophysical methods. 3 cred. per qtr., jr., sr., grad.; prereq., general course in physics, M.&M. 25; ar. Mr. Wetzel.
- 164f-165w-166s—Special Problems in Geophysics. Cred. and hrs. ar.; prereq. 161. Mr. Wetzel.

PHYSIOLOGICAL CHEMISTRY

- 100f,su—Physiological Chemistry. Application of physical and organic chemistry to physiology. 7 cred.; prereq., phys. and org. chem. Messrs. McClendon, Armstrong, Hemingway, Samuels, and Arnow.
Lect. IV MTWF; MeS Aud
Quiz I F
Lab. (1) I-III MW; 310MH (3) I-III ThS; 310MH
(2) I-III MW; 310MH (4) I-III ThS; 310MH
- 101w,su—Physiological Chemistry. Hormones, vitamins, digestion and mineral metabolism. 6 cred.; prereq., Physiol. 100. Messrs. McClendon, Armstrong, Hemingway, and Arnow.
Lect. IV TS, VI F; MeS Aud
Quiz VI T
Lab. (1) I-III MW; 310MH (3) I-III ThS; 310MH
(2) I-III MW; 310MH (4) I-III ThS; 310MH

POLITICAL SCIENCE

- 1f-2w-3s—American Government and Politics—Parts 1 and 2. National, state, and local. Constitutions and fundamental laws; governmental organizations; division and separation of powers; legislative, executive, and judicial procedure and problems. Part 3. Principal functions and services of government; defense, law enforcement, regulation of business, public works, and social services. 9 cred.; all; no prereq. Messrs. Christensen and Kirkpatrick.
(1) I MWF; 206Pt (2) IV MWF; BuAud

‡ A fee of \$2 is charged for this course.

RHETORIC

(College of Agriculture, Forestry, and Home Economics)

22f,w,s—Public Speaking. Practical course in fundamentals of speech making. 3 cred.; prereq., Engl. 6. Messrs. Routledge and Nichols.

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|-----|------------------------|-------------------------|
| 22f | (1) I MWF; 311En(UF) | (4) II TThS; 311En(UF) |
| | (2) I TThS; 310En(UF) | (5) III MWF; 311En(UF) |
| | (3) II MWF; 310En(UF) | (6) IV MWF; 311En(UF) |
| 22w | (1) I MWF; 311En(UF) | (5) III MWF; 311En(UF) |
| | (2) I TThS; 307En(UF) | (6) III TThS; 311En(UF) |
| | (3) II MWF; 102Ad(UF) | (7) IV MWF; 311En(UF) |
| | (4) II TThS; 311En(UF) | |
| 22s | (1) II TThS; 311En(UF) | (3) III TThS; 307En(UF) |
| | (2) III MWF; 311En(UF) | |

23s—Public Speaking. 5 cred.; prereq., Engl. 6; IV MTWFS; 311En(UF). Mr. Routledge.

SOILS

6w—Soils. Origin, formation, physical properties, moisture relations, principles of soil fertility, use of lime, commercial fertilizers, and stable manure; soil organisms and green manures; tillage. 5 cred.; no prereq.; II MTWThF; 204So(UF). Mr. Rost.

108w—Physical Properties of Soils. The determination of physical constants of soils, including mechanical composition. 3 cred.; jr., sr.; prereq., 6. Mr. McMiller.

Lect. VI W; 204So(UF)

Lab. VII-IX W, VI-VIII F; 201So(UF)

ZOOLOGY

1f†-2w†-3s††§—General Zoology. 10 cred.; no prereq. Messrs. Minnich, Wod-sedalek, Eddy, and Dawson.

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| Lect. | (1) II TTh; 06Bo (Limit 320) | (3) III WF; 06Bo (Limit 320) |
| | (2) IV TS; 06Bo (Limit 320) | (4) IV WF; 06Bo (Limit 240) |
| Lab. | (1) I-II MF; 101Z (Limit 150) | (5) I-II TS; 101Z (Limit 174) |
| | (2) III-IV MF; 101Z (Limit 174) | (6) III-IV TS; 101Z (Limit 174) |
| | (3) VI-VII MF; 101Z (Limit 174) | (7) V-VI TTh; 101Z (Limit 60) |
| | (4) VIII-IX MF; 101Z (Limit 174) | |

14f†-15w††—General Zoology. Structure, physiology, embryology, classification, and evolution of animals. Textbook, lectures, laboratory, and quizzes. 3 cred. per qtr.; no prereq. Mr. Dawson.

Lect. VII TTh; 15MeS (Limit 288)

Lab. (1) V-VI TTh; 101Z (Limit 114) (2) VIII-IX TTh; 101Z (Limit 174)

† The entire course must be completed before credit is received for any quarter.

‡ A fee of \$1 per quarter is charged for this course.

§ Students should elect lecture sections in which they can continue throughout the three quarters. Changes from one lecture or laboratory to another may be made only with the consent of the department office.

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The Bulletin
of the University of
Minnesota

West Central School and Station
Morris, Minnesota

Announcement for the Years
1938-1940



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SCHOOL CALENDAR

1938-1939

1938			
October	3	Monday	First term opens; registration
October	4	Tuesday	Organization of classes
November	11	Friday	Homecoming Day
November	23	Wednesday	Parents' Day
November	24	Thursday	Thanksgiving Day; a holiday
December	23	Friday	First term closes

1939			
January	9	Monday	Winter term opens; registration
January	10	Tuesday	Organization of classes
March	18	Saturday	Junior-Senior Banquet
March	24	Friday	Annual Music Recital
March	25	Saturday	Achievement Banquet
March	26	Sunday	Baccalaureate Service
March	29	Wednesday	Senior Class Play
March	31	Friday	Commencement Exercises Second term closes

1939-1940

1939			
October	2	Monday	First term opens; registration
October	3	Tuesday	Organization of classes
November	11	Saturday	Homecoming Day
November	22	Wednesday	Parents' Day
November	23	Thursday	Thanksgiving Day; a holiday
December	22	Friday	First term closes

1940			
January	8	Monday	Winter term opens; registration
January	9	Tuesday	Organization of classes
March	16	Saturday	Junior-Senior Banquet
March	23	Saturday	Achievement Banquet
March	24	Sunday	Baccalaureate Service
March	27	Wednesday	Senior Class Play
March	28	Thursday	Annual Music Recital
March	29	Friday	Commencement Exercises Second term closes

FACULTY

Lotus D. Coffman, Ph.D., LL.D., President of the University
Walter C. Coffey, M.S., LL.D., Dean of the Department of Agriculture

AT MORRIS

ADMINISTRATION

Theodore H. Fenske, B.S., Superintendent
Edwin J. Volden, Registrar
Hazel Brevig, Assistant Registrar
Dagmar Pedersen, B.A., Librarian
Dorothy Zellers, B.S., Director of Home Economics
Nanna Jelstrup, B.A., Dean of Women
Margaret Nerhagen, R.N., School Nurse
Gudrun Fredensberg, Accountant
Margaret Treinen, Secretary

AGRICULTURAL ENGINEERING

Julius Felt, Carpentry, Farm Structures
Albert C. Heine, Physics, Farm Mechanics, and Electricity
Alex B. Rolfe, Forge, Welding, and Mechanics
Albert Anderson, Forge
—————, Automotive Engineering

AGRONOMY AND HORTICULTURE

John A. Anderson, B.S.A., Botany and Horticulture
Roy O. Bridgford, M.S., Farm Crops and Soils

ANIMAL HUSBANDRY

Allen W. Edson, B.S., Poultry
Philip S. Jordan, B.S. in Agr., Animal and Dairy Husbandry
Walter Hokanson, Herdsman

AGRICULTURAL ECONOMICS

Allen W. Edson, B.S., Farm Management and Marketing
Glenn I. Prickett, B.A., Rural Sociology and Economics

HOME ECONOMICS

—————, Applied Art and Foods
Eugenia Clark, B.S., Clothing
Helen Prindle, B.S., Home Management and Child Training
Dorothy Zellers, B.S., Foods, Home Furnishing
Margaret Nerhagen, R.N., Nursing

ASSOCIATED SUBJECTS

Betty Caldwell, B.A., Typewriting and English
Lucille Cox, B.A., Business Training
Nanna Jelstrup, B.A., English and Mathematics
Theodore S. Long, B.A., English and Public Speaking
Margaret O'Connor, B.A., Music
Dagmar Pedersen, B.A., English and Physical Training
Glenn I. Prickett, B.A., History
Helen Swan, Piano
Edwin J. Volden, Accounting

GENERAL INFORMATION

PURPOSE

The West Central School of Agriculture was organized in 1910 as a division of the Department of Agriculture of the University of Minnesota. It was established primarily for the training of young men and young women for the vocations of farming and homemaking. It is a secondary school accepting students directly from the eighth grade and offers extensive opportunities to that large group of young people who desire intensive vocational training and who are limited as to the time they can give to the completion of their education. The work is planned and the subjects are taught with the purpose of making the students efficient in their chosen vocations. The courses are sufficiently extended to give a fairly complete technical knowledge of the vocations of farming and homemaking, and a working basis for the economic and sociological aspects of farm life. The technical courses are amply supplemented by cultural subjects designed to give the students a broad and liberal outlook and the necessary preparation for useful citizenship.

LOCATION

The school is admirably situated to serve that large section of the state in which it is located. A network of improved state highways connects the city of Morris with all parts of the district. The school itself adjoins the city of Morris and is situated on a natural rise of ground overlooking the Pomme de Terre Valley. The campus, with its twenty-nine buildings, attractive lawns, and pleasant drives, is one of the beauty spots in this section.

ADMISSION

The school will admit any young man or young woman of good moral character, who has completed the eighth grade and who desires a technical training in agriculture and home economics. In special cases those who have not completed eighth grade work will be admitted. Mature young men and women who have been out of school for one or more years and desire special training in agriculture and home economics will be admitted. High school courses equivalent to courses offered in the School of Agriculture will receive the same credit as those offered in the school. High school graduates may register for any of the courses offered, and by properly planning their program, may become graduates of the School of Agriculture in much less time than the three years required for the regular student. Many high school graduates come for one year of specialized vocational training. Students should correspond with the registrar, before coming to the school, and make the necessary preliminary arrangements for registration.

TIME OF OPENING

The fall term of the West Central School of Agriculture will open the first Monday in October and close the Friday before Christmas. The winter

term will open the second Monday in January and close the last Friday in March. The school work covers a period of six months, at a time when the student can best be spared from home.

THREE-YEAR COURSE

The regular courses cover a period of three sessions of six months each, from October through March. The course for young men is so arranged as to make it possible for the student to select a portion of the work in any of the following groups: agronomy, horticulture, animal husbandry, farm management, economics, or agricultural engineering. The course for young women provides special training in home management, clothing construction, foods, music, home nursing, public speaking, and business training. Both young men and young women may elect courses and receive credit in music in connection with any of the regular courses. They may also elect academic subjects in the third and fourth years, preparatory to college entrance. The main emphasis of the institution is given to the regular courses and all students are urged to complete the three-year course.

INDEPENDENT STUDY COURSE

Young men and young women who give satisfactory evidence that they have the ability and other necessary qualifications, may, with the approval of the superintendent and the Scholarship and Standards Committee, pursue an independent course of study plan which does not require the completion of specified courses. In such an independent study course, it is necessary for the student to submit a definite plan to be followed, and from time to time pass comprehensive examinations covering all work completed. Since the English language is the basis of all study and reading, the student will be expected to complete the equivalent of English courses required of all students in the regular three-year course at the West Central School of Agriculture. A regular school of agriculture diploma will be awarded to students who complete, satisfactorily, the independent study course.

ADVANCED COURSES

It has been found that many students desire an advanced year after completing the regular three-year course. To meet this demand a fourth session of six months of work is offered. During this advanced year, graduates of the three-year course may elect to specialize in one of the lines of work listed below. They may at the same time choose from the elective lists subjects that they could not obtain during their first three sessions. The major lines of work suggested for boys are dairying, livestock production, farm engineering, economics, and academic subjects. The major lines for girls are home training, nursing, music, business training, and academic subjects.

COLLEGE PREPARATORY

Graduates of the three-year course at the West Central School of Agriculture who have completed two summers of supervised work on their home farms, one additional school year of six months, and one additional sum-

mer's work or the equivalent thereof, will be admitted to the University of Minnesota, and to the state teachers colleges.

DEPARTMENT OF MUSIC

For students desiring special courses in music, credit courses in both vocal and instrumental music are offered. Prospective students should refer to the description of the music courses on pages 28-29.

HOME PROJECT WORK

The purpose of this work is to promote and extend the technical work given in the classrooms and laboratories during the regular school sessions. The approved methods of home economics and agricultural practice are applied to some branch of the home or farm enterprise which the project is intended to cover. Reports are required throughout the season and the work is, at all times, in charge of supervisors who make the necessary visits to each student.

A description of all projects is given on pages 30-34.

ROOMS IN DORMITORIES

Old or new students planning to attend the West Central School of Agriculture should write early to the registrar, asking him to reserve a room in one of the dormitories. Students should reserve rooms in advance. Each dormitory room is furnished with two single beds, mattresses and pillows, a dresser, table, and chairs. Preference as to roommates should be stated early, and will be considered as far as possible.

WHAT TO BRING

Each student should bring with him one comforter and two blankets, towels, comb, brushes, one tumbler, one teaspoon, bedroom slippers, and at least two nightgowns or pajama suits. Students will also bring four sheets, two pillow cases, and a bedspread for their beds.

Each girl should bring with her, in addition to the items mentioned above, bedroom slippers, a kimono, apron, and laundry bag. The kimono may be of any style and material; the laundry bag should be of washable material large enough to hold the soiled clothes of one person; the bedroom slippers should have soft soles; tennis shoes and gymnasium suits are also needed, but it is recommended that students acquire these after entering school.

TUITION FEES

The Minnesota legislature during the 1935 session amended the State School Aid Law, making it possible for eligible students to attend the schools of agriculture without the payment of tuition fees. The fees of such students are paid from State School Aid funds. These students will be required to pay only board and room.

All residents of Minnesota are eligible for tuition exemption who are eighth grade graduates and have not graduated from high school; who are

under 21 years of age; and who do not reside in accredited high school districts.

A student who is eligible for tuition exemption must secure a *tuition certificate* from the county superintendent of the county in which the student graduated from the eighth grade. This certificate must be presented at the time of registration.

Students who do not qualify for tuition exemption are those who have not completed the eighth grade or who are high school graduates; who are 21 years of age or older; who reside in accredited high school districts; or who reside outside of the state of Minnesota.

Students not eligible for fee exemption will pay the following fixed fees as well as fees charged for various courses where laboratory material is used. The amount of these fees will be found in the description of the courses, pages 20-30. Fees are payable at the time of registration.

	Per Term (3 months)
Registration	\$3.00
Gymnasium	1.00
Health Service	2.00
Book rent	1.50
Post office .....	.20
Privilege	2.50

Students who are not eligible for fee exemption may elect to pay \$18 per term to cover all the tuition, laboratory, and equipment fees (except deposit) rather than pay the individual fees listed above and the special fees charged for various courses.

BOARD AND ROOM

The cost of board will be \$3.50 per week and for room \$1.25 per week. No increases will be made unless living costs make the same necessary.

Board and room are payable the first of each month in advance. No accounts can be carried. No room rent refunds will be made for any period of less than two weeks. If students are compelled to be absent for that length of time they are allowed half rates in the dining hall provided they make arrangements with the manager of the dining hall before leaving. All students not residents of Morris are required to live in the dormitories and to board in the school dining hall, unless special arrangements are made with the superintendent.

On entering the school each student should bring sufficient money to pay for one month's board and room, and to pay his fees, if required. This will amount to from \$24 to \$42.

BREAKAGE DEPOSIT

All students are required to make a breakage deposit of \$5 at the time of registration. Students who break laboratory equipment or damage school property are charged for necessary repairs or replacement and such charges are deducted from breakage deposits. Miscellaneous damage to dormitories and other school buildings which cannot be charged to individual students may be charged collectively to the breakage deposits of all students occupying the building.

HEALTH SERVICE

The health fee is used to maintain the Students' Health Service. A special health service building is maintained and a full-time nurse is engaged during the school year. The health fee provides for physical examinations for all students, and care by the school nurse in case of illness. It does not provide for extra nurses in case of serious sickness, where such are necessary, for the extra costs caused by epidemics, nor does it provide for physician's calls. These must be paid for by the student receiving the service. The Health Service is not equipped to care for serious illness and cannot accept responsibility for such cases.

REGISTRATION

No student will be allowed to register for less than 23 credit hours of work, except by special permission of the chairman of the Scholarship and Standards Committee.

All fees must be paid at the time of registration.

No student will be allowed to register after the second week of the term, except by special permission.

CANCELLATION OF REGISTRATION

No student may drop a subject for which he is registered without the special permission of the chairman of the Scholarship and Standards Committee.

If a student is below grade in a subject at the time of cancellation, his record in that subject will be entered as a failure.

Changes in registration must be made before the end of the second week of school. All such changes must be on the proper form, which the student may obtain at the registrar's office. All changes in registration must be approved by the Scholarship and Standards Committee.

Where cancellation of registration is necessary before the close of the term, tuition fees will be refunded as follows:

Period of Attendance	Percentage of Deduction	Percentage of Refund
None	None	100
Two days to one week	10	90
One week to two weeks	20	80
Two weeks to three weeks	30	70
Three weeks to four weeks	40	60
Four weeks to five weeks	50	50
Five weeks to six weeks	60	40

No student who has been in attendance more than one half of the term shall receive any refund of tuition.

ABSENCES

No student will be reinstated in class after an absence without a pass from his preceptor or preceptress. Students living off the campus will secure a pass from the chairman of the Scholarship and Standards Committee. In case of sickness, where students are under the care of the nurse, passes will

be obtained from her. All work lost through absence from class must be made up.

Where no legitimate excuse can be given for a class absence, it shall be deemed an unexcused absence. An unexcused absence will automatically reduce the grade to E for the month in the class where the absence occurred. Three tardinesses will constitute an absence. Students leaving the campus must notify their preceptor or preceptress and arrange for such leave if excuses for classes missed are to be granted on their return.

CLASSIFICATION

In order to be classified as a junior, a student must have not less than 42 credit hours of work.

In order to be classified as a senior, a student must have not less than 94 credit hours of work.

In order to be classified as an advanced student, a student must have not less than 160 credits hours of work.

In order to be classified as a special student, a student must be a high school graduate, or must have completed the advanced course.

SCHOLARSHIP STANDARDS

Marking System

Students are graded on a scale of A, B, C, D, and E. A is a high honor mark and E denotes failure. The mark "incomplete" is reserved for special cases and means that for reasons not within the control of the student, he has failed to meet a specific and important requirement of the course, but has, in other respects, done passing work. The incomplete must be removed the month after it has been received. Extension of time for the removal of incompletes may be granted in special cases. If the deficiency is not made up, the mark of E is automatically substituted for the incomplete. If, on account of poor work, a student drops a subject during the term, he receives a mark of E in the subject.

Honor Point System

Honor points are determined on the basis of grades. For each hour credit of A quality, students receive 3 honor points; of B quality, 2 honor points; and of C quality, 1 honor point. Work of D quality commands no honor points. When a course in which a student receives a mark of E is repeated, only the second grade is considered in reckoning the honor points.

SCHOLARSHIP REQUIREMENTS

In order to obtain a diploma or certificate from the school, a student must have as many honor points as he has credit hours. This means that an average scholarship of C is required.

PROBATION AND ELIMINATION

A student who has less honor points than he has credit hours is placed on probation. A student is removed from probation when his total honor

points equal his credit hours. A student on probation is subject to dismissal from the school. He may, however, appeal for reinstatement to the Scholarship and Standards Committee.

ELIGIBILITY

The following rules will govern eligibility for all interscholastic contests. The Scholarship and Standards Committee must approve all eligible students.

- A. The student must be enrolled in the school not less than one week before the contest.
- B. He shall be making passing grades in at least four subjects for which he is enrolled. These four subjects must total 20 credit hours.

REQUIREMENTS FOR GRADUATION

Completion of the prescribed course of study, including all required work and enough electives to make a total of 160 credit hours.

Attainment of 160 honor points.

All boys who expect to graduate from the West Central School of Agriculture will be required to complete one crops project, one livestock project, and one farm accounts project. Candidates for graduation from the advanced year must complete an additional advanced project. Special cases may arise which make impossible the carrying out of the outlined schedule, in which case the student may, with the approval of the home project supervisor, and the Scholarship and Standards Committee, complete one project and substitute other credits for the remaining project requirements.

All girls who expect to graduate will be required to complete one foods project, two clothing projects, and either a home management or a home furnishing project. Candidates for graduation from the advanced year must complete an additional advanced project.

An honorable standing in deportment.

Payment of all accounts.

