

College of Agriculture



UNIVERSITY OF MINNESOTA

Board of Regents

Lauris D. Krenik, Madison Lake, Chair
 Charles F. McGuiggan, Marshall, Vice Chair
 Charles H. Casey, West Concord
 William B. Dosland, Moorhead
 Willis K. Drake, Edina
 Erwin L. Goldfine, Duluth

Wally Hilke, St. Paul
 David M. Lebedoff, Minneapolis
 Verne Long, Pipestone
 Wenda Moore, Minneapolis
 David K. Roe, St. Paul
 Mary T. Schertler, St. Paul

Administrative Officers

C. Peter Magrath, President
 Nils Hasselmo, Vice President for Administration and Planning
 Stanley B. Kegler, Vice President for Institutional Relations
 Kenneth H. Keller, Vice President for Academic Affairs
 David M. Lilly, Acting Vice President for Finance and Operations
 Neal A. Vanselow, Vice President for Health Sciences
 Frank B. Wilderson, Vice President for Student Affairs

College of Agriculture Administration

Dean—to be appointed (277 Coffey Hall, 373-0922)
 Keith Wharton, Assistant Dean, Academic and Student Affairs (277 Coffey Hall, 373-0922)
 Malcolm J. Purvis, Assistant Dean, International Agricultural Programs (277 Coffey Hall, 373-1498)
 Kathy Palmquist, Coordinator, Prospective Student Services (277 Coffey Hall, 373-3267)
 James C. Sentz, Student Training Officer, International Agricultural Programs (277 Coffey Hall, 373-1498)

Coffey Hall, which houses the main administrative offices of the College of Agriculture, is located at 1420 Eckles Avenue, St. Paul, MN 55108.

Cover Photos: *Front*, a St. Paul campus scene
Back, a student in the annual "Milkmaid" contest

117

COLLEGE OF AGRICULTURE

CONTENTS

Directory	3
Checklist of Procedures	5
I. General Information	6
II. Programs	19
III. Course Descriptions	77
IV. Faculty	121

This biennial bulletin, the official source of information about the College of Agriculture, should be kept handy for repeated reference. In addition, students are expected to be aware of the following resources:

College Office—For more information about policies and program requirements, check with the College of Agriculture Office, 277 Coffey Hall (612/373-0940).

Adviser—At your first registration, you will be assigned an adviser, who will be your guide in planning a course of study.

Class Schedule—Each quarter you will receive a *Class Schedule* with your registration materials. This publication lists University day school courses complete with hours, rooms, instructors, prerequisites, registration instructions, fees, maps, final exam schedules, grading definitions, and other valuable information.

Other Bulletins—The annual *General Information Bulletin* provides a brief overview of the University and its basic costs and regulations. Evening and summer courses are featured in the *Continuing Education and Extension Classes Bulletin* and *Summer Session Bulletin*, respectively. Separate bulletins are also published for other University colleges. Most may be obtained from the Office of Admissions and Records, 130 Coffey Hall.

Official Daily Bulletin Column—Printed in the Twin Cities campus newspaper, the *Minnesota Daily*, and posted on bulletin boards, this column keeps abreast of course changes, study opportunities, meetings, and activities.

Bulletin Use

The contents of this bulletin and other University bulletins, publications, or announcements are subject to change without notice. University offices can provide current information about possible changes.

Equal Opportunity

The University of Minnesota is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, creed, color, sex, national origin, or handicap. In adhering to this policy, the University abides by the requirements of Title IX of the Education Amendments of 1972, by Sections 503 and 504 of the Rehabilitation Act of 1973, and by other applicable statutes and regulations relating to equality of opportunity.

Inquiries regarding compliance may be directed to Lillian H. Williams, Director, Office of Equal Opportunity and Affirmative Action, 419 Morrill Hall, University of Minnesota, 100 Church Street S.E., Minneapolis, MN 55455 (612/373-7969), or to the Director of the Office of Civil Rights, Department of Education, Washington, DC 20202, or to the Director of the Office of Federal Contract Compliance Programs, Department of Labor, Washington, DC 20210.



A student works in the Horticultural Research Garden.