For students transferring from other schools one full year of residence is required. Under no circumstances will any student be permitted to participate in the graduation exercises who has not completed in full all of the requirements for graduation.

HOME LIFE IN THE DORMITORIES

The dormitory life of the students while attending the West Central School of Agriculture is subject to supervision. Everything possible is done to promote a healthful, moral atmosphere.

The preceptors and preceptresses have charge of students in their dormitories, and the regulations enforced are for the good of all.

From 8:00 a.m. to 4:20 p.m. students are busy with their school work. From 4:20 to 6:00 p.m. is a recreation period during which students' time is at their own disposal. During study hours students are expected to be in their rooms and to be quiet so that all may study undisturbed. Students may leave the campus in the evening only upon permission of the preceptors or preceptresses. No firearms of any kind will be permitted in dormitories.

The use of profanity and tobacco in dormitory rooms is strictly forbidden. Infraction of dormitory rules may be sufficient cause for dismissal from school. Any student found using intoxicating liquor on the school premises will be subject to expulsion from school.

DISCIPLINE

It is the aim of the administration to be firm, reasonable, and sympathetic. A student who becomes antagonistic to the spirit of the school will be dismissed whenever the general welfare requires. The school does not wish to undertake the problem of disciplining students who are not in sympathy with its purposes.

BUILDINGS AND EQUIPMENT

The physical plant now includes twelve modern brick and stone buildings which compose the educational group, and eleven frame buildings which make up the farm group. The school group includes two girls' dormitories with facilities for 125 girls; three boys' dormitories with accommodations for 225 boys; Agricultural Hall, with stock judging pavilion, meat cutting, dairy, soils, chemistry, horticulture, botany, and farm crops laboratories, and classrooms for all agricultural and academic work; the Engineering Building with woodshop, forge shop, welding shop, farm mechanics laboratory, drafting room, and three lecture rooms; the Music Hall, with two studios and numerous practice rooms. The Business Training Department is also located in this building and includes typewriting, shorthand, business training, and penmanship rooms. The Dining Hall has two large dining rooms and modern kitchens. The Students' Hospital and Health Service Building is equipped with twenty-seven beds, a dispensary, and the nurses' quarters. The Home Economics Building has two foods laboratories, two sewing laboratories, laundering laboratory, home management room, classrooms, and departmental offices. The Administration Building houses the auditorium, the large library, and the administration, business, and registrar's office. The Home Management Practice House will accommodate a group of ten people; and the Physical Education Building includes the gymnasium, swimming pool, locker rooms, and team training quarters.

The equipment in all shops and laboratories is ample and sufficient for the most practical and efficient instruction.

The eleven farm buildings give ample housing facilities for the herds, flocks, and farm equipment which are available for student use.

ASSEMBLY PERIOD

An assembly period is held twice each week throughout the school year. Students are required to attend these assembly exercises. It is the purpose of the school to secure prominent speakers to address the student body at these morning exercises. The assembly period is also used as a forum for public discussion of the many questions and for announcements of importance to the student body. The various societies and organizations also use one period a week for the promotion of their work.

HOLIDAYS

Lincoln's and Washington's birthdays will be appropriately observed, but classes will be held as usual. On Thanksgiving Day no classes will be held, but school will continue as usual on the Friday following.

RELIGIOUS WELFARE

In maintaining the highest moral and religious atmosphere and in fostering the development of complete Christian manhood and womanhood—physical, intellectual, social, and spiritual—the student body and faculty have developed a close relationship with all of the churches in Morris. Students affiliate with the church of their preference and make it their church home while attending school. In addition to this affiliation, religious services are held each Sunday on the school campus. These exercises are under the joint direction of the Faculty-Student Religious Welfare Committee. The Young Women's Christian Association is represented on the campus by a strong and active organization.

MUSICAL ORGANIZATIONS

The school musical organizations include a large chorus, a boys' glee club, a girls' glee club, a school orchestra, and a band. Students especially interested in music are urged to join one or more of these organizations and receive the training which they afford. The musical clubs appear at various school functions. A public concert recital is given at the close of the school year.

THE MOCCASIN

The *Moccasin* is the annual class book published by the senior class of the school. It gives an outline of all school and class activities, is fully illustrated, and contains, in addition to brief articles of student interest, a record of the development and growth of the institution.

WEST CENTRAL SCHOOL NEWS

The *West Central School News* is a quarterly published by the faculty of the school. It serves as a community publication, and is a medium by which former students and alumni are kept in touch with one another and with the school. It is also published to disseminate among its readers useful information and the results of station work.

STUDENT LOAN FUNDS

Students attending the West Central School of Agriculture are afforded the opportunity of participating in the student loan funds available to students who attend the University of Minnesota. This money is loaned to worthy and deserving students at the West Central School in amounts not to exceed \$50 to any one person in one year, at the rate of 5 per cent per annum. Students interested in securing a student loan should correspond with the superintendent of the West Central School of Agriculture.

THE WEST CENTRAL SCHOOL OF AGRICULTURE LOAN FUND

The classes of 1930 and 1931 have left a loan fund of \$450 to be loaned to needy and worthy students. This money is loaned in amounts not to exceed \$50 to any one person in one year at the rate of 5 per cent per annum.

SEVENTH DISTRICT FEDERATION OF WOMEN'S CLUBS LOAN FUND

The Seventh District Federation of Women's Clubs presented the sum of \$1,000 to the West Central School of Agriculture in 1932 to be used as a loan fund to assist needy and worthy students to acquire an education at the West Central School. Students who benefit from this fund must reside in the Seventh District. This fund is loaned in amounts and under conditions that govern other student loan funds.

CALEB DORR CASH SCHOLARSHIPS

By a decision made in April, 1922, by the Board of Regents of the University of Minnesota, a part of the income from a bequest made by the late Caleb Dorr, of Minneapolis, was made available to the schools of agriculture. At the West Central School this fund is awarded to worthy students for excellence in scholarship and for achievement in leadership. The scholarships awarded are used in helping to defray the students' expenses while they are in school.

INTERSCHOLASTIC ACTIVITIES

Each year the school is represented by teams in debating, declamation, and stock and grain judging, which meet in interscholastic contests with students from similar institutions.

In athletics the school is represented by both football and basketball teams. These teams schedule games with colleges and other agricultural schools.

LIBRARY

The library is well equipped to supply the needs of the students. A large number of books have been selected to meet the requirements of the various departments. These, with the government and station reports, are available for use by instructors and students.

The librarian is always ready to give assistance in directing students in the selection of books they may need in the pursuit of their work.

BOYS' AND GIRLS' CLUB WEEK

The annual Boys' and Girls' Club Week is held during June. This is a three-day course open to all boys and girls engaged in 4-H Club work. Boys are given special training in all of the boys' club projects. The girls are given work in home economics with special reference to the club projects. At the close of the course free trips to the Minnesota State Fair will be awarded to students who have done the best work in judging and other activities. Games, music, and special entertainment will make the entire program of special interest to all who attend. A special circular describing this short course will be issued.

SHORT COURSE FOR FARM WOMEN

An annual short course for farm women is held during the month of June. The main object of this course is to provide a few days of rest, recreation, and instruction for the women of the farms in west central Minnesota. Talks, classes, and demonstrations along lines of interest to farm women will fill in part of the day. The large dormitory and dining hall will provide ample living accommodations, and part of each day will be given to rest and recreation. A special bulletin describing this course will be issued.

EXPERIMENT STATION

The West Central School and Station is now conducting extensive experiments in crops, soils, horticulture, and animal husbandry. Special reports and bulletins are published from time to time giving the results of experimental work.

SCHOOL FARM

The farm comprises approximately 800 acres and furnishes an extensive laboratory for the work of the school. Information concerning the methods employed on the farm is always available to the students. The classroom work is supplemented with actual practice, either in the field or with laboratory practice using the crops grown on the farm.

STATION FLOCKS AND HERDS

The school now maintains excellent livestock herds and flocks, all of which are used for student work in the Animal Husbandry Department. Purebred Holstein and Shorthorn cattle, Percheron horses, Shropshire sheep, Poland China hogs, and White Leghorn chickens are maintained for station and school purposes. These afford excellent opportunities for students to study intelligently the various courses in animal husbandry.

COURSES OF STUDY

Figures following the names of courses indicate the number of credit hours.

One credit hour is equivalent to one class period per week devoted to recitation or two such periods devoted to laboratory work.

A class period is forty-five minutes and a laboratory period is ninety minutes.

For description of the following courses see pages 20-30.

For description of home project work see pages 30-34.

High school courses equivalent to required courses will be substituted for them in the case of students who transfer from other schools.

COURSES FOR BOYS

In addition to the required courses as outlined below, a boy who wishes to graduate from the three-year course must, during the time he is in school, elect two courses totaling at least 5 credit hours in each of the following: Agronomy and Soils, Animal and Poultry Husbandry, and Agricultural Engineering; and one course in Agricultural Economics. He may choose these from the elective courses listed. During any one term, at least 23 required and elective credit hours must be carried.

FRESHMAN YEAR

Required

First Term	Second Term
English I A, 5	English I B, 5
§Farm Arithmetic A, 3	§Farm Arithmetic B, 3
Agricultural Science A, 2	
†Freshman Lectures--no credit	

Either Term

- †Types of Farming, 2
- §Word Study and Penmanship, 3

Electives

*Carpentry I A, 2	*Carpentry I B, 2
*Forge I A, 2	*Forge I B, 2
*Farm Mechanics I A, 2	Farm Mechanics I B, 2
Management of Laying Flock, 3	Incubation and Brooding, 3
Elementary Beekeeping, 2	Livestock Selection, 1
	Agricultural Science B, 2

Either Term

- *Grain Crops, 5
- Livestock Production, 4
- Fruit and Vegetable Crops, 3
- Automotive Engineering, 5
- Chorus, 2
- Group Singing, 1
- Group or Private Music, 1 or 2

* Required as a prerequisite for later courses.

† Not required of transfer students.

§ May be removed as a requirement by special examination.

JUNIOR YEAR

First Term

English II A, 5
Chemistry A, 3

Second Term

English II B, 5
Chemistry B, 3

Required

Either Term

Farm Accounts, 3

Electives

Grain Judging, 2
*Physics, 5
*Farm Mechanics, II A, 3
Plant Diseases, 3
Stock Judging A, 1
Elementary Bookkeeping, 2
Landscape Gardening, 2
Argumentation, 2
Pure Seed Production, 2

*Feeds and Feeding, 5
Soils, 4
Farm Mechanics II B, 3
*Electricity, 4
Stock Judging B, 1
Fruit and Vegetable Crops, 3
Forage Crops, 2
Incubation and Brooding, 3
Public Speaking, 2
Electric Arc Welding, 2

Either Term

*Gas Welding, 2
Typewriting, 2 or 5
Conservation, 2
Farm Painting, 1
Group or Private Music, 1 or 2
Chorus, 2

SENIOR YEAR

First Term

English III A, 5
United States History, 5

Second Term

English III B, 5
Government, 5

*Required**Electives*

Livestock Management, 3
Dairy Production, 3
Pure Seed Production, 2
Farm Structures A, 1
Animal Breeding, 3
*Bookkeeping A, 5
*Elementary Algebra A, 5
Farm Marketing, 2
Farm Mechanics III, 4
*Commercial Law A, 5
Farm Economics, 3
Mechanical Drawing, 1
Special Problems in Farm Crops, 2
Farm Law, 5

Farm Management, 5
Animal Diseases, 2
Rural Sociology, 3
Farm Structures B, 1
Advanced Electricity, 3
Bookkeeping B, 5
Elementary Algebra B, 5
Farm Finance, 3
Livestock Problems, 2
Commercial Law B, 5
First Aid, 2
Advanced Poultry Production, 2

* Required as a prerequisite for later courses.

Either Term

Conservation, 2
 Meats, 4
 Typewriting, 2 or 5
 Shorthand, 5
 Gas Welding, 2
 Electric Arc Welding, 2
 Advanced Stock Judging, 2
 Group or Private Music, 1 or 2
 Chorus, 2

Two credits shall be allowed for participation in interscholastic debate. Members of interscholastic athletic teams will be excused from gymnasium classes. Not more than five special credits, including credits for debate and musical organizations, shall count toward graduation.

COURSES FOR GIRLS

FRESHMAN YEAR

First Term

Second Term

Required

English I A, 5
 General Science A, 3
 †Social Training A, 2
 Home Accounts I A, 3
 §Word Study I A, 2
 Gymnasium, 1

English I B, 5
 General Science B, 5
 Social Training B, 2
 Home Accounts I B, 3
 §Word Study I B, 2
 Gymnasium, 1

Electives

*Clothing I A, 3
 *Foods I A, 3
 *Drawing and Design I A, 2
 *Landscape Gardening, 2
 Management of Laying Flock, 3

*Clothing I B, 3
 *Foods I B, 3
 *Drawing and Design I B, 2
 Incubation and Brooding, 3

Either Term

Group Singing, 1
 Group or Private Music, 1 or 2

JUNIOR YEAR

First Term

Second Term

Required

English II A, 5
 Home Furnishing II A, 3
 Gymnasium, 1

English II B, 5
 Home Furnishing II B, 3
 Gymnasium, 1

* Required as a prerequisite for later courses.

† Not required of transfer students.

§ May be removed as a requirement by special examination.

Electives

- | | |
|-----------------------------|----------------------------|
| *Foods II A, 3 | *Foods II B, 3 |
| *Clothing II A, 3 | *Clothing II B, 3 |
| *Crafts A, 2 | Crafts B, 2 |
| Costume Design, 2 | *Home Nursing II B, 3 |
| *Laundering, 2 | Incubation and Brooding, 3 |
| *Home Nursing II A, 3 | |
| *Child Care and Training, 3 | |

Either Term

- Typewriting, 2 or 5
 Shorthand, 5
 Group or Private Music, 1 or 2

SENIOR YEAR

First Term

Second Term

Required

- | | |
|--------------------------|-----------------------|
| English III A, 5 | English III B, 5 |
| Home Management A, 3 | Home Management B, 3 |
| United States History, 5 | Government, 5 |
| Economics of Buying, 3 | Foods III B, 3 |
| Clothing III A, 4 | Clothing III B, 4 |
| Home Nursing III A, 3 | Home Nursing III B, 3 |

Either Term

- Home Management House, 8

Electives

- | | |
|--------------------------|----------------------------|
| *Crafts A, 2 | Crafts B, 2 |
| *General History A, 5 | General History B, 5 |
| *Elementary Algebra A, 5 | Incubation and Brooding, 3 |
| *Bookkeeping A, 5 | Elementary Algebra B, 5 |
| *Commercial Law A, 5 | Rural Sociology, 3 |
| *Art Appreciation A, 2 | Bookkeeping B, 5 |
| | Commercial Law B, 5 |
| | Art Appreciation B, 2 |

Either Term

- Typewriting, 2 or 5
 Dictation, 5
 Group or Private Music, 1 or 2

Through their choice of electives, students may prepare themselves for one of several lines of work. At the time of registration, students will be advised how to select their work so that it will prepare them for the vocation in which they are interested. They may prepare for business positions, for teacher training work, for college entrance, or for nurses' training.

* Required as a prerequisite for later courses.

COURSES FOR BOYS AND GIRLS

ADVANCED YEAR AND COLLEGE PREPARATION COURSES

First Term

Second Term

Required

English IV A, 5	English IV B, 5
Elementary Algebra A, 5	Elementary Algebra B, 5
Plane Geometry A, 5	Plane Geometry B, 5
General History A, 5	General History B, 5
Botany, 5	

Electives

Any course not previously completed during the regular three-year program or any business training courses. Attainment of 45 honor points and 45 credits required to complete advanced year.

BUSINESS TRAINING COURSES

Bookkeeping A, 5	Bookkeeping B, 5
Advanced Bookkeeping A, 5	Advanced Bookkeeping B, 5
Business Spelling and Penmanship A, 3	Business Spelling and Penmanship B, 3
Typewriting A, 2 or 5	Typewriting B, 2 or 5
Advanced Typewriting A, 2 or 5	Advanced Typewriting B, 2 or 5
Business English A, 5	Business English B, 5
Shorthand A, 5	Shorthand B, 5
Dictation A, 5	Dictation B, 5
Secretarial Studies A, 5	Secretarial Studies B, 5
Commercial Law A, 5	Commercial Law B, 5

A business training certificate will be awarded students who complete 50 credit hours of commercial work and attain 50 honor points. To qualify for this certificate the student must have graduated from a high school or from the Advanced Course at the Agricultural School prior to registering for the business training course.

DESCRIPTION OF COURSES

AGRICULTURAL ECONOMICS

- Farm Economics. A study of the fundamental economic principles including the economic organization for production, demand and supply, price and value, the economics of government, the nature of money and banking, international trade, and other current economic problems. Rec. 3 hrs.; 3 credits.
- Farm Finance. A study of the financial structure of agriculture, rural taxation, the relation of tariffs and the monetary system to the agricultural industry. The Farm Credit Administration is fully covered. Rec. 3 hrs.; 3 credits.
- Farm Accounts. A study of farm accounts. The student keeps a practical set of books on the year's work, from the taking of the inventory to closing the accounts at the end of the year. Rec. 3 hrs.; 3 credits.
- Farm Management. A study of farm organizations as related to types of farming, combinations of enterprises, crop rotation, soil management, field and farmstead arrangement, and the efficient use of labor and equipment. Rec. 5 hrs.; 5 credits.
- Farm Marketing. A study of the present system of distributing farm products. Special study is made of co-operative laws and co-operative marketing organizations. Consumer co-operation is discussed. Rec. 2 hrs.; 2 credits.
- Types of Farming. Different types of agriculture in the state and nation are studied. Designed to point out to the beginning student the diversity of the agricultural occupation and the opportunities in the different fields. Rec. 2 hrs.; 2 credits.

AGRICULTURAL ENGINEERING

- Carpentry I A. Carpentry; care, use, and sharpening of tools; laying-off work; making of joints and framing, and work designed to be especially helpful in planning, framing, and construction of farm buildings. Lab. 2, 2 hrs.; 2 credits; fee \$1.
- Carpentry I B. Continuation of Carpentry I A, with emphasis placed on completion of some project selected by the student. Prerequisite: Carpentry I A. Lab. 2, 2 hrs.; 2 credits; fee \$1.
- Farm Structures A. Design, location, and erection of farm buildings. A study is made of roofs, pitches, trusses, etc. Exercises in building, framing, window and door frame construction. Part of the time is devoted to mechanical drawing and plan reading. Lab. 1, 2 hrs.; 1 credit.
- Farm Structures B. A continuation of Farm Structures A. The student draws plans and makes up the material list for a farm building. Prerequisite: Farm Structures A. Lab. 1, 2 hrs.; 1 credit.
- Farm Painting. A study of paints and their uses. Simple exercises in painting, actual practice on buildings and farm equipment. Lab. 2 hrs.; 1 credit.

- Forge I A. Blacksmithing; forging and welding of iron and steel, making and tempering of hand tools. Work designed to be especially helpful in the repair and operation of machinery. Lab. 2, 2 hrs.; 2 credits; fee \$1.
- Forge I B. Continuation of Forge I A. Lab. 2, 2 hrs.; 2 credits; fee \$1.
- Farm Mechanics I A. A course designed to be of help in repairing general farm machinery and equipment. Work is offered in soldering, rope splicing, knots, belt lacing, use of taps and dies, tool sharpening and adjustment, harness repair work, etc. Lab. 2, 2 hrs.; 2 credits.
- Farm Mechanics I B. A continuation of Farm Mechanics I A. Emphasis is placed on some definite repair project which involves use of shop tools and equipment. Prerequisite: Farm Mechanics I A. Lab. 2, 2 hrs.; 2 credits.
- Farm Mechanics II A. Use of farm level—simple exercises in “running levels,” chaining and measuring land. Exercises in map reading, making of farm plats from measurements taken in the field. Rec. 2 hrs.; lab. 1, 2 hrs.; 3 credits.
- Farm Mechanics II B. A study is made of all types of farm machinery, their adjustment and care. Materials used in the construction of farm machinery are covered. Selection of machinery for the field. Prerequisite: Farm Mechanics II A. Rec. 2 hrs.; lab. 1, 2 hrs.; 3 credits.
- Farm Mechanics III. The first six weeks are given to a study of the uses of concrete about the farm, grading and proportioning of sand and gravel, water cement ratios, mixing and placing of concrete, use of reinforcing in concrete, and the estimating of materials, etc. The last six weeks are devoted to a study of modern lighting, heating, ventilating, plumbing, and sewage disposal systems for the farmstead, their cost of installation, care, and maintenance. Prerequisites: Physics and Electricity I. Rec. 3; lab. 1, 2 hrs.; 4 credits.
- Automotive Engineering. A study of internal combustion engines with emphasis placed on tractor, truck, and automobile motors. A careful study is made of carburetors, ignition, lubrication, and cooling systems; also differentials and transmissions. Rec. 3 hrs.; lab. 2, 2 hrs.; 5 credits.
- Electricity. Kinds of electrification, magnetism, electromagnetism, magnetic induction, chemical generators, dynamos, motors, etc. Rural electrification, wiring of farm buildings, maintenance of electrical appliances in the home. Prerequisite: Physics. Rec. 3 hrs.; lab. 1, 2 hrs.; 4 credits.
- Advanced Electricity. A continuation of Electricity, with considerable time devoted to the study of alternating currents. Rec. 2; lab. 1, 2 hrs.; 3 credits.
- Mechanical Drawing. Principles of drafting, lines, lettering, views of objects, making of working drawings, interpretation of drawings. Lab. 2 hrs.; 1 credit.
- Gas Welding. A careful study is made of the apparatus, of safety measures, of action of the various metals under the torch, and uses of flux. Student begins by running simple beads, gradually working into actual repair projects on welding, brazing, and cutting with the torch. Prerequisite: Forge I A and B. Rec. 1 hr.; lab. 1, 2 hrs.; 2 credits; fee \$3.

Electric Arc Welding. The course covers practice in both A.C. and D.C. equipment. Much practice is given on actual repair welds. Prerequisite: Gas Welding. Rec. 1 hr.; lab. 1, 2 hrs.; 2 credits; fee \$5.

AGRONOMY AND SOILS

- Grain Crops. A study of corn and the principal cereal crops with emphasis placed upon the types and varieties most desirable, soil and cultural requirements, seed selection and preparation, cost of production, harvesting, and methods of improvement. Rec. 5 hrs.; 5 credits.
- Grain Judging. Score card practice, commercial grading and judging work, with the object in view of making the student proficient in the selection and growing of purebred seed. Lab. 2, 2 hrs.; 2 credits.
- Forage Crops. A study of the leguminous crops, clover, alfalfa, etc., pastures and meadows, and the annual forage crops. Cultural requirements of forage crops and their importance to the farm. Lab. 2, 2 hrs.; 2 credits.
- Pure Seed Production. Methods of breeding and growing purebred seed corn and grain on the farm. The course includes a study of certification and seed registration. Prerequisite: Grain Crops. Lab. 2, 2 hrs.; 2 credits.
- Plant Diseases. A study of the most important diseases affecting farm crops, with the recommended methods for control. Rec. 3 hrs.; 3 credits.
- Soils. This course is applied to the needs of western Minnesota. Soil formation, soil types, soil physics, soil chemistry, soil tillage, and the use of fertilizers are given attention. Prerequisite: Chemistry A. Rec. 3 hrs.; lab. 1, 2 hrs.; 4 credits.
- Special Problems in Farm Crops. A course for seniors and advanced students. Takes up problems of a practical nature in farm crops and farm management and covers them more fully than do the elementary courses. Prerequisites: Grain Crops and Forage Crops, or their equivalent. Rec. 2 hrs.; 2 credits.

ANIMAL AND DAIRY HUSBANDRY

- Livestock Production. An introduction to the livestock industry. The place of livestock on the farm is discussed, the types and breeds best adapted to the needs of different kinds of farms are studied. Principles of care and management outlined. Practice in selection and judging. Rec. 4 hrs.; 4 credits.
- Livestock Selection. Study and practice in the use of score cards, showing the relation of the body structure to economical production, covering all classes of livestock. Lab. 1, 2 hrs.; 1 credit.
- Stock Judging A. Comparative judging of beef cattle, swine, and sheep. Lab. 1, 2 hrs.; 1 credit.
- Stock Judging B. An advanced course in comparative judging of dairy cattle and horses. Lab. 1, 2 hrs.; 1 credit.
- Advanced Stock Judging. Open to those trying out for the interscholastic stock judging team. Lab. arranged; 2 credits.

- Feeds and Feeding. General composition of the animal body; composition and digestibility of feeds; feeding standards; methods of feeding. Prerequisite: Chemistry A. Rec. 5 hrs.; 5 credits.
- Livestock Management. Production of beef cattle, sheep, swine, and horses, both purebred and market stock, including, from a practical standpoint, feeding and management of the herd or flock, selection of breeding stock, and arrangement of buildings and yards. Rec. 3 hrs.; 3 credits.
- Dairy Production. This course is designed to fit the student for the successful management of a dairy herd. The course prepares students for positions as testers in dairy herd improvement associations. Rec. 2 hrs.; lab. 1, 2 hrs.; 3 credits.
- Animal Diseases. Causes, prevention, and cure of animal diseases, including emergency treatment. Rec. 2 hrs.; 2 credits.
- Animal Breeding. Theory and practice of animal breeding, including variation, heredity, selection, effect of purebred animals in improving types of stock and pedigrees. Rec. 3 hrs.; 3 credits.
- Meats. Practice in killing, cutting, and curing of meats for home consumption on the farm. Course is limited to seniors. Lab. 8 hrs.; 4 credits.
- Livestock Problems. A seminar and reading course in which the student selects problems of special interest to him. Open only to seniors and advanced students with at least 10 credit hours in animal husbandry. Rec. 2 hrs.; 2 credits.

BEE CULTURE

- Elementary Beekeeping. Fundamentals of bee behavior throughout the cycle of the year. Fundamentals of beekeeping practice throughout the year. Modern equipment for beekeeping practice. Starting with bees, increase, moving, uniting, feeding. Rec. 2 hrs.; 2 credits.

BUSINESS

- Business Spelling and Penmanship A. An advanced course in spelling and penmanship for students taking the business course. Rec. 3 hrs.; 3 credits.
- Business Spelling and Penmanship B. Continuation of Business Spelling and Penmanship A. Rec. 3 hrs.; 3 credits.
- Typewriting A. Provides individual instruction in the use of the machine. Memorization of the keyboard and graded lessons are used. Each lesson must be done correctly before the student is advanced. 2 or 5 credits; fee \$1.50.
- Typewriting B. A continuation of Typewriting A. 2 or 5 credits; fee \$1.50.
- Advanced Typewriting A. For those who have had previous typing experience. Speed and accuracy is stressed. 2 or 5 credits; fee \$1.50.
- Advanced Typewriting B. Continuation of Advanced Typewriting A. 2 or 5 credits; fee \$1.50.

- Shorthand A. Gregg system supplemented with speed studies is used. Rec. 5 hrs.; 5 credits.
- Shorthand B. Continuation of Shorthand A. Rec. 5 hrs.; 5 credits.
- Dictation A. For those who have had previous training in shorthand. A continuation of Shorthand A and B, stressing speed and accuracy. Rec. 5 hrs.; 5 credits.
- Dictation B. Continuation of Dictation A. 5 hrs.; 5 credits.
- Business English A. The practical application of the English language to business usage. Includes training in the writing of business letters and other forms. Rec. 5 hrs.; 5 credits.
- Business English B. Continuation of Business English A. Rec. 5 hrs.; 5 credits.
- Secretarial Studies A. Course includes training in office routine, advanced dictation, business correspondence, billing, invoices, statements, filing and indexing, stenciling, office appliances, and business ethics. Rec. 5 hrs.; 5 credits.
- Secretarial Studies B. Continuation of Secretarial Studies A. Rec. 5 hrs.; 5 credits.
- Bookkeeping A. Preparation and interpretation of balance sheets; purpose of accounts and principles of account classification; profit and loss statements. Rec. 5 hrs.; 5 credits.
- Bookkeeping B. Source of ledger entries; cash receipts and disbursements; general journal; purchase and sales records. Practice set. Rec. 5 hrs.; 5 credits.
- Advanced Bookkeeping A. Controlling accounts; records of original entry; business practice and procedure; depreciation and bad debts; accruals and deferred items; adjusting and closing entries; partnerships, departmental revenue accounts; practice set. Rec. 5 hrs.; 5 credits.
- Advanced Bookkeeping B. Nature and characteristics of the corporation; proprietorship in the corporation; formation and operation of a corporation; corporation accounts; fixed and intangible assets; manufacturing; analysis of financial statements; use of statistical data in business management; graphical method of presenting accounting facts. Rec. 5 hrs.; 5 credits.
- Commercial Law A. A thoro study is made of contracts, sales, agency, and negotiable instruments. Rec. 5 hrs.; 5 credits.
- Commercial Law B. Continuation of Commercial Law A and further study includes guaranty, bailment, insurance, real property, fixtures, partnership, corporations, and bankruptcy. Rec. 5 hrs.; 5 credits.
- Farm Law. A study of the common principles of commercial law as applied to the farm. Rec. 5 hrs.; 5 credits.

ENGLISH AND PUBLIC SPEAKING

- English I A. Reading, spelling, and a brief review of the principles of grammar. Considerable time is devoted to oral reports. Short written theme required. One hour each week is devoted to speech work. Rec. 5 hrs.; 5 credits.

- English I B. Continuation of English I A. Letter writing in connection with simple sentence and paragraph structure. Several selections are memorized. One hour each week is devoted to speech work. Rec. 5 hrs.; 5 credits.
- English II A. Letter writing and spelling continued. Standard books and selections of interest are read. The outline is used exclusively in oral and written work. One hour each week is devoted to speech work. Rec. 5 hrs.; 5 credits.
- English II B. A continuation of English II A. Rec. 5 hrs.; 5 credits.
- English III A. Advanced work in written composition of a narrative type. An appreciation of good literature is cultivated by extensive reading. One hour each week is devoted to speech work. Rec. 5 hrs.; 5 credits.
- English III B. Reading and advanced composition of descriptive and argumentative types continued. One hour each week is devoted to speech work. Rec. 5 hrs.; 5 credits.
- English IV A. English literature. History of English literature with readings from masterpieces. Rec. 5 hrs.; 5 credits.
- English IV B. English Literature. Continuation of English IV A. Rec. 5 hrs.; 5 credits.
- Elementary English. A course for older boys and men who attend school during the winter term. Reading, spelling, and a brief review of the principles of grammar is given. Rec. 3 hrs.; 3 credits.
- Argumentation. Principles of debate are studied, gathering of evidence and outlining arguments stressed. Practice in speaking. Rec. 2 hrs.; 2 credits.
- Public Speaking. Training in thinking and talking before an audience. Practice speeches are given. Rec. 2 hrs.; 2 credits.
- Word Study and Penmanship. Drill in spelling and usage of common words, and penmanship. Rec. 3 hrs.; 3 credits.

HOME ECONOMICS

To defray costs of laboratory supplies used in the various courses, a fee of \$2 per term is charged all students registering in home economics courses.

FOODS AND HOME MANAGEMENT

- Foods I A. This course is divided into five parts. It gives the basic principles and standards for each of the following: canning, food service, planning and preparation of breakfasts, breads, and salads. Lab. 3, 2 hrs.; 3 credits.
- Foods I B. A continuation of the Foods I A course as applied to luncheons or suppers and dinners. A study of batters, doughs, cakes, cookies, and meats is included here. Lab. 3, 2 hrs.; 3 credits.
- Foods II A. A study of body needs, planning of dietaries, menus, and meals. Prerequisites: Foods I A and B. Lab. 3, 2 hrs.; 3 credits.
- Foods II B. A continuation of Foods II A, the actual serving of meals to small groups, and a detailed study of meats. Lab. 3, 2 hrs.; 3 credits.

- Foods III B. This course is planned to help the girls realize the possibility of using their foods training to provide an income and to aid them in planning, preparing, and serving special foods for club meetings, ladies' aids, group suppers, buffet meals, teas, etc. Rec. and lect. 2 hrs.; 2 hrs. lab. as arranged; 3 credits.
- Home Management A. A study of the problems of management in the home including family and community relationships. Prerequisites: Child Care and Training, Foods I and II, Laundering. Rec. 3 hrs.; 3 credits.
- Home Management B. A continuation of Home Management A. Includes a study of possible vocations for the home economics trained girl. Rec. 3 hrs.; 3 credits.
- Home Management House. Senior girls spend eight weeks living in the practice house, where, with the supervision of a resident instructor, they actually manage the home, and care for a child. 8 credits.
- Child Care and Training. This course is to give an understanding of the place of the child in the home, through the study of the physical care and mental training of the infant and preschool child. Rec. 3 hrs.; 3 credits.
- Laundering. Includes care of laundry and utensils, study of water, soap, starch, removal of stains, washing of woolen and silk garments, ironing, and the principles of dry cleaning. Rec. 1 hr.; lab. 1, 2 hrs.; 2 credits.
- Social Training I A. The subject matter includes the study of conversation, table etiquette, dress, boy and girl relationships, and social correspondence. Rec. 2 hrs.; 2 credits.
- Social Training I B. Continuation of Social Training I A. Rec. 2 hrs.; 2 credits.
- Economics of Buying A. A general study of buying points for household supplies, such as clothing, equipment, and luxuries. Rec. 3 hrs.; 3 credits.
- Home Accounts A. Simple arithmetic as applied in figuring costs of what we produce and consume. The making of budgets and keeping of accounts as suited to needs. Rec. 3 hrs.; 3 credits.
- Home Accounts B. Continuation of Home Accounts A. Rec. 3 hrs.; 3 credits.
- Word Study A. A study of the spelling, meaning, use, and pronunciation of words. Rec. 2 hrs.; 2 credits.
- Word Study B. A continuation of Word Study A. Rec. 2 hrs.; 2 credits.

CLOTHING AND RELATED ART

All materials for clothing courses must be selected in consultation with the instructor. Students are requested not to bring materials from home, unless arrangements have been made with the instructor. Each girl should have a thimble, tape measure, scissors, and needles.

Clothing I A. Two aprons, a holder, a slip or panties, and Christmas gifts are made. Problems of darning and patching are required. A study of cotton materials is made, including wearing qualities and prices. Simple

- decorations, trimmings, and the cost of finished garments are discussed. Demonstration of sewing machine attachments. Lab. 3, 2 hrs.; 3 credits.
- Clothing I B. A study of cotton and linen dress fabrics; making pajamas, a simple wash dress, and a better wash dress. Simple problems in decorative needlework; discussion of clothing budget. Lab. 3, 2 hrs.; 3 credits.
- Clothing II A. Includes the study and making of a house dress for wear in foods classes and the Home Management House. A study of wool and making of at least one wool garment. The use of sewing machine attachments is studied and practiced. Prerequisites: Clothing I A and B, or equivalent. Lab. 2, 3 hrs.; 3 credits.
- Clothing II B. A study of silk fabrics, the making of a silk garment. A study of children's clothing and the making of one child's outfit. Lab. 2, 3 hrs.; 3 credits.
- Clothing III A. A course in make-over. Each student in conference with the instructor decides on the problem. A study of millinery is included. Prerequisites: Clothing II A and B, or equivalent. Lect. 1 hr.; lab. 3, 2 hrs. or lab. 4, 2 hrs.; 4 credits.
- Clothing III B. Each girl makes as many complicated garments as time will permit, in order to improve her technique. At least one dress or suit and a complete outfit for graduation is made. Lect. 1 hr.; lab. 3, 2 hrs. or lab. 4, 2 hrs.; 4 credits.
- Costume Design. This course is so planned that it enables the girl to plan clothes appropriate to various types, figures, and colorings, and which are suitable for long wear. Lect. 2, 1 hr.; 2 credits.
- Home Furnishings II A and B. Courses include the fundamentals of artistic home planning and furnishing, including interior finish of walls, floors, and furniture, as well as selection of rugs or carpets, curtains, and pictures. Renovation of used furnishings is discussed and whenever possible, carried out in the laboratory. Prerequisites: Drawing and Design, Landscape Gardening. Rec. and lect. 3, 2 hrs.; 3 credits, each course.
- Drawing and Design I A. Principles of design and color harmony with emphasis upon design as expressed in clothing, house furnishings, and articles in common use. Lab. 2, 2 hrs.; 2 credits.
- Drawing and Design I B. Application of design principles to costume selection and design. Lab. 2, 2 hrs.; 2 credits.
- Crafts A. Application of the principles of design to the making of worthwhile decorative household articles and personal belongings. Lab. 2, 2 hrs.; 2 credits.
- Crafts B. Continuation of Crafts A, with more advanced problems. Lab. 2, 2 hrs.; 2 credits.
- Art Appreciation A and B. Appreciation gained through the study of various forms of art, including pictures, ceramics, decorative objects, and costume. Rec. or lect. 2, 1 hr.; 2 credits.
- Home Nursing II A. Structure and function of the human body and personal hygiene. Rec. 3 hrs.; 3 credits.

Home Nursing II B. Communicable diseases, prevention and care. First aid. Rec. 3 hrs.; 3 credits.

Home Nursing III A. Home care of the sick, including preparation and serving of food. Prerequisites: Home Nursing II A and B. Rec. 3 hrs.; 3 credits.

Home Nursing III B. Hygiene of maternity, prenatal care; infant nutrition and care. Rec. 3 hrs.; 3 credits.

HORTICULTURE

Fruit and Vegetable Crops. Planning, planting, culture, value, and management of the orchard and garden on the general farm. Rec. 3 hrs.; 3 credits.

Landscape Gardening. A study of trees, shrubs, and flowers adapted to western Minnesota and the proper arrangement of these plants on the farmstead. Rec. 2 hrs.; 2 credits.

MATHEMATICS

Farm Arithmetic A (Boys). Training in simple mathematical processes, applications of principles to problems requiring measurements of material, extension, capacity, with practical applications to farm work. Assists in the mathematics of the technical school course. Rec. 3 hrs.; 3 credits.

Farm Arithmetic B (Boys). Continuation of Farm Arithmetic A. Rec. 3 hrs.; 3 credits.

Elementary Algebra A. Designed to cover the usual first semester academic credit work in elementary algebra. Rec. 5 hrs.; 5 credits.

Elementary Algebra B. Continuation of Elementary Algebra A. Rec. 5 hrs.; 5 credits.

Plane Geometry A. Planned to cover usual first semester academic course in plane geometry. Rec. 5 hrs.; 5 credits.

Plane Geometry B. Completion of Plane Geometry A. Rec. 5 hrs.; 5 credits.

MUSIC

Private musical instruction includes twelve private lessons and daily supervised practice periods. Music Hall is equipped with practice rooms for the use of music students. The fees for private lessons pay also for the use of a practice studio.

Piano. Elementary training in scales, chords, arpeggios, and selected studies. Technical exercises for the development of the hands, fingers, and arms. Studies and compositions adapted to the individual student. 2 credits; fee \$7.

Voice. Fundamentals of voice culture, placement, formation of vowels, diction, and flexibility. Studies and methods by Franz Prochowski. Solos according to the ability of the individual student. 2 credits; fee \$7.

Violin. Methods and studies by Grun, Fischel, Sevcik, Dancla, Kayser, Kreutzer, Rode, and Fiorillo. Solos adapted to each grade. 2 credits; fee \$7.

Band and Orchestral Instruments. Carefully arranged courses in each instrument. Cello, trombone, clarinet, trumpet, saxophone, drums, etc. 1 credit; fee \$7.

Group Singing. A beginning course in vocal study for freshmen. Principles of musical notation, formation of scales, musical terms, sight reading, ear training, and the appreciation of music taught through participation in group singing. Rec. 1 hr.; 1 credit.

Chorus. Both sacred and secular music are sung by this group. The chorus sings on Sunday evenings at the vesper service, furnishes music for assembly programs and concerts throughout the year, and presents an operetta or musical comedy. 2 credits.

Orchestra. Two orchestras, one for beginners and one for advanced students, are organized at the beginning of the school year. Credit is given for membership in these organizations. 1 credit.

Group lessons are offered in piano, voice, and instruments. These are small classes for the benefit of those who do not desire to register for private instruction. 1 credit; fee \$1.50.

PHYSICAL TRAINING

Gymnasium (Girls). All girls will be required to take gymnasium work during their entire residence at the school. Girls will be organized into classes for exercise, gymnastics, swimming, and games. 1 credit.

POULTRY HUSBANDRY

Management of Laying Flock. Principles of general management, house construction, important commercial breeds and types, feeding and culling for egg production; common ailments and treatments. Rec. 2 hrs.; lab. 2 hrs.; 3 credits.

Incubation and Brooding. A study of the best methods of incubation and brooding; natural and artificial, includes selection of breeds, eggs for incubation, feeding and care of chicks, how to avoid losses. Rec. 3 hrs.; 3 credits.

Advanced Poultry Production. A seminar course for students especially interested in poultry production. Prerequisites: Management of Laying Flock, and Incubation and Brooding. Rec. 2 hrs.; 2 credits.

SOCIAL SCIENCE

General History A. A study of world history during the ancient and medieval periods to the French Revolution, designed to show the social and political development of men and nations during these periods. Rec. 5 hrs.; 5 credits.

General History B. A continuation of General History A from the French Revolution to the present time, with special emphasis on the growth and development of nationalism and democratic and liberal reforms during this period. Rec. 5 hrs.; 5 credits.