DIRECTORY

ADMINISTRATIVE OFFICES

College of Agriculture Office—277 Coffey Hall, 1420 Eckles Avenue, St. Paul MN 55108 (Student Services: 612/373-0940; Career Services: 373-0923; Prospective Student Services: 373-3267; Dean: 373-0922)

Office of Admissions and Records—130 Coffey Hall, 1420 Eckles Avenue, St. Paul, MN 55108 (612/373-0703)

Office of Student Financial Aid—199 Coffey Hall, 1420 Eckles Avenue, St. Paul, MN 55108 (612/376-2572)

Housing Office—Comstock Hall East, 210 Delaware Street S.E., Minneapolis, MN 55455 (612/373-7542)

Campus Assistance Center—209 Eddy Hall, 192 Pillsbury Drive S.E., Minneapolis, MN 55455 (612/373-1234)

DEPARTMENT OFFICES

Agricultural and Applied Economics—G. Edward Schuh, head, 231 Classroom-Office Building, 1994 Buford Avenue, St. Paul, MN 55108 (612/373-0945)

Agricultural Education—R. Paul Marvin, head, 320 Vocational-Technical Education Building, 1954 Buford Avenue, St. Paul, MN 55108 (612/373-1021)

Agricultural Engineering—Frederick G. Bergsrud, head, 213 Agricultural Engineering, 1390 Eckles Avenue, St. Paul, MN 55108 (612/373-1305)

Agronomy and Plant Genetics—Herbert W. Johnson, head, 303 Agronomy, 1509 Gortner Avenue, St. Paul, MN 55108 (612/373-0855)

Animal Science—Richard D. Goodrich, head, 120 Peters Hall, 1404 Gortner Avenue, St. Paul, MN 55108 (612/373-1488)

Entomology—Richard L. Jones, acting head, 219 Hodson Hall, 1980 Folwell Avenue, St. Paul, MN 55108 (612/373-1701)

Food Science and Nutrition—Elwood F. Caldwell, head, 225 Food Science and Nutrition, 1334 Eckles Avenue, St. Paul, MN 55108 (612/373-1071)

Horticultural Science and Landscape Architecture—James F. Bartz, head, 305 Alderman Hall, 1970 Folwell Avenue, St. Paul, MN 55108 (612/373-1028)

Information and Agricultural Journalism—Donald E. Wells, head, 326 Haecker Hall, 1364 Eckles Avenue, St. Paul, MN 55108 (612/373-0713)

Plant Pathology—David W. French, head, 304 Stakman Hall of Plant Pathology, 1519 Gortner Avenue, St. Paul, MN 55108 (612/373-0852)

Rhetoric—Thomas E. Pearsall, head, 202 Haecker Hall, 1364 Eckles Avenue, St. Paul, MN 55108 (612/373-0917)

Soil Science—William E. Larson, head, 125 Soils, 1529 Gortner Avenue, St. Paul, MN 55108 (612/373-1062)

Access to Student Educational Records

In accordance with regents' policy on access to student records, information about a student generally may not be released to a third party without the student's permission. The policy also permits students to review their educational records and to challenge the contents of those records.

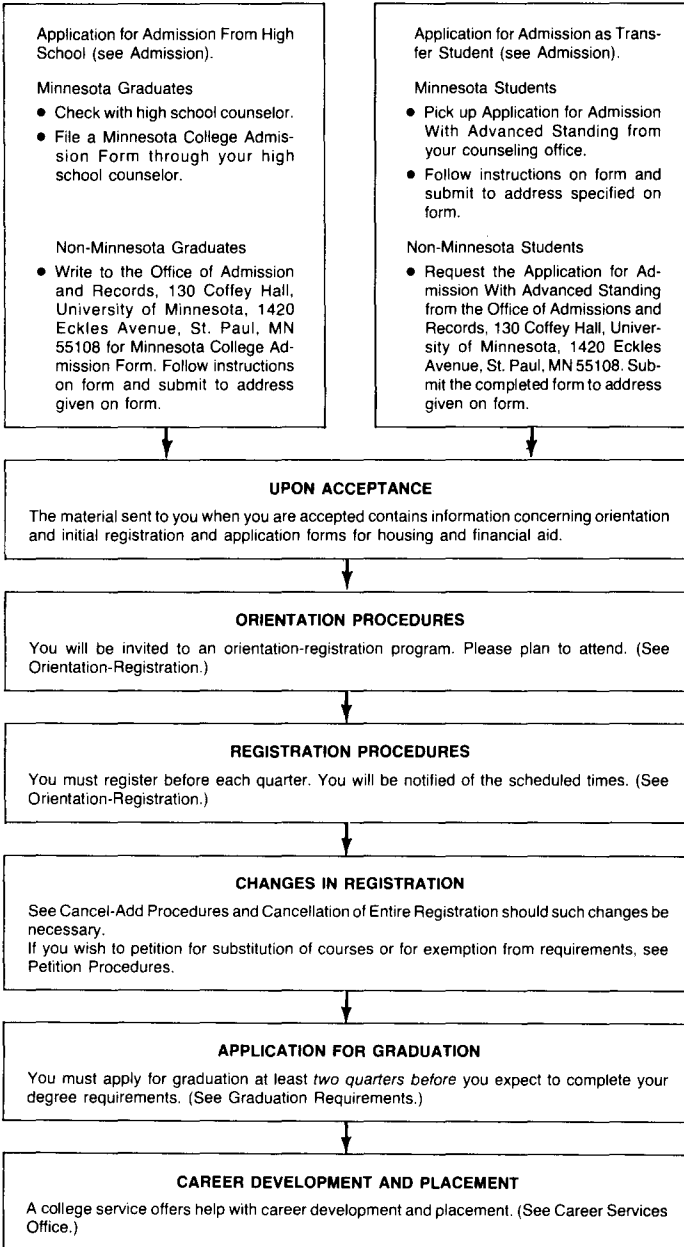
Some student information—name, address, telephone number, dates of enrollment and enrollment termination, college and class, major, adviser, and degrees earned—is considered public or directory information. To prevent release of such information outside the University while in attendance at the University, a student must notify the records office on his or her campus.