- United States History. A course intended to present a clear account of the colonial backgrounds of the United States with greater emphasis on the recent industrial, economic, and social development of our nation. Rec. 5 hrs.; 5 credits.
- Government. A limited study of the departmental organization and function of the national, state, and local government. Rec. 5 hrs.; 5 credits.
- Rural Sociology. A limited study of the backgrounds of sociology. Rural social institutions and existing rural problems. Rec. 3 hrs.; 3 credits.
- Freshman Lectures. A noncredit course for beginning students, designed to aid them in adjusting themselves to the school, and to life.

SCIENCE

- General Science A. To acquaint the student with the many happenings of everyday life and their relation to the sciences of chemistry, physics, and biology. Rec. 3 hrs.; 3 credits.
- General Science B. Continuation of General Science A. Rec. 5 hrs.; 5 credits.
- Agricultural Science A. A foundation course covering the fundamentals of botany, zoology, chemistry, and soils, and their relationship and use to agriculture. Rec. 2 hrs.; 2 credits.
- Agricultural Science B. A continuation of Agricultural Science A. Rec. 2 hrs.; 2 credits.
- Botany. A study of flowering plants, molds, mushrooms, rots or decays, and yeast. Rec. 3 hrs.; lab. 2, 2 hrs.; 5 credits.
- Chemistry A. A general introductory course in chemistry treating of the fundamental principles necessary for an understanding of chemistry in its relation to agriculture. Rec. 2 hrs.; lab. 1, 2 hrs.; 3 credits; fee \$1.
- Chemistry B. A continuation of Chemistry A, with a more direct application to the chemistry of plants and animals. Rec. 2 hrs.; lab. 1, 2 hrs.; 3 credits; fee \$1.
- Physics. A practical course in physics as related to agricultural engineering. Covering a study of the mechanics of solids, liquids, gases, heat, sound, and light. Rec. 5 hrs.; 5 credits.
- Conservation. A study of the natural resources of the state, with special emphasis on the student's responsibility and opportunities for their conservation. Rec. 2 hrs.; 2 credits.
- First Aid (Boys). A course in junior first aid, as outlined by the American Red Cross. The course includes artificial respiration, and diagnosis and temporary treatment of all kinds of accidents. Rec. 2 hrs.; 2 credits.

SUMMER HOME PROJECTS

AGRICULTURAL PROJECTS

From 2 to 5 credits will be allowed, depending on the quantity and quality of work. A charge of 25 cents is made for the record books made up by the school. Other record books and supplies are charged for at cost.

Sequence in which project work must be taken is explained in Requirements for Graduation, on page 10.

Farm Accounts. Keep complete records of the farm business at home for six months. Submit the completed book at the close of the project year. Four reports will be required for the six months. This project may be carried for an entire year for extra credit.

Personal Accounts. Those boys who are working out and unable to carry the Farm Accounts project may keep records of personal expenses for a period of six months. Submit bank book or other evidence of saving, to indicate that at least 50 per cent of wages earned have been saved. Included in savings shall be evidences of old notes or bills paid, and clothing bought for personal use.

Swine—Cost of Production. Take over the management of the swine herd, keep farrowing records, earmark litters if possible (extra credit for doing so), keep accurate labor, feed, and financial records, and submit the same monthly. Final report is also required.

Swine—Ton Litter. For those who are enrolled in the Swine 4-H Club Project, produce a ton litter, if possible, from one sow. Must be kept separate from other hogs. Keep labor, feed, and financial records, and submit same as called for.

Swine Sanitation. Take over the management of the entire herd. Keep farrowing records. Pigs are to be raised on clean and sanitary ground, on which pigs have not been grown the previous year. The McLean System, or a modification of it, is expected to be carried out. Keep labor, feed, and financial records and submit same monthly. Sow testing may also be carried on with this for extra credit.

Sheep Management. Take over the management of the flock. Ownership by student is desirable. Lambs should be creep fed for at least a month. Student should dock and castrate lambs and treat for stomach worms, and if necessary, dip sheep. Keep labor, feed, and financial records, and submit same as called for.

Dairy Herd Management. Student assumes care of dairy herd on his home farm for at least six months, making regular reports in regard to feeding and management and keeping accurate accounts of milk production, butterfat test, feed consumed, etc.

Horse Management. Take over the management of the horses on the farm. Not less than four horses. Keep records of work done by horses, feeds fed, time spent in caring for horses, and submit records monthly. Final report, including summary of financial and labor records.

Beef. Intended for boys in the 4-H Beef Club Project. Fatten a baby beef and keep accurate feed and labor records of the same. Submit records as called for by supervisor. Extra credit given to students who reach Junior Livestock Show with their beef animal.

Incubation and Brooding. Course in poultry work required as prerequisite. In this project 100 or more chicks, or 50 poults, are brooded, fed, and raised by the student. Poultry must be kept on clean ground or screen,

- up to 12 weeks of age. A definite ration is fed throughout the project, and accurate feed and labor records are kept.
- Beekeeping.** In this project the student takes charge of an apiary of not less than ten hives. Care and management of the bees and production records are included as a part of the project.
- Fruit Growing.** Management of the home orchard for one season. The work will consist of pruning, cultivation, spraying, harvesting, and preparing the orchard for winter. Cost records are kept.
- Home Beautification.** Planning and planting foundation shrubs and plants around the farm home and other buildings, caring for the same during the growing season, and preparing for winter. The student makes a planting plan which is approved before the work is undertaken. At least one farm building must be completely planned for and planted.
- Tractor Operation.** A study of the management and operation of the tractor on the home farm, including cost of fuel and oil, repairs, etc., and complete records of work done.
- Farm Woodwork.** Make five small articles, or two larger ones, selected from list prepared by supervisor, or build one small farm building. Keep farm tools in good condition. Submit records during the summer and a final report before August 1.
- Potato.** Grow one-half acre or more of a standard variety to be compared with one-half acre or more of one of the new varieties of potatoes developed by the University of Minnesota, such as the Warba and Katahdin. If possible, select and show peck sample of potatoes at county fair. Keep cost of production and labor records, and submit reports as called for.
- Garden.** Grow a garden of at least 5,000 square feet. Prepare a garden plan and submit it to the project supervisor. Keep yield, labor, and financial record and submit reports as called for.
- Corn—Varietal Comparison.** Plant at least one half an acre of one of the improved hybrids of the University of Minnesota, alongside at least a similar amount of local farm variety. Record of labor and costs required, and reports to be submitted as called for by supervisor. Yields to be checked by county agent. Make application through your county agricultural agent for 5 pounds of seed for this project.
- Corn—Cost of Production.** Consists of keeping accurate costs of production record on at least ten acres of corn. The student should choose one field of ten acres or more in size and keep the records of all cash and labor items which go into producing the corn. Ownership desirable. Three reports throughout the summer, and a final summary report required from all students.
- Crops—Varietal Comparison.** In this project students will make a comparative yield trial of a standard recommended variety of grain with a farm variety. At least one acre or more to be grown alongside an equal amount of their home variety and wherever possible the two varieties cut and threshed separately for determining yields. Square yard samples to be taken by student for yield check. Prerequisite: Cereal Crops course.
- Weeds I.** Involves a study of the most noxious weeds on the home farm. Students registered for this project are required to identify and describe

at least twenty-four different kinds and make a weed seed and plant collection of same.

Weeds II. Make a collection of forty-eight noxious weed seeds, together with the plants. If the student has already received credit for Weeds I project, the weed case from it must be submitted with the two required for this.

Weeds III. Select a patch of ground infested with quack grass or some other noxious weed. Practice cultural methods to eradicate the same; keep a financial and labor record and submit reports as called for during the summer.

Farm Improvement. Plan a comprehensive program of farm repair, improvement, and beautification work, such as fencing and building repairs, painting buildings, cutting and killing weeds, cleaning out orchard and woodlot, rearranging or repairing smaller outbuildings, etc. Submit plan to supervisor at beginning of the project. Keep labor and cash record and submit reports as called for by supervisor.

4-H Club Leadership. Must be a junior leader of a standard 4-H Club; must take part in county, state, or interstate events through an exhibit or as a member of a demonstration or judging team, must submit a report of all work done on the regular 4-H Club Work Leadership Report Blank, and in addition a report of regular 4-H Club project carried.

Community Club or Church Leadership. The student will submit the annual program of work and meetings, as outlined by the officer and committee of the organization. Record shall be made of the part the student had in this program. Wherever possible, the student shall help with all regular meetings and help plan and participate in any special events, such as local or county picnics or other activities sponsored by the organization. This report shall be supplemented by a scrapbook, including newspaper and poster advertising, snapshots, and any other illustrative material which will better picture the student's work in the organization.

Alumni Relationships. Secure a list of all alumni and former students of W.C.S.A., living within a reasonable radius of one's home territory, contact them by letter or in person, arrange an Aggie-Alumni reunion, prepare publicity, send in three news items for *Projector*, and promote alumni relationships in every way possible. Reports required.

HOME ECONOMICS PROJECTS

Canning Fruits and Vegetables. The student will can not less than twelve quarts of vegetables, including two or more kinds, and not less than twelve quarts of fruit, including two or more kinds, and not less than six glasses of jelly. Records of methods, time, and costs are made a part of this project. 2 credits.

Baking. Includes the baking of not less than eight bakings of yeast bread and rolls, and the baking of quick breads until a standard product is obtained with a record of time, costs, and materials. 2 credits.

- Foods and Cookery.** Includes the preparing of salads, salad dressing, cakes, pies, cookies, puddings, and other simple desserts. Each product is made and scored at least three times. 2 credits.
- Home Management.** Includes the planning and preparation of all meals in the home for a period of two weeks. 2 or 3 credits.
- Garment Making.** Making a dress for self or for another member of the family. A record is to be kept of the time and cost. Credit will be given according to garment made and material used. 1 to 3 credits.
- Clothing Repair.** Not less than 15 articles of clothing and household linen are to be repaired. A record is kept of time and expenses, and money saved. 1 or 2 credits.
- Laundering.** This project includes doing the family laundering for four weeks, dry cleaning, stain removal, etc. 1 or 2 credits.
- Children's Clothing.** Consists of making a layette for a baby, or two suits or dresses for a small child. 2 credits.
- Make-Over.** In consultation with instructor the student will arrange to make over some garment before leaving school. After the work is completed, it is to be approved by the instructor before credit is given. 2 credits.
- Home Furnishing.** Includes the redecorating of a room, including walls, woodwork, and furniture, making of curtains, etc. 2 or 3 credits.
- Working Out.** In this project, with the approval of her employer, the girl keeps a careful and complete record of her daily tasks. 2 to 4 credits.
- Personal Accounts.** Records are kept of personal expenses for a period of six months. Bank book or other evidence of saving should indicate that at least 50 per cent of earnings have been saved. Payment of old bills and notes and clothing bought shall be included as savings. Credit will be based on merit of record submitted.

SIXTEENTH ANNUAL
Short Course for Veterinarians
and Thirty-Ninth Semi-Annual Meeting
of the
Minnesota State Veterinary Medical Society
June 29 and 30, 1938



Representative Minnesotans

University Farm, St. Paul, Minn.

Vol. XLI

No. 34

June 10 1938

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W. C. COFFEY, M.S., LL.D., Dean and Director, Department of Agriculture
C. P. FITCH, D.V.M., D.Sc., Chief, Division of Veterinary Medicine, and Professor of Animal Pathology and Bacteriology

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THIS year as usual, the semi-annual meeting of the Minnesota State Veterinary Medical Society will be held at University Farm in connection with a University Short Course for Veterinarians. This has proved to be a very satisfactory arrangement. As usual, the clinical subjects will be stressed. The last day will be devoted almost entirely to the clinic. This part of the program has become very popular, and the veterinary profession of Minnesota believes that it is valuable.

Because of repairs being made in our dining hall, it will be impossible to serve dinner for the group. The cafeteria will be open as usual and all meals will be served there. Because of this we are planning an evening session, at which Dean Coffey will speak. His experience and knowledge of agricultural conditions, especially as affected by the federal action programs, will make a very interesting subject for discussion. Veterinarians should be informed of the details of the changed conditions, which so vitally affect agriculture.



Active for the Benefit of the Minnesota Farmer

Following Dean Coffey's talk, equine encephalomyelitis and rabies, two diseases of great interest to Minnesota veterinarians, will be discussed.

The business meeting of the Minnesota State Veterinary Medical Society will conclude the Wednesday evening session. A number of very important matters will come up at this time.

The ladies will be entertained.

SHOW THIS PROGRAM TO YOUR WIFE

PROGRAM

Meetings will be held in Room 102, Veterinary Building

WEDNESDAY, JUNE 29

Morning

DR. B. A. POMEROY, President of the Minnesota State Veterinary Medical Society, presiding

10:30 "Studies and Observations on Hog Cholera,"
DR. H. C. H. KERNKAMP, Associate Professor
of Veterinary Medicine, University Farm, St.
Paul

"Results of Recent Studies on Infertility,"
DR. W. L. BOYD, Professor of Veterinary
Medicine, University Farm, St. Paul

Afternoon

PRESIDENT B. A. POMEROY, presiding

1:30 "Common Ailments of Swine," DR. E. A.
DOWNS, Practitioner, Mount Sterling, Ohio

2:30 "Problems in Cattle Practice," DR. M. G.
FINCHER, Department of Medicine and Ob-
stetrics, New York State Veterinary College,
Ithaca, New York

3:30 "Some Important Diseases of Small Animals,"
DR. F. F. PARKER, Practitioner, Des Moines,
Iowa

Supper will be served in the cafeteria.

Evening

Room 102, Veterinary Building

PRESIDENT B. A. POMEROY, presiding

Address, MR. W. C. COFFEY, Dean and Director, Department of Agriculture, University of Minnesota, St. Paul, Minn.

"Equine Encephalomyelitis and Rabies as Problems in Minnesota." DR. C. E. COTTON, Secretary and Executive Officer of the Minnesota State Live Stock Sanitary Board, St. Paul, Minn.

Discussion opened by DR. F. M. WILSON, Mechanicsville, Iowa, and DR. F. F. PARKER, Des Moines, Iowa

Meeting of the Minnesota State Veterinary Medical Society



"Lest We Forget"

The late Dr. C. S. Shore, Lake City, Minn., and the late Dr. H. E. Bemis, University of Pennsylvania, Philadelphia, Pa.



Are You Here?

THURSDAY, JUNE 30

Morning

PRESIDENT B. A. POMEROY, presiding

8:30 "Poultry Diseases from the Standpoint of the Practitioner," DR. C. D. LEE, Veterinary Research Institute, Iowa State College, Ames, Iowa

9:30 "Indigestion in the Equine With Especial Reference to the Newer Methods of Treatment," DR. F. M. WILSON, Practitioner, Mechanicsville, Iowa

The general clinic will follow.

General Director—DR. WILLARD L. BOYD

Poultry—DR. CHESTER D. LEE

Canine—DR. FOSTER F. PARKER

Porcine—DR. E. AARON DOWNS

Equine—DR. FRANK M. WILSON

Bovine—DR. MYRON G. FINCHER

ENTERTAINMENT FOR THE LADIES

The ladies are requested to register at the main desk in the Veterinary Building as soon as they arrive. The Ladies' Auxiliary voted last year not to meet on the afternoon of the first day. The first meeting therefore will be held Wednesday evening. Mrs. W. A. Billings, of Minneapolis, is chairman of the committee arranging the entertainment for the ladies. Details will be announced at the time you register.



**We Are Still Working for
Minnesota Agriculture**

The Nursery School and The Kindergarten

1938-40



Institute of Child Welfare
University of Minnesota



Playing House in the Nursery School Yard



Finger Games Provide Quiet Play

The Institute of Child Welfare

The Institute of Child Welfare was organized at the University of Minnesota in July, 1925 for the purpose of making scientific studies of the development of the child, training future workers in the field of child welfare, and bringing to parents, through an extension organization, the information accumulated in its own and other research centers. The institute is organized as a separate division of the University, co-operating with the schools and colleges and departments of the University that are carrying on work related to its own. These departments are: Anatomy, Dentistry, Education, Home Economics, Nervous and Mental Diseases, Pediatrics, Physical Education, Physiological Chemistry, Psychology, Public Health Nursing, Sociology, and Speech. The institute also co-operates with the State Board of Health and with the General Extension Division and the Agricultural Extension Division of the University.



The Indoor Sandbox



In the Swing

ing the first term of the Summer Session—from the middle of June to the end of July. Children may be entered in either nursery school or kindergarten in September or in February for the regular school-year sessions of about nineteen weeks each, or in June for the Summer Session of about six weeks.

The schools are conducted on the semester basis so that the time of promotion from the kindergarten to the first grade will conform with the elementary school schedule. Both the nursery school and the kindergarten accept children for full day (8:45 a.m. to 3:45 p.m.), for half day with dinner (8:45 a.m. to 1 p.m.), or for half day without dinner (8:45 to 11:45 a.m.).

General Information

The institute maintains a nursery school for children aged two, three, or four years, and a kindergarten for five-year-olds. Both schools are in session from Mondays to Fridays inclusive during the academic year, with the Christmas and spring vacations at the same periods as those of the University. The two schools are open also dur-



At the Piano

In general, children will be accepted in order of application. All children are expected to be vaccinated for smallpox and immunized against diphtheria before they are admitted to either school. Children cannot be accepted who need a special diet or who, because of recent illness, are so frail that they require constant attention. Before an application for admission will be considered, the child should report to the institute for a physical examination, which will be given by a staff physician. Children for whom admission is asked will also be given a mental test. None who are greatly retarded in mental development can be accepted.

Both schools aim to keep the children in the best possible physical condition and to protect the entire group. Each child is given at least one complete physical examination during the school year, and parents are informed if any undesirable condition is found. In addition to this



The Ever Popular Teeter-Totter



The Playground Is Protected by a Fence



Boxes Stimulate Large Muscle Play



Jungle-Gym

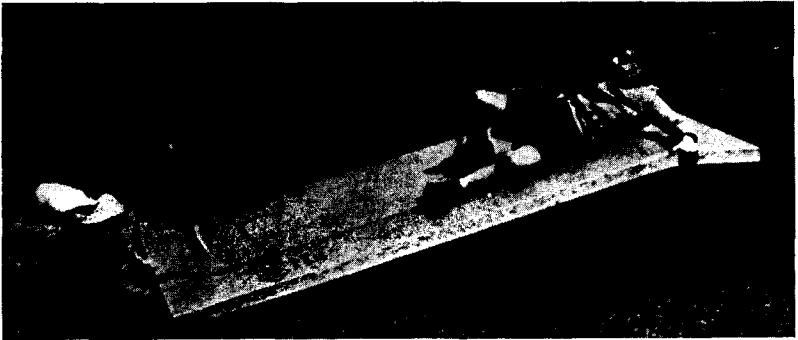
complete examination, each youngster is inspected by a trained nurse every morning on his arrival at school, and any child who shows signs of having a fresh cold or a communicable disease is promptly sent home.

Once or twice each year parents of children attending the nursery school may be asked to fill out a record blank giving details about the child's home life. Re-

ports on the progress of nursery school children are sent to parents every eight weeks, and to parents of kindergarten children twice during the school year. Parents may



The Wading Pool—Fresh Air and Sunshine



A Modern "Cellar Door"

consult members of the institute staff about their children, or may visit the nursery school or kindergarten, at any time they wish.

Fees for Nursery School and Kindergarten

Fees for a semester in the nursery school, payable in advance, are as follows:

Full day, including orange juice and cod-liver oil in the morning, dinner at noon, and milk and crackers in the afternoon	\$60.00
Half day, including orange juice and cod-liver oil and dinner	48.00
Half day, including orange juice and cod-liver oil, no dinner	30.00

Fees for a semester in the kindergarten, payable in advance, are as follows:

Full day, including dinner, nap, and afternoon play	50.00
Half day, including dinner	38.00
Half day, no dinner	20.00

Transportation can be furnished for children living in southeast Minneapolis at an additional \$15 a semester if this is requested by a sufficient number of parents.

Fees for the Summer Session are given on page 24.



An Interested Kindergarten Group

Staff of the Nursery School and the Kindergarten

John E. Anderson, Ph.D.	Director, Institute of Child Welfare
Josephine C. Foster, Ph.D.	Principal and Professor
Edith Boyd, M.D.	Medical Adviser and Assistant Professor
Marion Mattson, Ph.D.	Head Teacher in the Nursery School
Neith E. Headley, M.A.	Head Teacher in the Kindergarten
Naomi Briggs, B.S.	Teacher in the Kindergarten
Leone M. Parkinson, B.S.	Teacher in the Nursery School
Amy Peterson, B.S.	Teacher in the Nursery School
Mabel M. Sampson, B.S.	Teacher in the Nursery School
Ruth M. Morrison, R.N.	Nurse
Joseph T. Cohen, D.D.S.	Dental Research Worker
Katherine Maurer, M.A.	Psychometrist
Lorraine Johnson, B.S.	Dietitian and Cook
Donovan Lawrence	Technical Assistant
Kathryn Bloom	Clerk-Stenographer

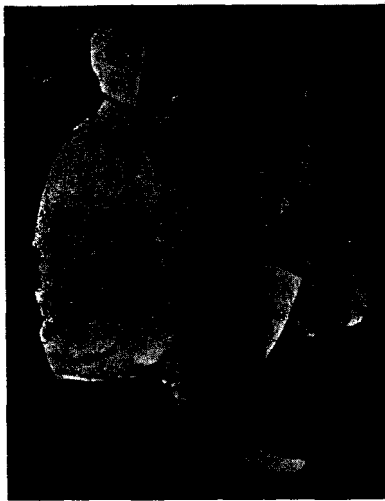
In addition, the members of the research staff and the parent education staff of the institute co-operate with the nursery school and the kindergarten and are available for special services.

The Nursery School

Step into the nursery school and you enter a little wonderland—a child's own world. No matter how much care is exercised to adapt the home to a child's needs, it remains primarily an adult home. But in the nursery school everything is child size. Chairs and tables are of playhouse dimensions. Washbowls and toilets are small, and so arranged that children can use them without trouble. For each youngster's wraps a little locker is provided. With such attractive aids, even the youngest soon learns to take off and put on his outdoor clothes and to attend to washing and toilet



A Mental Test



Inspection by the Nurse

needs with little or no adult help.

Bright pictures decorate the walls, there is a piano, a good supply of books, and cupboards filled with play equipment. Since it is desirable that children of nursery school age should have experiences with numerous kinds of materials, the school provides blocks of many shapes and sizes, dolls and doll furniture, trains, pegboards, beads,

paper and crayons, paint, sand, clay, wagons, wheelbarrows, kiddy kars, and a Jungle-Gym. All of this equipment is very strongly made, so that it is unnecessary to keep cautioning the children to "be careful" while they are playing.

The big outdoor playground, where, in suitable weather, long, sunny hours are spent, is well protected by a high fence, making it safe from traffic, and inaccessible to older children.

(The kindergarten has a separate playground of its own.) Slides, swings, and rocking boats, a sandbox, a wading pool, and other delightful outdoor equipment make the nursery school yard an attractive place where the children can enjoy themselves in the fresh air and sunshine.



Practice in Self-Help



A Young Artist

Program

There is plenty of variation in every day's activities, but also a definite routine that aids in the formation of good habits. Children arrive in the morning between 8:45 and 9:15. Each child is inspected by the school nurse

before he is allowed to mingle with the others, and those showing any signs of illness or of colds are sent home at once. Play is, of course, the main concern of the young child, and he enjoys both supervised and "free" play at the nursery school. During the day, toilet periods are observed at regular intervals, and rest periods and quiet activities are interspersed with more strenuous indoor and outdoor games, so that the child does not become overtired or too excited. When nap time comes, all playthings are put away, windows darkened, and absolute quiet maintained while the children sleep. There is a quarter-hour rest period just before the midday dinner, which is served at 11:45. After dinner the younger children have a nap, while the older ones play outdoors for a while before they sleep. After naps all the children enjoy another play hour, outdoors or indoors, depending on the weather.



Self-Service in the Nursery School

The meals are carefully planned and prepared by a dietitian, and the teachers lunch with the children in sociable little groups at the small tables. Orange juice and cod-liver oil are served in the middle of the morning, and crackers and milk just before school closes in the afternoon.

For short periods during each day, children of similar ages are brought together in small groups for music, stories, and conversation with a teacher. Two-year-olds are kept by



Washing



Play Period in the Nursery School

themselves for a good part of the day, so that they will not be 'bossed' or interfered with by the older children. At other times all the children play together, since the younger ones may learn much from watching and following their older companions, and the older children receive good social training by learning to understand and help the smaller ones.

A Few Words to Parents

The nursery school is conducted on the idea of giving the children the happiness of a day filled with many interesting things to do plus encouragement in self-help, in desirable eating, resting, and toilet habits, and in social adjustment. The school is able to provide equipment beyond the possibilities of the average home, playmates



Rhythm Play with Flags and Drums

more numerous and varied than a child could find in most neighborhoods, and teachers who have specialized in the care and education of young children. While it does not pretend to be a substitute for the home, the nursery school can and does supplement it. Parents are cordially invited to visit the school or consult with the staff at any time.

In the interests of all the children, we ask that a child be kept at home when he

1. Shows evidence of a fresh cold (sore throat, running nose, cough, frequent sneezing, etc.)
2. Has sore or discharging eyes
3. Has discharging ears
4. Has a rash
5. Has a temperature of over 99° by mouth or over 100° by rectum
6. Has had an upset stomach within the last twenty-four hours
7. Has been exposed to any contagious disease such as whooping cough, measles, mumps, or chicken pox.



Good Eating Habits Are Taught at Lunch



On the Slide

Clothing worn by the children should be roomy enough to prevent binding or restriction of movement, provided with simple fastenings, and not easily torn or mussed or so dainty that a boy or girl cannot sit on the floor. Winter clothing should be warm but light in weight, and during the coldest weather it is desirable to have the children's knees covered.

Each child is asked to keep a sweater at school. Heat in the rooms is kept as uniform as possible, but once in a while some child will feel chilly. The sweaters are also used on cold or stormy days when, instead of going outdoors, the children enjoy active play in a room with windows wide open.



Interpretations of Music

If a child is not fully trained in toilet habits before he starts school, please send an extra suit of clothing with him. This will be kept in his locker to be put on when a change is needed, and the soiled clothes sent home at night with him. All the children's clothing, including shoes, rubbers, galoshes, mittens, sweaters, caps, handkerchiefs, and underwear should be marked with his name. If marked handkerchiefs are lost they will be returned to the child after laundering, but the school cannot be responsible for unmarked articles.

Children are permitted to bring toys from home when they wish, but it is necessary to make the following exceptions, for obvious reasons:

Any very valuable or very fragile toy

Toys meant to be put in the mouth, such as horns, clay pipes, mouth organs

Food, gum, candy, nuts.



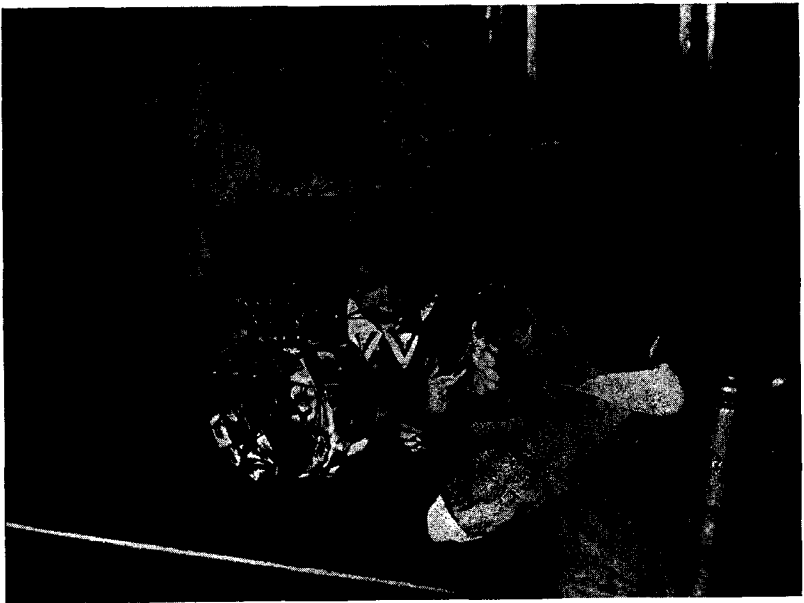
The Conversation Period in the Nursery School

The Kindergarten

The kindergarten of the Institute of Child Welfare was established in 1928. For seven years, two sessions were held each day, one in the morning and the other in the afternoon. In 1935 a full-day program, including luncheon, was introduced. Under the present arrangements, the kindergarten meets each day, Monday through Friday, from 8:30 in the morning until 3:45 in the afternoon. Lunch is served at twelve o'clock. Children may attend for a full day, for a half day with lunch (leaving at 1:00 p.m.), or for a half day without lunch (leaving at 11:45 a.m.).

Aims

It is the aim of the kindergarten to help each child to make the most of his ever increasing powers and abilities.



Nature Study Is Fascinating at Kindergarten Age

Since the maximum number of children enrolled is twenty-five, the teachers are able to give a great amount of individual attention to each child. The kindergarten also provides a wholesome social atmosphere in which the child learns to adjust himself and to make his special contributions to his group. Not only does the kindergarten prepare a child generally for the adventure of meeting the varied situations of life, but it



Finishing "Dobbin"

also bridges the gap between home and the first grade by giving him a carefully planned background for the specific subject-matter of grade school.



The Book Corner



Tree Climbing

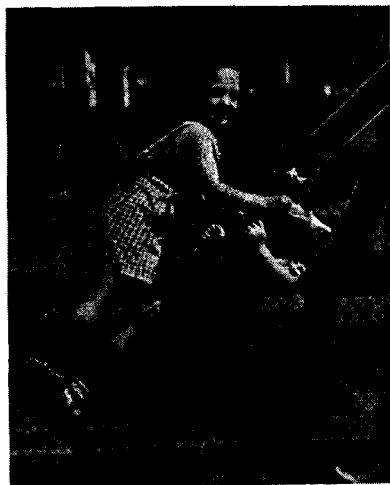
along one side. Thus teachers can have every child in view all the time, yet children on the balcony have the feeling of being by themselves. On the balcony is a library, equipped with small tables, comfortable chairs, and a small studio couch. Here the children spend many pleasant hours. In addition to the daily story period, much leisure time is occupied with books. Each year from the many good new books for children that are published, a number are carefully selected and added to the kindergarten library.

A Jungle-Gym, a climbing tree, swings, turning bars, a teeter-totter, and a set of stile steps provide for healthful large-muscle exercise. In addition to these

Equipment

Like the nursery school, the kindergarten was designed and furnished especially for children. It consists of a large room, bright and cheerful, well lighted and spacious, with a separate entrance for the children. Individual lockers are provided for wraps, treasures, and uncompleted pieces of work.

Instead of a second room there is a wide balcony all



Team Work

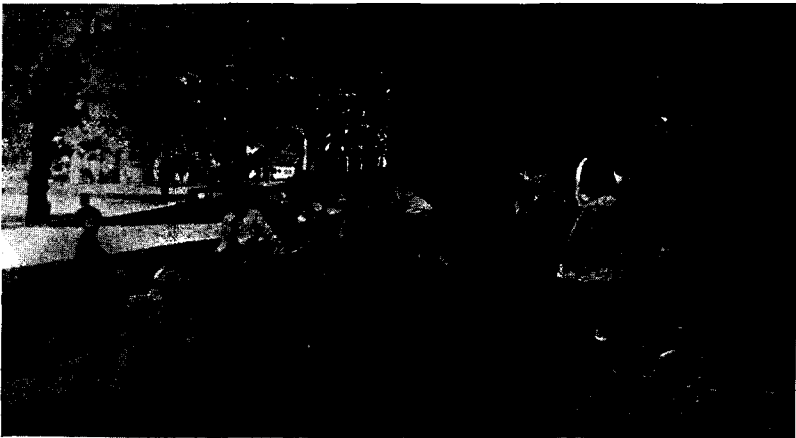
the school has a manual training bench, wood of various sorts, tools, clay, plasticine, paint, crayons, paper, cloth, sand, and three large sets of different kinds of building blocks.

Occasionally live animals, such as chickens, ducks, turtles, squirrels, and white rats are kept at the school. Much attention is given to helping the children become alert to the wonders of nature that are everywhere about. Thus their curiosity is stimulated and their knowledge enriched. The location of the kindergarten on the University campus gives them many valuable opportunities for observation and learning that they might otherwise miss.

Program

Altho a routine of activities is usually followed, the program of the kindergarten is extremely flexible. It varies with the weather and with the needs and interests of the children.

The general morning program includes free play, a discussion period, a work period, library and story period, a pause for a mid-morning lunch of fruit juice, then conversation, rhythms, songs, games, and a rest before



In the Kindergarten Yard

lunch. During the afternoon there is outdoor play, rest or sleep on cots for one hour, a lunch of milk and crackers, followed by games or a story, and play or excursions outdoors when the weather is suitable. On fine, sunny days, the whole school practically moves outdoors.

The yard of the kindergarten is a grassy slope with trees, a sandbox, and space for a garden. Many a half hour is spent in healthful play in the swings, in sliding or rolling down hill, or in digging and planting the garden.

Visitors to the kindergarten may find the children building a post office with large wooden blocks, making furniture with hammer and saw, painting at the easel, drawing on the table or floor, playing house, interpreting



Relaxation between Work and Play

music, singing at the piano, or breathlessly listening to a story. Activities are numerous and materials for work and play are many and varied—all selected by experts with a child's best development in mind. Few finished toys are provided, since children enjoy making their own, and this sort of work is always encouraged for its high educational value. There is a stock room of materials not

usually thought of as kindergarten equipment—wooden boxes, cartons, casters, bolts, burrs, rope, tin, wheels, etc., which all lend themselves to constructive activities. The children have shown much pleasure and ingenuity in making toys out of these articles.

When, for instance, they became interested in street-cars, they built a streetcar and a track, with all details, even down to the push buttons and the motorman's cap, made by themselves. Instead of giving them ready-made toy animals to play "barnyard," the teachers encouraged them to make their own. A horse, crude but recognizable, was manufactured out of a log of wood, and a troop of chickens, ducks, dogs, and other creatures followed—all constructed by the children out of the odds and ends provided.

Summer Term

Both the nursery school and the kindergarten are open for half days during the first term of the University



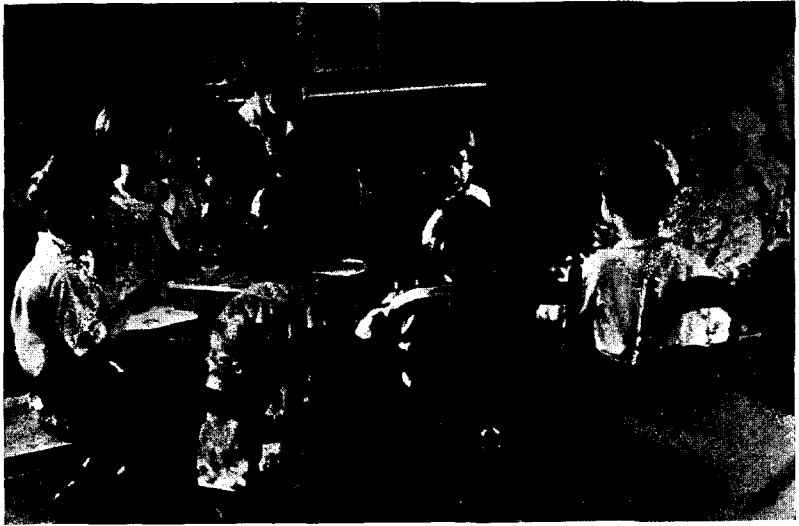
Co-operation in the Kindergarten

Summer Session, lasting about six weeks. Fees for attendance during this session are as follows:

Nursery school, half day including lunch	\$20.00
Nursery school, half day without lunch, but including orange juice	15.00
Kindergarten, half day including lunch	15.00
Kindergarten, half day without lunch	10.00

Transportation can be furnished children living in southeast Minneapolis at an additional cost of \$8 for the term if requested by a sufficient number of parents.

A special announcement of the summer program of the institute will be sent to anyone interested.



Orange Juice Provides Social Contacts

The Bulletin
of the University of
Minnesota

The Graduate School
Announcement of Graduate Work in
Dentistry
1938-1939



Vol. XLI No. 36 June 15 1938

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GRADUATE WORK IN DENTISTRY

The graduate work in dentistry is a part of the Graduate School of the University. This bulletin is issued as a supplement to the regular Bulletin of the Graduate School which contains announcements of graduate work in dentistry, medicine, and public health in the Medical School and the Mayo Foundation.

Inquiries may be addressed to the dean of the Graduate School.

GENERAL INFORMATION

The graduate work in dentistry here outlined is not intended for those seeking brief practitioners' or refresher courses. Opportunities of this kind are offered and special announcement of them is made in the Bulletin of the School of Dentistry.

Graduate work for a limited number of properly prepared students is offered in certain fields of dental research and dental specialties. The work is under the direction of a joint committee in dentistry and medicine in the Graduate School. All graduate students are admitted by the dean of the Graduate School. Candidates for admission must be graduates of an acceptable dental school with at least two years of preliminary general college work. They must also present or acquire sufficient training in the basic sciences, such as bacteriology, anatomy, pathology, physiology, and physiologic chemistry, to enable them to apply these disciplines to research on some of the problems facing dentistry as one of the health sciences. The minimum training to meet this requirement at the University of Minnesota is in general the equivalent of that required of graduate students in the fields of clinical medicine. The basic science courses necessary as a foundation for advanced study are outlined under the departmental offerings in the Bulletin of the Graduate School. Altho a reading knowledge of German is recommended as highly desirable, candidates for the Master's degree in dentistry are exempted from the foreign language requirement. Qualified students who give full time to their studies and absolve the requirements, including a satisfactory thesis, will normally require three years for the degree of master of science in dentistry.

The specific problems which are being offered are in the field of *oral pathology, orthodontia, oral surgery, and restorative dentistry*. In the field of oral pathology research in dental caries,

periodontal tissue pathology, and orthodontia is offered. It is expected that the student will devote approximately one third of his time to the pursuit of such basic science courses as are essential to carrying on laboratory and clinical investigation in the several fields of research, and approximately two thirds of his time will be allotted to clinical studies, fundamental research, and the thesis. A review of literature covering research in the field chosen by the graduate student will also be required. Close co-operation between medicine and dentistry is maintained and students are offered the facilities in the Medical School of the basic science courses relative to the problems studied. Hospitalization facilities for problem patients are also available.

Thesis.—Each candidate for the Master's degree must submit a thesis and the subject should be filed with the dean of the Graduate School six months prior to candidacy. The subject must be approved by the adviser and by the Medical Graduate Committee. The topic should be within the field of the major, and the thesis should represent approximately half of a year's work by the student.

The Master's thesis must be typewritten in quadruplicate, two copies on a special form of linen stock, the other two as carbon copies. Samples of the paper required should be examined in the dean's office. The four copies of the thesis must be filed in the dean's office not later than four weeks before graduation. The thesis will be examined by a committee appointed by the dean on recommendation of the Medical Graduate Committee.

Final written examination.—In addition to the usual course examinations in all subjects where such are given, the candidate for the Master's degree must pass a final written examination in the field of the major. (No *special* final examination is required in the minor.) The final written examination will be held not later than two weeks before commencement. It is given by the members of the graduate faculty in the major department, the adviser acting as chairman. This examination shall cover all the work done in the major, and may include any work fundamental thereto.

Final oral examination.—If all other requirements for the degree have been met, including the final written examination and the acceptance of the thesis, the final oral examination will be held not less than two weeks before commencement.

Fellowships.—A limited number of post-doctorate fellowships for graduate work in dentistry is offered at the University of Minnesota. Under a grant from the Carnegie Corporation, intended to support research in graduate work in dentistry, two fellowships which carry remuneration of \$1,500 per annum have been made available. Other fellowships are available through the Mayo Foundation and other possible sources at the University. All appointments are made for one year and may be renewed annually for three years upon basis of satisfactory progress in the work pursued. Requests for blanks for application for fellowships should be addressed to the dean of the Graduate School, University of Minnesota.

Courses offered in the Mayo Foundation.—The section on dental surgery offers an opportunity for a small number of those students who are graduates of Class A dental colleges, who are interested in dental diagnosis and exodontia.

Laboratory facilities are available for work in dental radiography, bacteriology, and pathology.

Recommendations for fellowships in dentistry are made by the Medical Graduate Committee to the Board of Regents for periods of three years. There is opportunity for a limited number of special students in dentistry in the Mayo Foundation for periods of two years. Arrangements may be made for fellows in the Mayo Foundation to take part of their work at the School of Dentistry, University of Minnesota.

Dental fellows may qualify for the degree of master of science in dentistry upon completion of requirements as indicated for advanced degrees in other clinical fields. For further information, refer to the Bulletin of the Graduate School, Announcement of Graduate Work in Dentistry, Medicine, and Public Health in the Medical School and the Mayo Foundation, 1937-1939.

Tuition.—The tuition fee for the graduate work in dentistry for those not holders of fellowships or otherwise entitled to exemption is \$75 per quarter for residents of Minnesota and \$125 per quarter for nonresidents. For students in the fundamental laboratory branches, the tuition fee is \$20 per quarter for residents of Minnesota and \$40 per quarter for nonresidents. Extra fees may be charged to cover the cost of materials and supplies for exceptional laboratory experimentation. The special fees for graduate work in the Summer Session are stated in the separate Sum-

mer Session Bulletin. Fellows, scholars, and members of the teaching or scientific staff are exempt from tuition, except in the Summer Session.