Students are notified annually of their right to review their educational records. The regents' policy, including a directory of student records, is available for review at the information booth in Williamson Hall, Minneapolis, and at records offices on other campuses of the University. Questions may be directed to the Office of the Coordinator of Student Support Services, 260E Williamson Hall (612/373-2106).



A surveying course is part of many agricultural programs.

Checklist of Procedures—Application Through Graduation



I. GENERAL INFORMATION

As a science and an industry, agriculture is a dynamic profession that presents challenging opportunities in a variety of areas. The following curricula and majors, offered by the College of Agriculture (except where otherwise indicated), accommodate students with various personal and professional goals.

1. Agricultural Business Administration Curriculum
Agricultural Business Administration
2. Agricultural Science and Industries Curriculum
Agricultural Economics
Agricultural Education
Agricultural Engineering Technology
Agronomy
Animal Science
Entomology
Horticulture
Plant Health Technology
Soil Science
3. Communication Science Curriculum
Agricultural Journalism
Technical Communication
4. Fisheries and Wildlife Curriculum (*transferred to the College of Forestry as of July 1, 1983*)
Fisheries
Wildlife
5. Food Science and Nutrition Curriculum
Consumer Food Science
Food Science and Technology
Nutrition and Dietetics
6. Resource and Community Development Curriculum
Economics of Public Services
Landscape Architecture
Resource Economics
Recreation Resource Management (*offered only through the College of Forestry*)
Soil and Water Resource Management

For complete information about these programs, see section II.

Degrees Offered

Baccalaureate Degrees—Most of the curricula of the college lead to a bachelor of science degree. Several majors and degrees are offered jointly or in cooperation with other colleges in the University:

Agricultural Business Administration—School of Management (bachelor of agricultural business administration)

Agricultural Education—College of Education (bachelor of science)

Agricultural Journalism—School of Journalism and Mass Communication (bachelor of science)

Landscape Architecture—Institute of Technology (bachelor of landscape architecture)

The general philosophy of the College of Agriculture is that students who wish to develop two or more areas of specialization in programs offered by the College of Agriculture should receive only one bachelor of science degree. Recognition for accomplishments in other areas should be made through the minor or a second major. (See Double Major later in this section of the bulletin.)

Master of Agriculture Degree—In addition to the above, the College of Agriculture offers the master of agriculture degree, a professional, non-research-oriented degree designed for those who seek postbaccalaureate education to further advance their professional competence in agriculture. For further information, obtain the brochure *The Master of Agriculture* from the College of Agriculture Office, 277 Coffey Hall, University of Minnesota, 1420 Eckles Avenue, St. Paul, MN 55108 (612/373-0940).

Graduate Degrees—The departments in the College of Agriculture, through the Graduate School, also offer the master of science and the doctor of philosophy degrees. For information about these programs, see the *Graduate School Bulletin*.

Admission

Requirements for admission to the College of Agriculture for high school graduates and transfer students are explained below. Information for adult special students and senior citizens is also included. For requirements and procedures concerning nonresident admission, admission with advanced standing, adult special admission, and admission by examination, consult the *General Information Bulletin* or the Office of Admissions and Records, 130 Coffey Hall, University of Minnesota, 1420 Eckles Avenue, St. Paul, MN 55108.

You should apply by August 15 for fall quarter admission, November 15 for winter quarter, and February 15 for spring quarter. Applications received after these dates may be considered but cannot be assured of action in time for enrollment in the quarter you request. A nonrefundable application fee, payable to the University, must accompany your application.

Send requests for information to the College of Agriculture Office, 277 Coffey Hall, University of Minnesota, 1420 Eckles Avenue, St. Paul, MN 55108, or call 612/373-0940.