FIELDS FOR RESEARCH

DENTAL CARIES

A wide range of clinical material offering special problems in research on dental caries is available in the clinic of the School of Dentistry and in the Department of Pediatrics. Patients are also brought to the Dental Research Clinic by private practitioners for consultations and treatment. Under the guidance of staff members in the Department of Pediatrics dental research fellows are afforded a unique opportunity to familiarize themselves with the fundamental data pertaining to the general health of children presenting special dental problems. A limited number of patients presenting special metabolic problems can be admitted to the hospital for more elaborate investigation. Students are required to carry out original research on fundamental problems pertaining to dental caries. Adequate laboratory facilities are available in close proximity to the clinic. All original research work of fellows in dental research both in the clinic and in the laboratory is carried out under the supervision of competent investigators. Dr. Brekhus, Dr. McQuarrie, Dr. Armstrong, and staffs. (See Courses 204f, 205w, 206s, Oral Pathology, in the Bulletin of the Graduate School, Announcement of Graduate Work in Dentistry, Medicine, and Public Health in the Medical School and the Mayo Foundation, 1937-1939.)

ORTHODONTIA

A study of the growth and development of the structures of the oral cavity and their relationship to adjacent structures. Problems of biological, anatomical, and functional relationships partially dealt with by mechanics. Physical properties of mechanical appliances. Clinical material in abundance presenting

1. Malposition of individual teeth
2. Maldevelopment of arch form
3. Malposition of maxilla to skull
4. Malrelationship of dental arches to each other
5. Malocclusion of one or more teeth
6. Maldevelopment of the maxilla or the mandible, or both

Congenital conditions resulting in maxillary cleft and other deformities of prenatal influence resulting in abnormalities in tooth

form, number, eruption, etc. Uninterrupted clinical relationship with pediatrics throughout the course. Complete case histories along with medical examination of each case required. Dr. Rudolph, Dr. McQuarrie, and staffs. (See Courses 207f, 208w, 209s, Oral Surgery, in the Bulletin of the Graduate School, Announcement of Graduate Work in Dentistry, Medicine, and Public Health in the Medical School and the Mayo Foundation, 1937-1939.)

PERIODONTIA

A study of the pathology of the investing tissues of the teeth relative to local and systemic irritation with special reference to reactions of bone in the oral cavity as compared with other osseous structures of the body. In the clinic of the School of Dentistry and the Outpatient Department of the University Hospitals a wide range of clinical material offering specific problems in periodontal diseases is available to graduate students. The work is under the direction of the Department of Periodontia with the assistance of teachers in the Department of Medicine. Students will be required to study the general medical physical condition of cases presenting general health problems which may be traced to pathological conditions in the oral cavity. Dr. R. E. Johnson and staff. (See Courses 213f, 214w, 215s, Periodontia, in the Bulletin of the Graduate School, Announcement of Graduate Work in Dentistry, Medicine, and Public Health in the Medical School and the Mayo Foundation, 1937-1939.)

ORAL SURGERY

A wide range of clinical material is available for the training of the graduate student in the diagnosis, surgical treatment, and post-operative care of patients suffering from injuries, infection, tumors, or abnormalities of the mouth.

The average number of post-mortems available is about 175 per month or about 2,100 per year. Graduate students take part in post-mortems, prepare post-mortem records, and make microscopic examinations of various organs and tissues. The student may attend as many post-mortems as his other work will allow.

Gross specimens, microscopic slides, and other materials are available for a complete study of special pathology of all the subject-matter included in the course, as well as facilities for research in the field in the laboratory of oral pathology in the School of Dentistry. Facilities are also available for experimental surgery and

pathology in animal surgery. Dr. Waldron and staff. (See Courses 207f, 208w, 209s, Oral Surgery, in the Bulletin of the Graduate School, Announcement of Graduate Work in Dentistry, Medicine, and Public Health in the Medical School and the Mayo Foundation, 1937-1939.)

RESTORATIVE DENTISTRY

Courses are offered to properly qualified graduate students whose major interests are centered on the problems of restorative dentistry. Facilities are available to pursue investigations in the following fields:

1. The study of the materials used in operative and crown and bridge work in restorations placed in the mouth. It may be a study of the entire group or a single material. This study should include the technic of insertion, the properties of the material, its behavior in the mouth, and its effect on tooth tissue.
2. The study of denture base materials and the reaction of tissue to them.
3. The effect of dentures on the supporting tissues including a study of changes which take place and the frequency and cause of pathology.
4. Electric reactions between dissimilar materials in the oral cavity.
5. The temporo-mandibular joint with related anatomy and the effect of closure of the bite on these.
6. A study of the chief troubles encountered by patients who have difficulty in using dentures successfully.
7. A study of such other problems as the Department of Restorative Dentistry might select.

The student will be required to carry on a continuous contact in clinical restorative dentistry, selecting for his endeavors specialized services. Dr. Flagstad and staff. (See Courses 216f, 217w, 218s, Restorative Dentistry, in the Bulletin of the Graduate School, Announcement of Graduate Work in Dentistry, Medicine, and Public Health in the Medical School and the Mayo Foundation, 1937-1939.)

DESCRIPTION OF COURSES AND OPPORTUNITIES

(For Graduate Training in the Basic Medical Sciences)

Courses in basic science subjects which are essential in carrying on laboratory investigations in the several fields of research are listed below.* The numbers in parentheses after each course listed indicate the requirements of the specific problems, which are designated as follows: dental caries, 1; orthodontia, 2; periodontia, 3; oral surgery, 4; and restorative dentistry, 5. Before registration, arrangements for the individual courses must be made with the department concerned.

ANATOMY

- 103s,su. Human Histology. Microscopic study in the various tissues and organs. Prerequisite, Course 100-101; 165 hours; 9 credits. Enrolment limited to 140 students in the spring quarter. Dr. Downey and assistants. (2,3)
- 107s. Human Embryology. Development of the human body. Prerequisite, Course 100-101; 99 hours; 6 credits. Enrolment limited to 140 students. Dr. Boyden and assistants. (2,3,5)
- 153f-154w-155s-156su. Advanced Anatomy. Individual topics for advanced work in gross anatomy, histology, embryology, or neurology will be assigned to students who have completed the elementary courses in the corresponding subjects. Special courses are arranged for clinical graduate students. Dr. Jackson, Dr. Boyden, Dr. Downey, Dr. Rasmussen, Dr. Miller, Dr. Blount. (1,2,3,4,5)

BACTERIOLOGY

- 101w. General Bacteriology. Culture media; methods of staining and identification; principles of sterilization and disinfection; examination of air, water, milk; relation of bacteriology to the industries. Prerequisites, 10 credits in chemistry and 10 credits in biology; 99 hours; 5 credits. Dr. Green, Dr. Henrici, Dr. Skinner. (1,2,3,4,5)
- 102s. Medical Bacteriology. The pathogenic bacteria, especially in relation to the definite diseases; principles of infection and immunity. Prerequisite, general bacteriology; 77 hours; 4 credits. Dr. Larson, Dr. Green. (1,2,3,4)

METALLOGRAPHY

- 153f-154w-155s. Metallography. Theory of metallic alloys. Metallographic technique. Properties of metals and alloys. Metallography of iron and

* A student who presents satisfactory credits in any of the required basic science courses may, with the consent of the adviser, be exempted from repeating these subjects.

steel and commercial alloys. Technical metallography. Laboratory work. Prerequisite, Met. E. 12 or equivalent; 4 credits per quarter. Dr. Dowdell, Dr. Forsyth. (2,5)

PATHOLOGY

- 101w. Pathology. Part I. General Pathology. Prerequisites, histology, embryology, and special bacteriology; 165 hours; 9 credits. Dr. Bell, Dr. Clawson, Dr. McCartney. (1,2,3,4)
- 104su,f,w,s. Autopsies. Dr. Bell and staff. (3,4)
- 107f,w,s. Advanced Pathology. Prerequisite, 102.
- 107f. Surgical Pathology. 33 hours; 3 credits. Dr. Bell, Dr. McCartney. (3,4)

PEDIATRICS

- 104f,w,s. Endocrinology As Applied to Pediatrics. Seminar course. Dr. McQuarrie, Dr. Thompson. (1,2)

PHYSIOLOGY

- 100f,su. Physiologic Chemistry. Application of inorganic and physical chemistry to physiology. Prerequisites, organic chemistry and physics; 99 hours; 7 credits. Dr. McClendon, Dr. Arnow, and others. (1,2,3,5)
- 101w,su. Physiologic Chemistry. Metabolism of proteins, fats, carbohydrates. Prerequisite, Course 100; 110 hours; 6 credits. Dr. McClendon, Dr. Arnow, and others. (2)
- 103f,su. Physiology of Cells, Muscle, Nerve, Blood, Circulation, Respiration, Digestion, Metabolism, Nutrition, and Excretion. Several lectures on the medical aspects of genetics are included. Prerequisites, organic chemistry and zoology; 132 hours; 9 credits. Dr. Visscher, Dr. Scott, Dr. Oliver, and others. (2,3,4)
- Physiology of Nutrition. Special course in nutrition is offered to graduate students in dentistry by the Department of Physiology. Dr. Visscher, Dr. Armstrong. (1,2,3,4,5)

PREVENTIVE MEDICINE

- 110f,s.‡ Biometric Principles. An introduction to statistical analysis with special emphasis on the basic principles of statistical reasoning as applied to the description of univariate distributions, normal correlations, goodness of fit, and simple tests of significance. Training in techniques of application with calculating machines given in laboratory. Lecture, 3 credits; laboratory, 2 credits; to be taken concurrently. Dr. Treloar. (5)

ZOOLOGY

- 83s. Genetics and Eugenics. Facts and theories of heredity and application to man. 3 credits. (1,2)

‡ A fee of \$1 per quarter is charged for this course.

ELECTIVES

The courses listed below are available as electives. In addition the above courses are offered as electives to students on whose program they are not required.

ANATOMY

- 115f,w,s. History of Anatomy. Medical bibliography is included. Lectures 22 hours; 2 credits. Dr. Miller.
- 129f-130w. Topographic Anatomy. Based upon a study of cross sections of the head. Lectures and laboratory work. Prerequisite, Course 100-101. 2 credits (or more). Dr. Jackson.
- 157s. Developmental Anatomy of the Head. Prerequisite, Course 107; 66 hours; 3 credits. Dr. Boyden. (Offered only in odd-numbered years.)
- 158s. Special Histology and Neurology of the Head Region. Prerequisites, Courses 103, 111; 66 hours; 3 credits. Dr. Rasmussen. (Offered only in even-numbered years.)

BACTERIOLOGY

- 114s. Molds, Yeasts, and Actinomycetes. Prerequisite, Course 41 or 101; 66 hours; 4 credits. Dr. Henrici.
- 116w. Immunity. Laws of hemolysis. Quantitative relationship between antigen and antibody. Wassermann reaction. Opsonins, vaccines, toxin, antitoxin, precipitin reactions, blood grouping, atopy, anaphylaxis. Prerequisite, Course 102; 66 hours; 3 credits. Dr. Larson.
- 121f-122w. Physiology of Bacteria. Effect of environment on growth. Enzymes. Food requirements. Carbohydrate, protein, and fat metabolism. Products of growth. Dormancy, death. Prerequisites, Course 41 and 8 credits in organic chemistry or biochemistry; 33 hours; 6 credits. Dr. Green, Dr. Halvorson.

HISTORY OF SCIENCE

- 190f-191w-192s. History of Science. Open to qualified graduate and Senior College students in any field of scientific or historical specialization. Conferences, reading, and occasional lectures. Consult Professor Scammon before registering. This course may count as major or minor on approval of the student's adviser in the Graduate School. Credits arranged. Dr. Scammon.

PATHOLOGY

- 102s. Pathology. Part II. Special Pathology. Prerequisites, Pathology, Part I; 165 hours; 9 credits. Dr. Bell, Dr. Clawson, Dr. McCartney.
- 107bw. Diseases of the Heart. 22 hours; 2 credits. Dr. Clawson.
- 111su,f,w,s. Conference on Autopsies. Prerequisite, Course 102. Dr. Bell and staff.

PREVENTIVE MEDICINE

- 100s. Preventive Medicine. A consideration of the environmental and biologic factors concerned in the maintenance and transmission of disease, and the possibilities of control or prevention through the efforts of the

private physician alone or in collaboration with community, state, or federal agencies. 36 hours; 3 credits. Dr. Anderson, Dr. Diehl, Dr. Myers.

106f.s. Public Health Administration—General. Promotion of hygiene through public health and community effort, maternal, infant, preschool, school, college, industrial, and adult. Lectures and field trips. 4 credits. Dr. Boynton, Dr. Ellis, and staff.

120w.‡ Correlational Analysis. Topics: total, partial, and multiple correlation and regression; correlation ratio; contingency; biserial methods; tetrachoric correlation; rank-order; the symmetrical table and intraclass correlation. Prerequisite, Course 101. 5 (or 3) credits. Dr. Treloar.

EDUCATION

Especially for those preparing for teaching in dentistry.

‡ A fee of \$1 per quarter is charged for this course.

The Bulletin
of the University of
Minnesota

Instructions for Registration of New
Advanced Standing Students
Fall Quarter, 1938



Vol. XLI

No. 37

June 16 1938

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REGISTRATION INSTRUCTIONS

NEW ADVANCED STANDING STUDENTS FALL QUARTER, 1938

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS, September 19-23:

1. Report to the Students' Health Service, University of Minnesota Hospitals, for physical examination.
2. Report to the University Armory, 17th and University Avenues, for matriculation. You will be required to present admission certificate, record of advanced standing, aptitude test card, and physical examination appointment slip. You will receive a Combined Class Schedule. Freshmen, sophomores, and unclassified will receive registration blanks. Juniors and seniors will receive registration blanks when they report for registration.
3. Report for registration:
Freshmen and Sophomores, 113 Folwell Hall.
Juniors and Seniors, 219 Folwell Hall.
Unclassified, 219 Administration Building.
4. Report to 106 Folwell Hall to have your registration blank tallied.
5. Report to a fee statement table in the University Armory to turn in your registration blank. You will be required to present your admission certificate and will receive a statement of fall quarter fees.
6. Report to Bursar's Office, Administration Building, and pay fees before 4:30 p.m. Friday, September 23. Fees may be paid by mail and should be postmarked on or before September 23 to avoid late fees. When paying by mail, enclose your fee statement (all three copies) and your check or money order for the exact amount payable to the University of Minnesota. Envelopes should be addressed to the Bursar, University of Minnesota, Minneapolis, Minn.
7. Report to classes Monday, September 26. Receipts for payments received by mail will be placed in the post-office box assigned, the number of which will be posted in the basement of the Administration Building about the third day after mailing. Students should save their fee receipts throughout the quarter and have them available to present to instructors and others upon request.

COLLEGE OF EDUCATION, September 22-23:

1. Report to the Students' Health Service, University of Minnesota Hospitals, for physical examination.
2. Report to the University Armory, 17th and University Avenues, for matriculation and to receive registration material. You will be required to present your admission certificate, record of advanced standing, and physical examination appointment slip. You will receive a registration blank, a Combined Class Schedule, and a memorandum of year's registration. Students who wish to register for directed teaching should request a directed teaching card and instructions.

3. For special help or advice either before or after arrival, consult Miss Dora V. Smith, chairman of the New Students' Committee of the College of Education, Room 206, Burton Hall. Programs of events of Freshman Week are available in her office. Attend the college convocation for new students in the auditorium of Pattee Hall at 9:30, Thursday morning, September 22.
4. Report to your major adviser for registration. Department major advisers' names and offices are listed on your major program blank and memorandum of year's registration, which you have in triplicate. All requirements for the last two years' work must be listed in appropriate columns and signed by a different major adviser in each of the three fields: your major, your minor, and education. All copies of the fall and year's program will then be signed by the adviser in your major field. After you have had your courses for the fall quarter tallied, turn in your white major program blank to Room 202 Burton Hall, your blue one to your major adviser, and keep the yellow one for reference. Your fall quarter registration blank should be turned in at the fee statement table in the Armory.
5. Report to checking desk outside 208 Burton Hall. Make an appointment to take the educational psychological examination required of all students entering the College of Education before registration is accepted. These examinations are given daily from Wednesday through Saturday of Freshman Week.
6. Report to tally desk, 106 Folwell Hall (unless registration blank was stamped tallied at checking desk.)
7. Report to fee statement table in the University Armory to turn in your registration blank. You will be asked to present your admission certificate. You will receive a statement of your fall quarter fees.
8. Report to Bursar's Office, Administration Building, and pay fees before 4:30 p.m. Friday, September 23. Fees may be paid by mail and should be postmarked on or before September 23 to avoid late fees. When paying by mail, enclose your fee statement (all three copies) and your check or money order for the exact amount payable to the University of Minnesota. Envelopes should be addressed to the Bursar, University of Minnesota, Minneapolis, Minn.
9. Report to classes Monday, September 26. Receipts for payments received by mail will be placed in the post-office box assigned, the number of which will be posted in the basement of the Administration Building about the third day after mailing. Students should save their fee receipts throughout the quarter and have them available to present to instructors and others upon request.
A passing grade in qualifying examinations is required of all students as a prerequisite to the work in the senior year in the College of Education. All registrations in student teaching, or courses involving student teaching or faculty supervision, are tentative and subject to cancellation for all students who have not received a passing mark in all four of these examinations. Watch Official Bulletin, *Minnesota Daily*, for announcement of time and place of examinations.

COLLEGE OF PHARMACY, September 22-23:

1. Report to the Students' Health Service, University of Minnesota Hospitals, for physical examination.

2. Report to the University Armory, 17th and University Avenues, for matriculation, and obtain statement of fees. You will be required to present your admission certificate, record of advanced standing, and physical examination appointment slip.
3. Report to Bursar's Office, Administration Building, and pay fees.
4. Report to 101 Pharmacy Building for registration. You will be asked to present your paid fee receipt before registering. Registration and payment of fees should be completed before 4:30 p.m. Friday, September 23, to avoid late fees.

COLLEGE OF AGRICULTURE, FORESTRY, AND HOME ECONOMICS, September 22-23:

1. Report to the Students' Health Service, University of Minnesota Hospitals, for physical examination.
2. Report to 203D Administration Building, University Farm, for registration. You will be required to present your admission certificate, record of advanced standing, aptitude test card, and physical examination appointment slip.
3. Pay fees at Cashier's Office, University Farm, before 4:30 p.m. Friday, September 23, to avoid late fees.

GENERAL COLLEGE, September 21-23:

1. Report to the Students' Health Service, University of Minnesota Hospitals, for physical examination.
2. Report to the University Armory, 17th and University Avenues, for matriculation, and obtain registration material. You will be required to present your admission certificate and physical examination appointment slip.
3. Report to 202 Wesbrook Hall for registration. Your registration blank must be approved by an adviser.
4. Report to one of the fee statement tables in the Armory to turn in your registration blank and receive a statement of your fall quarter fees. When you turn in your registration blank, you will be asked to present your admission certificate.
5. Report to Bursar's Office, Administration Building, and pay fees before 4:30 p.m. Friday, September 23. Fees may be paid by mail and should be postmarked on or before September 23 to avoid late fees. When paying by mail, enclose your fee statement (all three copies) and your check or money order for the exact amount payable to the University of Minnesota. Envelopes should be addressed to the Bursar, University of Minnesota, Minneapolis, Minn.
6. Report to classes Monday, September 26. Receipts for payments received by mail will be placed in the post-office box assigned, the number of which will be posted in the basement of the Administration Building about the third day after mailing. Students should save their fee receipts throughout the quarter and have them available to present to instructors and others upon request.

DENTAL HYGIENISTS, September 22-23:

1. Report to the Students' Health Service, University of Minnesota Hospitals, for physical examination.
2. Report to the University Armory, 17th and University Avenues, for matriculation, and to obtain statement of fees. You will be required to present your admission certificate, record of advanced standing, and physical examination appointment slip.
3. Report to Bursar's Office, Administration Building, and pay fees.
4. Report to 106 Medical Sciences Building for registration. You will be asked to present your paid fee receipt before registering. Registration and payment of fees should be completed before 4:30 p.m. Friday, September 23, to avoid late fees.

SCHOOL OF NURSING, September 22-23:

1. Report to the Students' Health Service, University of Minnesota Hospitals, for physical examination.
2. Report to the University Armory, 17th and University Avenues, for matriculation, and to obtain registration material. You will be required to present your admission certificate, record of advanced standing, aptitude test card, and physical examination appointment slip.
3. Report to 125 Medical Sciences Building for registration. Advanced standing students will turn in their approved registration at the Armory to obtain statement of fees.
4. Report to Bursar's Office, Administration Building, and pay fees before 4:30 p.m. Friday, September 23. Fees may be paid by mail and should be postmarked on or before September 23 to avoid late fees. When paying by mail, enclose your fee statement (all three copies) and your check or money order for the exact amount payable to the University of Minnesota. Envelopes should be addressed to the Bursar, University of Minnesota, Minneapolis, Minn.
5. Report to classes Monday, September 26. Receipts for payments received by mail will be placed in the post-office box assigned, the number of which will be posted in the basement of the Administration Building about the third day after mailing. Students should save their fee receipts throughout the quarter and have them available to present to instructors and others upon request.

INSTITUTE OF TECHNOLOGY, September 22-23:

1. Report to the Students' Health Service, University of Minnesota Hospitals, for physical examination.
2. Report to the University Armory, 17th and University Avenues, for matriculation, and to obtain statement of fees. You will be required to present your admission certificate, record of advanced standing, and physical examination appointment slip.
3. Report to 206 Main Engineering Building for identification photograph. Obtain receipt.

4. Report for registration. Present fee statement and receipt for photograph.

Architecture.....	318 Main Engineering Building
Engineering Curricula	101 Main Engineering Building
Chem., Chem. Eng., Physics	Library, Chemistry Building
Mines and Metallurgy.....	103 Mines Building

5. Report to Bursar's Office, Administration Building, and pay fees before 4:30 p.m. Friday, September 23. Fees may be paid by mail and should be postmarked on or before September 23 to avoid late fees. When paying by mail, enclose your fee statement (all three copies) and your check or money order for the exact amount payable to the University of Minnesota. Envelopes should be addressed to the Bursar, University of Minnesota, Minneapolis, Minn.
6. Report to classes Monday, September 26. Receipts for payments received by mail will be placed in the post-office box assigned, the number of which will be posted in the basement of the Administration Building about the third day after mailing. Students should save their fee receipts throughout the quarter and have them available to present to instructors and others upon request.

LAW, DENTISTRY, BUSINESS ADMINISTRATION, September 22-23:

1. Report to the Students' Health Service, University of Minnesota Hospitals, for physical examination.
2. Report to the University Armory, 17th and University Avenues, for matriculation, and to obtain statement of fees. Present admission certificate, record of advanced standing, and physical examination appointment slip.
3. Report to Bursar's Office, Administration Building, to pay fees.
4. Report to college office and complete registration by 4:30 p.m. Friday, September 23:

Law School.....	214 Law Building
School of Dentistry	149 Medical Sciences Building
School of Business Administration	113 Business Administration

MEDICAL SCHOOL, MEDICAL TECHNOLOGISTS, September 22-23:

1. Report to the Students' Health Service, University of Minnesota Hospitals, for physical examination.
2. Report to the University Armory, 17th and University Avenues, for matriculation, and to obtain registration material. Present admission certificate, record of advanced standing, and physical examination appointment slip.
3. Report to 136 Medical Sciences Building for registration.
4. Report to a fee statement table in the University Armory to turn in your registration blank and obtain statement of fees.
5. Report to Bursar's Office, Administration Building, and pay fees before 4:30 p.m. Friday, September 23. Fees may be paid by mail and should be postmarked on or before September 23 to avoid late fees. When paying by mail, enclose your fee statement (all three copies) and your check or money order for the exact

amount payable to the University of Minnesota. Envelopes should be addressed to the Bursar, University of Minnesota, Minneapolis, Minn.

6. Report to classes Monday, September 26. Receipts for payments received by mail will be placed in the post-office box assigned, the number of which will be posted in the basement of the Administration Building about the third day after mailing. Students should save their fee receipts throughout the quarter and have them available to present to instructors and others upon request.

UNIVERSITY COLLEGE, September 22-23:

1. Report to the Students' Health Service, University of Minnesota Hospitals, for physical examination.
2. Report to the University Armory, 17th and University Avenues, for matriculation and to obtain registration material. Present admission certificate, record of advanced standing, and physical examination appointment slip.
3. Report to 143 Physics Building for registration.
4. Report to tally desk, 106 Folwell Hall.
5. Report to Window 19, Registrar's Office, for fee statement.
6. Report to Bursar's Office, Administration Building, and pay fees before 4:30 p.m. Friday, September 23. Fees may be paid by mail and should be postmarked on or before September 23 to avoid late fees. When paying by mail, enclose your fee statement (all three copies) and your check or money order for the exact amount payable to the University of Minnesota. Envelopes should be addressed to the Bursar, University of Minnesota, Minneapolis, Minn.
7. Report to classes Monday, September 26. Receipts for payments received by mail will be placed in the post-office box assigned, the number of which will be posted in the basement of the Administration Building about the third day after mailing. Students should save their fee receipts throughout the quarter and have them available to present to instructors and others upon request.

PUBLIC HEALTH NURSING, September 21-23:

1. Report to the Students' Health Service, University of Minnesota Hospitals, for physical examination.
2. Report to the University Armory, 17th and University Avenues, for matriculation and to obtain registration material. Present admission certificate, record of advanced standing, and physical examination appointment slip.
3. Report to 121 Millard Hall for registration.
4. Report to a fee statement table in the University Armory to turn in your registration blank and obtain statement of fees.
5. Report to Bursar's Office, Administration Building, and pay fees before 4:30 p.m. Friday, September 23. Fees may be paid by mail and should be postmarked on or before September 23 to avoid late fees. When paying by mail, enclose your fee statement (all three copies) and your check or money order for the exact amount payable to the University of Minnesota. Envelopes should be addressed to the Bursar, University of Minnesota, Minneapolis, Minn.

6. Report to classes Monday, September 26. Receipts for payments received by mail will be placed in the post-office box assigned, the number of which will be posted in the basement of the Administration Building about the third day after mailing. Students should save their fee receipts throughout the quarter and have them available to present to instructors and others upon request.

READ THE FOLLOWING ITEMS CAREFULLY—THEY MAY SAVE YOU UNNECESSARY DELAY AND INCONVENIENCE.

- a. You are strongly advised to take the required tests and obtain your admission certificate before coming to the University.
If you have not written the tests, arrange to come to the University before the registration period begins, if possible, to write these tests. Appointments for the tests may be made at 310 Northrop Memorial Auditorium at any time.
- b. If you have lost your admission certificate a duplicate may be obtained at Windows 18-20, Registrar's Office, first floor, Administration Building.
- c. If you have **not** received an admission certificate, and have had your credits forwarded from the last school attended, report to the Board of Admissions, Windows 18-20, Registrar's Office, first floor, Administration Building, for an admission certificate.
- d. Test cards will not be required if your admission certificate shows the tests to have been taken.
- e. If you have **lost your aptitude test card**, a duplicate may be obtained in Room 310 Northrop Auditorium.
- f. If you need to write the college aptitude test, English placement test, and English theme (either the first two tests or all three) make appointment at 310 Northrop Auditorium to take these tests, preferably during the summer. If it is not convenient to report earlier these tests may be taken Monday, September 19, at 9:00 a.m. or 1:30 p.m. in Room 150 Physics Building.
- g. If you wish special advice before proceeding with your registration, members of the faculty will be available for consultation in the University Armory, and the Committee on Vocational Counseling will be available in Room 310 Northrop Auditorium.

PLEASE NOTE ESPECIALLY

Do not report to the Armory without the credentials referred to in the instructions. Do not report to the Registrar's Office for an admission certificate until after you have written the tests (if required) and at least 12 hours have elapsed to permit their being scored.

DURING REGISTRATION DAYS BULLETINS AND GENERAL INFORMATION MAY BE OBTAINED AT THE TICKET BOOTH. EAST ENTRANCE (17th AVENUE) ADMINISTRATION BUILDING.

If your credentials are not on file in the Registrar's Office, immediate arrangements (by telephone or telegraph) should be made to have credits and honorable dismissals forwarded.

R. M. WEST, Registrar

The Bulletin *of the University of* **Minnesota**

North Central School and Station
Grand Rapids, Minnesota

Announcement for the Years
1938-1941



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FACULTY

Lotus D. Coffman, Ph.D., LL.D., President of the University
Walter C. Coffey, M.S., LL.D., Dean of the Department of Agriculture

AT GRAND RAPIDS

ADMINISTRATION

Raymond L. Donovan, B.S., Superintendent
Mary Kulstad, Registrar, Librarian and Instructor
———, Preceptor
Marie O. Mollins, Instructor and Dining Hall Matron
Harold W. Stunneck, Accountant
Hazel M. Erickson, Secretary

AGRICULTURAL ENGINEERING

Arthur F. Dahlberg, B.S., Farm Mechanics
Otto W. Swenson, Assistant in Farm Machinery and Motors

AGRONOMY

Raymond L. Donovan, B.S., Soils and Farm Management
Theodore S. Weir, B.S., Soils and Farm Management
Otto W. Swenson, Assistant in Agronomy

ANIMAL HUSBANDRY

Clarence L. Cole, M.S., Animal and Dairy Husbandry
Raymond L. Donovan, B.S., Animal and Dairy Husbandry
Arthur F. Dahlberg, B.S., Poultry

HORTICULTURE AND ENTOMOLOGY

Theodore S. Weir, B.S., Horticulture and Entomology

ASSOCIATED SUBJECTS

Arthur F. Dahlberg, B.S., Sciences
Mary Kulstad, Mathematics
Marie O. Mollins, English
Leona Vieths, B.A., B.S., History and Commercial Subjects
Vernie Miller, B.A., Athletics
———, Music and Speech

GENERAL INFORMATION

LOCATION

The North Central School of Agriculture is located at the Experiment Station, one and one-half miles east of Grand Rapids, Minnesota, on the paved State Highway No. 169. Busses from the Twin Cities and from the Mesaba Range stop at the station when requested.

PURPOSE

The North Central School of Agriculture was established in 1926 for the purpose of giving the farm boys of northeast Minnesota an opportunity better to fit themselves for the profession of farming and the necessary training for more useful citizenship. The time of opening the fall term is set late enough so that students may help with the fall work on the farm and the spring term closes early enough to permit them to return to the farm for the rush of spring work.

TIME OF OPENING

The fall term opens about the first of October and closes the Friday before Christmas. The winter term opens the first week in January, after New Year's Day, and closes the last of March.

THREE-YEAR COURSE

The course of study offered covers a wide range of subjects, largely agricultural, and requires three winters of six months each for completion. The methods of instruction tend to educate the students toward the farm instead of away from it; to develop in them a love of farm life by showing its possibilities.

ADVANCED COURSES

A student, after completion of the regular three-year course, may desire to prepare himself to enter the University or another higher institution. This preparation is provided for by offering such a student an additional six months at the school, in which time he will be required to cover a prescribed amount of academic work. He may also choose from the elective lists subjects that he could not obtain during his first three sessions, such as more specialized work in animal husbandry, horticulture, farm engineering, commercial subjects, and academic work.

ADMISSION

Applicants who have completed a common school course will be admitted without examination.

Applicants who have not completed the eighth grade should write to the registrar for further information.

Students who cannot pursue the full course either from lack of time or proper preparation may make special arrangements for taking such subjects as will be most helpful to them. These students can become candidates for a diploma only after meeting all entrance requirements. High school credits are accepted for work in English, physiology, algebra, geometry, civics, history, and sciences.

ROOMS IN DORMITORY

The rooms are all cheerful and modern. Each room is furnished with two single beds, a chiffonier, a table, and chairs. Students planning to attend the School of Agriculture should reserve rooms in advance. Write early, asking the registrar to reserve a room in the dormitory.

WHAT TO BRING

Each student should come provided with comforters or blankets, sheets, pillow cases, towels, comb, brushes, tumbler, and pajamas.

EXPENSES*

The necessary expenses for the year do not exceed \$135. This amount does not include traveling and personal expenses.

Each student is required to pay for breakage of apparatus used in practical work, and for all damage done to school property.

Textbooks are furnished at a rental of \$1 to students who do not desire to purchase. A fee of \$2.50 each term will entitle all students to attend all school functions, athletic contests, games, and entertainments.

It should be remembered that fees are for the entire term; after the first month, the only expenses are for board and room.

Board is payable the first of each month in advance. A surtax of 2 per cent is added to all bills delinquent more than ten days. No deduction is made for board for any absence of less than five days. If students are compelled to be absent for that length of time, they are allowed half rates, provided they make arrangements with the accountant before leaving. On entering the school, each student should bring sufficient money to pay for one month's board and room, and for books and fees. This amounts to about \$32.

The following expenses are charged to all students. Fees are payable at the time of registration, and board and room on the first of each school month.

* See page 19.

Registration fee per term to residents	\$3.00
Deposit as guarantee of proper treatment of school property	5.00
Board, per week	3.50
Room per week, including flat laundry	1.25
Book rent, per term	1.00
Student privilege ticket for all school functions, athletic contests, games, and entertainments, per term	2.50
Health fee, per term	1.50
Registration fee per term to nonresidents	6.00

Special fees in laboratory courses are as follows: carpentry, engineering, farm mechanics, chemistry, \$1 each a term. Crop studies and dairying, 50 cents each a term. A rental fee of \$1 a month is charged for the use of typewriters.

HEALTH SERVICE FEE

The health service fee provides for physical examinations for all students, doctor's advice as to anything that would correct present health conditions and for sick calls that are made to the school dormitory. It does not provide for nurse's care in case of serious sickness or extra costs caused by epidemics, or hospital care, in case the student is taken to a hospital. These must be paid for by the student receiving the service.

REQUIREMENTS FOR GRADUATION

Completion of the prescribed course of study, including all required work and enough electives to make a total of 160 credit hours.

Two summers of supervised home project work. Of the 160 credits necessary for graduation 10 must be home project work.

An honorable standing in department.

Payment of all school accounts.

HOME LIFE IN THE DORMITORY

The dormitory life of the students while attending the School of Agriculture is subject to supervision. Everything possible is done to promote a healthful, moral atmosphere.

The preceptor and preceptress have charge of students in the dormitory and regulations enforced are for the good of all.

From 8:15 a.m. to 4:30 p.m. students are busy with their school work. From 4:30 to 6:00 p.m. there is a recreation period in which the student's time is at his own disposal. After 7:30 p.m. students are expected to be in their rooms and to be quiet so that all may study undisturbed. Students may leave the campus in the evening only upon the permission of the preceptor or preceptress.

Students are required to be correct in their habits, and to observe pleasantly all directions for their government. Anyone not in accord with these restrictions and not willing to lend a hand toward strong moral growth should not come to the school. Infraction of dormitory rules may be sufficient cause for dismissal from school.

The use of profanity and tobacco in dormitory rooms is strictly forbidden. Any student found using intoxicating liquor will be immediately expelled from school.

ASSEMBLY PERIOD

An assembly period is held once every week throughout the school year. Students are required to attend these assembly exercises. It is the purpose of the school to secure prominent speakers to address the student body at these morning exercises. The assembly period is also used as a forum for public discussion of the many questions and announcements of importance to the student body. The various societies and organizations also use this period for the promotion of their work.

SUNDAY SERVICES

A short devotional service not exceeding half an hour is offered on Sunday morning immediately following breakfast, with speakers representing various denominations. Attendance at these services is entirely voluntary.

MUSICAL ORGANIZATIONS

All students wishing to take lessons on violin or piano will receive such lessons free of charge. An orchestra is organized each year and some vocal training is given.

ELIGIBILITY FOR CONTESTS

The following rules will govern eligibility for all interscholastic games :

1. A student must be enrolled in the school not less than two weeks before the contest, or from beginning of term.
2. He shall be making grade in at least four subjects for which he is enrolled. These four subjects must total twenty credit hours.
3. He must carry 25 hours of work during each quarter unless he is a senior in his list quarter and does not need that amount to graduate.
4. No student will be allowed more than four years' competition in any one sport, including his high school and agricultural school competition. A year's competition is defined as having won his letter in that sport.

STATE AID

For any farm boy or girl under 21 years of age who has completed the eighth grade but is not a high school graduate and who comes from a school district which does not maintain an accredited high school within its own jurisdiction, the state of Minnesota will pay the necessary tuition, laboratory, and equipment fees (except deposits) at the school. Deposits are to be paid by the individual student.

A rate of \$6 per month has been established to cover all the tuition, laboratory, and equipment fees (except deposits) of such students and the

same privilege is extended to any other students in attendance at such schools electing to pay fees on this basis.

Student must secure a tuition certificate from the county superintendent of schools in the home county and present it when registering at the School of Agriculture.

For further information regarding this matter, write to Superintendent R. L. Donovan, North Central School and Station, Grand Rapids, Minnesota.

SCHOLARSHIP AND LOAN FUNDS

The North Central School of Agriculture considers itself very fortunate in being able to present the following loan fund provisions. The donors have specified the purposes for which each may be used. The general purposes, however, are to enable the school to reach a large number, to provide the means of encouraging many to acquire the training which the school offers, and to stimulate greater effort in school work.

For further details regarding these loan funds, write to Superintendent R. L. Donovan, North Central School of Agriculture, Grand Rapids, Minnesota.

GRAND RAPIDS COMMERCIAL CLUB LOAN FUND

The Commercial Club of Grand Rapids has created a revolving loan fund to aid students at the North Central School of Agriculture.

CALEB DORR CASH SCHOLARSHIP PRIZES

By a decision made in April, 1922, by the Board of Regents of the University of Minnesota, a part of the Dorr fund is now made available to the schools of agriculture. This fund consists of \$50,000 willed by the late Caleb Dorr, of Minneapolis, the income of which will be used to promote scholarship and student activity records. Further information regarding this fund as it applies to the North Central School of Agriculture may be obtained by writing to the superintendent.

SEARS ROEBUCK AGRICULTURAL SCHOLARSHIPS

Sears Roebuck and Company of Chicago, Illinois, has established a fund of approximately \$2,500 to aid beginning students in the College of Agriculture, Forestry, and Home Economics and the schools of agriculture—preferably those students who would not be able to attend without this aid. For the year 1937-38, eleven scholarships of \$100 each were awarded to entering freshmen in the college whose high school record, 4-H Club and other extra-curricular activities, freshman tests, and personality records gave promise of success in college. It is the announced intention of the donors to continue these scholarships.

WOMAN'S CLUB LOAN FUND

This fund was started in 1933 by the Grand Rapids Woman's Club to aid needy students at the North Central School of Agriculture.

CROP JUDGING TEAM LOAN FUND

This fund was created by the grain judging team from the North Central School of Agriculture that won first place at the World's Grain Judging Contest at Regina, Canada, in July, 1933. Part of the prize money that was won was donated to establish this fund to aid needy students in attending the North Central School of Agriculture.

LUDDEN TRUST FUND

This fund may be used by students of the North Central School of Agriculture in accordance with the action of the Board of Regents.

STAFF AND EMPLOYEES SCHOOLS OF AGRICULTURE LOAN FUND

This fund, created by the staff and employees of the schools of agriculture, is available for student use in accordance with the action of the Board of Regents, June 19, 1933.

4-H CLUB WEEK

The annual 4-H Club Week, which is usually held during the month of June each year, is open to boys and girls from twelve to twenty years of age. With the exception of \$1 for board, there is no expense connected with the course. The course aims to deepen the interest of boys and girls in life on the farm. Special emphasis is placed on boys' and girls' club work. Instruction is given for the planning and carrying out of work in such projects and contests as gardening, corn and potato growing, pig, calf, and chicken raising, cooking, sewing, and canning. Illustrated lectures, moving pictures of educational value, games, singing, and excursions add interest and pleasure to the course. The 4-H Club one-act play contests and musical contests are usually held at this time.

GRAIN, LIVESTOCK, AND FLOWER CONTESTS

These contests, which have become an annual event, are open to farmers' clubs, 4-H clubs, and high schools. The instructor at the head of each department is in charge and judges are secured from the University of Minnesota. In addition to the regular grain and livestock judging contest, there is a tree and flower identification contest for women.

WOMEN'S CAMP

The annual Women's Camp is held at the North Central School during the month of June each year, for three or four days, to provide instruction and recreation for homemakers. Instruction in the form of demonstrations will be offered in homemaking, community building, child training, music, and recreation.

NORTH CENTRAL QUARTERLY

The *North Central Quarterly* is published by the school faculty. It serves as a medium by which former students and alumni are kept in touch with one another and with the school. It also contains much useful

information regarding farm problems in horticulture, dairying, poultry, agronomy, and other information that is of much interest to the average farmer.

EXPERIMENT STATION

The North Central School and Station is now conducting extensive experiments in agronomy, soils, horticulture, forestry, animal husbandry, poultry, apiary, and agricultural engineering.

SCHOOL FARM

The farm comprises 457 acres, and furnishes an extensive laboratory for the work of the school. Over 100 acres are in forest reserve, so designated by the Board of Regents; 250 acres are included in crop lands and grounds; and the rest is stump-land pasture not suited for crop purposes. Information concerning the methods employed on the farm is always available to the students. The classroom work is supplemented with actual practice either in the field or with crops grown on the farm.

STATION FLOCKS AND HERDS

The school now maintains an abundance of livestock, all of which may be used for student work in animal husbandry. Purebred Guernsey cattle, Shropshire sheep, Percheron horses, Duroc Jersey hogs, and White Leghorn and White Orpington chickens are maintained for station and school purposes. Excellent opportunities are thus provided for students to study intelligently the various courses in animal husbandry.

LIBRARY

The school is equipped with a good reference library to meet the needs of the various departments.

COURSES OF STUDY

THREE-YEAR COURSE

FRESHMAN

<i>Fall</i>		<i>Winter</i>	
<i>Required</i>	Credits	<i>Required</i>	
English Ia	5	English Ib	5
Farm Dairying	3	Dairy Breeds and Judging	5
Livestock Breeds and Judging	5	Cereal Crops	5
Poultry I	3	Industrial Geography	5
Plant Life	5	Gymnasium	1
Arithmetic	5	Poultry II	3
Gymnasium	1	Carpentry I	2
Health Education	2		—
	—	Total	26
Total	29		
	<i>Elective</i>		<i>Elective</i>
Farm Motors	2	Spelling and Penmanship	3
Piano	2	Piano	2
Violin	2	Violin	2
Glee Club	2	Glee Club	2
Typewriting I	5	Mechanical Drawing	2
Spelling and Penmanship	3	Typewriting I	5
Farm Shop	2	Typewriting II	5

JUNIOR

<i>Fall</i>		<i>Winter</i>	
<i>Required</i>	Credits	<i>Required</i>	
English IIA	5	English IIB	5
Chemistry or Physics*	5	Fruit and Vegetable Crops	5
Forage Crops	5	Feeds and Feeding	5
Gymnasium	1	Gymnasium	1
Speech I	3	Physics or Chemistry	5
Electives	6	Speech II	3
	—		—
Total	25	Total	24
	<i>Elective</i>		<i>Elective</i>
Farm Mechanics	2	Mechanical Drawing	2
Piano	2	Piano	2
Violin	2	Violin	2
Farm Motors	2	Glee Club	2
Corn and Grain Judging	2	Bookkeeping II	5
Glee Club	2	Typewriting I	5
Advanced Livestock Judging	3	Typewriting II	5
Bookkeeping I†	5	Carpentry II	2
Typewriting I	5		
Typewriting II	5		

* Chemistry and Physics will be offered alternate years.

† For credit in bookkeeping, students must complete both Bookkeeping I and Bookkeeping II.

COURSES OF STUDY

SENIOR

<i>Fall</i>		<i>Winter</i>	
<i>Required</i>		<i>Required</i>	
	Credits		Credits
English IIIa	5	English IIIb	5
United States History	5	American Government	5
Soils Management	3	Farm Management and Accounts	5
Farm Forestry	4	Electives	10
Electives	8		
Total	25	Total	25
<i>Elective</i>		<i>Elective</i>	
Farm Mechanics	2	Farm Machinery	2
Dairy Management	3	Livestock Management and Market- ing	5
Piano	2	Ornamental Planting	2
Violin	2	Insects and Bees	3
Glee Club	2	Piano	2
Bookkeeping I	5	Violin	2
Shorthand I	5	Glee Club	2
Shorthand II	5	Bookkeeping II	5
Typewriting I	5	Shorthand I	5
Typewriting II	5	Shorthand II	5
Advanced Stock Judging	3	Typewriting I	5
Advanced Grain Judging	3	Typewriting II	5

ADVANCED

<i>Fall</i>		<i>Winter</i>	
<i>Required</i>		<i>Required</i>	
	Credits		Credits
English IVa	5	English IVb	5
Ancient History	5	Modern History	5
Elementary Algebra Ia	5	Elementary Algebra Ib	5
Geometry Ia	5	Geometry Ib	5
Electives	5	Electives	5
Total	25	Total	25
<i>Elective</i>		<i>Elective</i>	
American Problems	3	Insects and Bees	3
Glee Club	2	Ornamental Planting	2
Piano	2	Livestock Management and Market- ing	5
Violin	2	Animal Breeding	3
Bookkeeping I	5	Bookkeeping II	5
Typewriting I	5	Typewriting I	5
Typewriting II	5	Typewriting II	5
Shorthand II	5	Shorthand II	5
Advanced Stock Judging	3	Glee Club	2
Advanced Grain Judging	3	Piano	2
		Violin	2

DESCRIPTION OF COURSES

AGRONOMY AND FARM MANAGEMENT

- A. Cereal Crops. A study of the principal cereal crops, classes, and varieties adapted to northern Minnesota; production, seed selection, seed treatment, control of disease, soil and cultural practices, harvesting. Mr. Swenson.
- B. Forage Crops. A study of leguminous crops, grasses for pastures and meadows; annual forage crops, root and tuber crops grown for livestock; seed selection, cultural requirements and their importance to the farm. Mr. Swenson.
- C. Grain Judging. Score card practice, grading and judging; identification of farm crop plants; seeds and weed seeds, diseases and weed plants, with the object of making the student proficient in judging and identifying good and pure seed. Mr. Swenson.
- D. Pure Seed Production. A study of the methods of breeding and growing purebred seed grain and corn. The course includes certification and seed registration; pure seed and weed laws. Mr. Swenson.
- E. Soil Management. Soil formation and classification with particular attention to those of this territory. Factors influencing the fertility of soil and its maintenance including texture, tilth, moisture, air, tilling, organic matter, soil organisms, acidity, plant food, crop rotation, farm manures, commercial fertilizers, and types of farming. Mr. Swenson.
- F. Farm Management and Accounts. Study of the farm as organized business, giving consideration to types of farming, combination of enterprises, field and homestead arrangement, crop rotation, soil management, labor with livestock, equipment and improvements, factors affecting cost of production and farm profits, land tenure. A study of farm accounts. Mr. Swenson.
- G. Advanced Grain Judging. Primarily for those interested in becoming more proficient in grain judging and identification of grains and grasses. Mr. Swenson.

HORTICULTURE AND ENTOMOLOGY

- A. Botany. A course in the study of the names and function of the different parts of a flowering plant. Elementary botany. Mr. Weir.
- B. Ornamental Planting. A study of the most common plants used in home beautification, trees, shrubs, annual and perennial flowers; arrangement and propagation; planning the grounds, making lawns. Mr. Weir.
- C. (a) Fruit and Vegetable Crops. Fruit growing. Importance of farm orchard and small-fruit gardens is emphasized. Field work consists of a study of orchard soils, planting and cultural methods, propagation, pruning, spraying, harvesting, marketing, selection of varieties of native and hardy fruits. Mr. Weir.
(b) Vegetable Gardening. The value of the home vegetable garden, preparation of the ground, and selection of plants and seeds are given

- attention. Includes tillage, rotation, transplanting, preparation and care of hotbeds, and insects dangerous to the garden. Mr. Weir.
- D. Farm Forestry. Identification of native trees. Study of growing conditions and habits of growth; woodlots; selection of suitable species, planting, and care. Planting and conserving forests as a crop. Mr. Weir.
- E. Insects and Bees. An elementary study of insects, anatomy and life history of a number of the more important species. A study of the life history and habits of bees, management and equipment. Mr. Weir.

AGRICULTURAL ENGINEERING

- A. Blacksmithing. Instruction is given in the common hot-metal operations on the farm including forging, welding, tempering of tools. Mr. Dahlberg.
- B. Carpentry I. Care and sharpening of wood-working tools useful on the farm. Construction and repair of agricultural equipment and farm buildings. Mr. Dahlberg.
- C. Carpentry II. Continuation of Carpentry I with emphasis on building construction, foundation, framing, rafter cutting, concrete work. Mr. Dahlberg.
- D. Mechanical Drawing. The use of mechanical drawing instruments is taught by drawing farm equipment and buildings. Mr. Swenson.
- E. Farm Motors. The principles of construction and operation of gasoline engines is given by laboratory work on stationary engines. Mr. Dahlberg.
- F. Farm Shop. Practice in rope work, soldering, belt lacing, pipe fitting, and harness repair. Mr. Dahlberg.
- G. Farm Mechanics. Practice is given in stump and rock blasting, in running levels for drainage and foundations, study of home conveniences such as water, heating, and lighting systems. Mr. Dahlberg.
- H. Farm Machinery. Selection, use, care, and operation of farm machinery including plows, disk harrows, cultivators, binders, mowers, etc. Mr. Swenson.

DAIRY AND ANIMAL HUSBANDRY

- A. Farm Dairying. A study of the principles and practices of producing dairy products, including a discussion of dairy barns and silos, milk production and testing. Mr. Cole.
- B. Livestock Judging. Various breeds for dairy purposes are studied. Comparative judging. Score cards. Mr. Cole.
- C. Dairy Breeds and Judging. Breeds of beef cattle, hogs, horses, and sheep are discussed as to origin, development, characteristics, adaptation, and economic importance. Score card judging. Mr. Cole.
- D. Feeds and Feeding. General composition of the animal body; composition and digestibility of feeds; feeding standards; methods of feeding. Mr. Cole.
- E. Dairy Management. Feeding and general management of dairy herd; value of purebred sires; study of records and pedigrees, and method of registration. Problems of sanitation and disease. Mr. Cole.

- F. Livestock Management and Marketing. Study of market classes and grades, market reports, management of livestock, butchering, meat cutting. Mr. Cole.
- G. Animal Breeding. Theory and practice of animal breeding, including variation, heredity, selection, effect of purebred animals in improving types of stock and pedigrees. Mr. Cole.
- H. Advanced Livestock Judging. Continuation of first year judging. Mr. Cole.
- I. Advanced Stock Judging. Primarily for those interested in becoming more proficient in the art of livestock judging. Mr. Donovan.

POULTRY HUSBANDRY

- A. Poultry I. A study of the farm laying flock and the best approved farm practices for profitable poultry and egg production for northern Minnesota. Feeding, housing, house construction and illumination; breeds, culling, exhibiting, and judging for standard breeding and utility. Mr. Dahlberg.
- B. Poultry II. A continuation of the study of the laying flock, presenting principles and practices of breeding, selection and mating of breeders; incubation and brooding; range management, sanitation; disease diagnosis and eradication; marketing eggs and poultry; caponizing; keeping the flock records. A study of the enterprise of raising poultry; individual and national programs for poultry improvement. Poultry I, prerequisite. Mr. Dahlberg.

ENGLISH

- A. English Ia. Review of parts of speech. Oral and written themes required. An appreciation of good literature is encouraged by the reading of the simpler classics. Book reviews are given. Mrs. Mollins.
- B. English Ib. Continuation of English Ia. Sentence and paragraph structure. Letter writing. Theme work is continued. Most common rules of punctuation. Mrs. Mollins.
- C. English IIa. More advanced theme writing. Oral reports. Book reports. Standard books and selections of interest are read. Mrs. Mollins.
- D. English IIb. A continuation of English IIa. Punctuation is studied extensively. Business letter. Outlining in oral and written reports. Mrs. Mollins.
- E. English IIIa. Advanced work in written composition of descriptive type. Advanced classics and extensive outside reading. History of American literature is also taken up in this year with readings from American authors. Special emphasis is placed on contemporary American writers. Mrs. Mollins.
- F. English IIIb. Reading of classics continued. Composition work of narrative and argumentative types. Simple newspaper writing. American literature continued. Mrs. Mollins.
- G. English IVa. History of English literature with reading from masterpieces. A few themes. Mrs. Mollins.

- H. English IVb. Continuation of English IVa. Mrs. Mollins.
- I. Public Speaking and Debate. The purpose is to develop skill and experience in appearing before the public as both speaker and debater. Orations and topics are used for drill in deportment and in expression and the principles of argumentation are taught by debating. Methods of conducting public meetings are taught by parliamentary procedure.

SOCIAL SCIENCES

- A. Industrial Geography. A review of physical and political geography of the world with a study of the principal commodities in commerce, and conditions, natural and otherwise, that affect their production. Miss Kulstad.
- B. American History. A study of the early discovery and colonization of the continent leading to the formation of the Union, the growth of the nation, and recent problems. Miss Vieths.
- C. Ancient History. This course shows the emergence of mankind from savagery, the formation of the ancient nations and especially the contributions of Greece and Rome to modern civilization. In the medieval period, the rise of modern nations, inventions and conditions affecting modern life are noted. Mr. Weir.
- D. Modern History. The development of the present European nations is studied, particularly as it influences conditions in America. Changes in political, economic, and social conditions during the last one hundred years are stressed with post-war developments in international relations. Mr. Weir.
- E. American Government. Legislative, judicial, and executive departments and their functions. School districts, townships, county, state, and national government with special stress placed on Minnesota government. Miss Vieths.
- F. American Problems. A study of problems, social, economic, and political, confronting the citizens of our country; their history, causes, and effect on everyday life. Miss Vieths.

MATHEMATICS

- A. Arithmetic. Fundamentals of arithmetic; mastery of tables; important and useful formulas; fractions; decimals; linear, square, and cubic measure; lumber problems; building construction; silos, etc.; percentage; interest, insurance, etc. Application of knowledge to farm problems with a view to using practical short cuts. Miss Kulstad.
- B. Algebra I. This course covers the usual first half-year academic credit work in algebra. Miss Kulstad.
- C. Algebra II. A continuation of Algebra I. Miss Kulstad.
- D. Geometry I. This course is designed to cover the usual first half-year credit work in plane geometry. Miss Kulstad.
- E. Geometry II. Continuation of Geometry I. Miss Kulstad.

BUSINESS TRAINING

- A. Bookkeeping I. The principles of double entry bookkeeping, as far as controlling accounts, are illustrated by exercises and sets. The use of ordinary business papers is shown with the principles of banking and transportation. Miss Vieths.
- B. Bookkeeping II. Continuation of Bookkeeping I with more on accruals, trade discounts, consignments, etc. Required before credit is given for Bookkeeping I. Miss Vieths.
- C. Shorthand I. Students complete the *Gregg Shorthand Manual* and easy business letters are introduced. Miss Vieths.
- D. Shorthand II. A review of the *Manual* with *Gregg Speed Studies* plus more difficult business letters. Miss Vieths.
- E. Spelling and Penmanship. Drill in spelling a certain set of words in common use. Rules for spelling. Daily drill and individual instruction in penmanship. Miss Kulstad.
- F. Typewriting I. Proper use of the machine; accuracy in touch typing through exercises. Simple business letters are introduced. Miss Vieths.
- G. Typewriting II. Continuation of Typewriting I consisting of business letters, tabulating, and executing legal documents. Miss Vieths.

PHYSICAL SCIENCES

A full year course in physics is alternated each year with a full year course in chemistry. Individual laboratory practice is provided with class recitations.

- A. Chemistry for Today. An elementary course in the realm of chemical facts and laws and the solution of simple chemical problems, with a study of practical application of chemical science in agriculture and industry in general. Mr. Dahlberg.
- B. Physics in Everyday Life. A study of familiar phenomena and fundamental principles involved with illustrative and explanatory exercises for their interpretation and practical application. Mr. Dahlberg.

MUSIC

- A. Glee Club. A glee club is organized each term with practice twice a week. Three- and four-part songs are sung. Reading of notes is aimed at in every practice. The organization furnishes musical numbers for the literary society and assembly programs.
- B. Chorus. All members of the school are included in the chorus which meets weekly. Two-, three-, and four-part songs are used.
- C. Orchestra.

HEALTH EDUCATION

Health and Human Welfare. Presenting the fundamentals as well as more advanced information on anatomy, physiology, and hygiene. A course designed to meet in a practical way the everyday health problems of youth. For first year students. Mr. Dahlberg.

SUMMER HOME PROJECTS

The *Project* presents an opportunity for students to demonstrate ability to put into practice some of the approved farm practices taught in the classroom or demonstrated at the station. A supervised home project is required for each school year. Of the 160 credits necessary for graduation, 10 must be for home project work.

Project plans shall be submitted to the project supervisor by March 1. Students should consult the instructors in the field of their project for suggestions in planning their work.

Progress reports shall be given the supervisor or mailed to the station during the months of April, June, and August. A summary and accounting of the work accomplished together with a story of the project shall be submitted in the final project report on or before November 15 of the year of the project.

Three successfully completed projects are required for entrance to the University.

AGRICULTURAL PROJECTS

- A. Dairy Herd Management. Student assumes care of dairy herd on his home farm for at least six months, making regular reports in regard to feeding and management and keeping accurate accounts of milk production, butterfat tests, feed consumed, etc. 5 credits.
- B. Swine Management. Management and feeding of the home herd. Farrowing records, feed records, and cost of production figures are made a part of this project. Opening and closing inventories are required and a financial statement showing total costs and receipts. 5 credits.
- C. Lamb Production. Ten or more ewes are required for this project. Lambing records are kept, the lambs are earmarked and dates of birth recorded. Feed records are kept and the lambs weighed up when averaging 150 days old. A student is required to show a pen of at least 3 lambs at his county fair. 5 credits.
- D. Incubation and Brooding. In this project 100 or more chicks are brooded, fed, and raised by the student. A definite ration is fed throughout the project and accurate records are kept. 5 credits.
- E. Potato Production. Growing an acre or more of a standard variety. The work includes selection and treatment of seed, control of diseases, cultural practices, costs of production, and financial returns. 5 credits.
- F. Home Beautification. Planning and planting foundation shrubs and plants around the farm home and other buildings, caring for the same during the growing season, and preparing for winter. The student makes a planting plan which is approved before the work is undertaken. 5 credits.
- G. Beekeeping. In this project the student takes charge of an apiary of not less than 3 hives. Care, management, and production records are included as a part of the project. 5 credits.
- H. Tree Fruits. Establishing an orchard of not less than 12 trees consisting of varieties recommended by the Minnesota Horticultural Society. 5 credits.

- I. Small Fruits. Establishing a patch large enough to supply a family of five with at least any two of the following: raspberries, strawberries, grapes, etc. Varieties recommended by the Minnesota Horticultural Society. 5 credits.
- J. Pure Seed Production. Consists of raising not less than an acre of certified seed of any of the recommended grain varieties. Cost of production records are kept. 5 credits.
- K. Plant Identification. Students are required to collect, press, and mount not less than 75 plants to consist of not less than 24 common weeds, also grasses, legumes, and other wild plants, excluding trees and shrubs. Specimens will be named for the student and he must learn to identify at least 50 plants of his collection. All names or information written on mounted specimens required to be made in pencil. 5 credits.
- L. Windbreak Planting. Consists of planting a windbreak or shelter belt to shelter the farmstead. The use of cuttings, seed, or seedlings. The selection and choice of trees to suit the particular site and the subsequent care and maintenance. 5 credits.
- M. Community Social Improvement. Includes 4-H Club work, Boy Scout work, farm bureau, young people's society, dramatic clubs, orchestra, etc. 5 credits.
- N. Home Improvement. Establish water system, septic tank; install toilets, electric lights, cement walks, homemade shower bath; improve kitchen arrangements for convenience. 5 credits.
- O. Farm Structures. Plan and build brooder house, poultry house, machine shed, garage, dairy barn, and other farm buildings. 5 credits.
- P. Insect Collection. Collect and mount not less than 50 insects with records according to instructions. 5 credits.
- Q. Management of the Laying Flock. The student takes full charge of the laying flock of 50 or more hens for egg production. A balanced ration is fed, and feed and production records are made a part of the project. 5 credits.

SCHOOL EXPENSES

SIX-MONTH SCHOOL YEAR

First Term

To be paid on registration day :	
Registration fee‡	\$ 3.00
Breakage deposit‡‡	5.00
Health fee	1.50
Book rent	1.00
Privilege ticket	2.50
Board and room (first four weeks)	19.00
	\$32.00
Total payment on registration day	\$32.00
Board and room (second four weeks)	19.00
Board and room (third four weeks)	19.00
	\$ 70.00
Total for first term	\$ 70.00

Second Term

To be paid on opening day :	
Registration fee‡	\$ 3.00
Health fee	1.50
Book rent	1.00
Privilege ticket	2.50
Board and room (first four weeks)	19.00
	\$27.00
Total payment on opening day	\$27.00
Board and room (second four weeks)	19.00
Board and room (third four weeks)	19.00
	\$ 65.00
Total for second term	\$ 65.00
	\$135.00
Less breakage deposit‡‡	5.00
	\$130.00
Total for school year	\$130.00

The above itemized statement does not take into account laboratory fees, typewriter rentals, etc. These additional fees must be paid at the beginning of the term.

Note all first term fees and first four weeks' board and room must be paid on registration day. Balance of board and room must be paid on the first Monday of each four-week period.

Second term fees must be paid on opening day after Christmas vacation. Students starting school second term must pay breakage deposit fee the same as in the first term.

‡ Registration fee for nonresidents of Minnesota is \$6 per term.

‡‡ Breakage deposit is refunded at the end of year if no charges for breakage, loss, etc., are brought against it.