High School Graduates—If you are a high school graduate in the upper 60% of your class, you may enter the college if you have completed 12 units in grades 10 through 12. For those 12 units you should choose from offerings in English, social studies and history, mathematics, the natural sciences, and foreign languages. At least 1 unit must be in natural science or agriculture, and 3 must be in mathematics, including the following: 1 unit in elementary algebra, 1 unit in plane geometry, and 1 unit in higher algebra or its equivalent.

Participation in high school vocational agriculture activities is recognized as excellent preparation for the study of agriculture at the college level. Rural background and experience, however, are not required for admission to the college.

You may seek exception to the above requirements if you can provide information indicating promise of academic success.

Transfer Students—You may apply for admission to the College of Agriculture from other colleges or universities. You may be accepted if you meet the entrance requirements of the college and of the major you wish to enter. General requirements for entrance by transfer include a minimum cumulative grade point average of 2.00 (where A = 4.00, B = 3.00, C = 2.00, D = 1.00, N or no credit = 0.00) and a mathematics background at least equal to that required of high school graduates (see above).

You may seek exception to these requirements if you can provide information indicating promise of academic success.

After you have applied for transfer, the Office of Admissions and Records and the college office will evaluate all previous college work according to the standards of the University and the College of Agriculture. You will then be provided with a Transfer Credit Evaluation showing how your previous work has been evaluated.

As a transfer student, you must complete all specific course and area distribution requirements of the college regardless of the number of credits accepted for transfer.

General Information

Therefore, if you begin your degree work elsewhere intending to transfer later, you should carefully plan your pretransfer program to meet as many College of Agriculture requirements as possible. See the requirements for the various curricula in section II, and take special note of All-College Requirements near the end of the section.

Transfer of Credit in Agricultural Courses Taken at Minnesota Non-Land-Grant Institutions—Credit for courses in agriculture taken at Minnesota non-land-grant institutions is limited to introductory courses or those similar to the introductory courses offered at the University. If you seek credit for advanced courses in agriculture, you should take examinations for credit in these courses.

Transfer of Credit From Continuing Education and Extension—To transfer credits and grades for courses taken through Continuing Education and Extension, submit a transcript of these courses to the Office of Admissions and Records for evaluation and inclusion on your record in the College of Agriculture.

Change of College Within the University—To transfer to the College of Agriculture from another college unit of the University, you must meet the entrance requirements of the college. Apply for transfer at the Office of Admissions and Records on the campus where you are currently registered or where you last attended classes.

Minority Admission—The College of Agriculture seeks applications from minority students. Applicants who do not meet the regular admission criteria will be so notified and encouraged to request review of their application by the college Admissions Board of Review. The college will accept students recommended for admission by this board.

Adult Special Students—If you wish to register for particular courses to meet particular needs and are not interested in working toward a degree, you may enter the college as an adult special. Both college and department approval is required. Normally, adult special students are not enrolled for a long time, but only as necessary to acquire the specific training desired.

If you enter the college as an adult special student with the intention of transferring later to the Graduate School, you should be aware that there are restrictions on the number of adult special credits that may be transferred to a graduate program. Consult the *Graduate School Bulletin*. For enrollment information and deadlines, contact the College of Agriculture Office, 277 Coffey Hall, University of Minnesota, 1420 Eckles Avenue, St. Paul MN 55108 (612/373-0940).

Senior Citizens—Minnesota residents 62 years or older are admitted to all University of Minnesota classes on a space-available basis, provided they have completed specified prerequisites. If a course is taken without credit, there is no fee unless materials or other special charges are involved. If a course is taken for credit, there is a fee of \$6 per credit as well as any materials or special charges. Eligible persons should check with the Office of Admissions and Records, 130 Coffey Hall.

Financial Aid

Freshmen—Entering Minnesota freshmen interested in loans, scholarships, or grants should contact their high school counselor or principal for application forms. Forms are also available from the Office of Student Financial Aid, 199 Coffey Hall, University of Minnesota, 1420 Eckles Avenue, St. Paul, MN 55108. (*Non-Minnesota residents must write directly to the Office of Student Financial Aid.*) One application ensures consideration for all types of financial assistance that the University offers—scholarships, loans, educational opportunity grants, and college work-study.

Late applications receive lower priority for financial assistance. A part of the application requires parents or guardians to submit a statement of family financial resources. Forms are revised annually, so students should be sure that they have the most recent form before filling one out.

For information on deadlines, refer to the Financial Aid packet or contact the Office of Student Financial Aid.

Presently Enrolled Students, Transfer Students—Undergraduate and graduate students may obtain application forms and information by contacting a University financial aid office. Complete and accurate applications should be received by the Office of Student Financial Aid by April 22.

Orientation-Registration

As a new student in the College of Agriculture, whether an entering freshman or a transfer student, you will be mailed an invitation to an orientation-registration program. At this program, in addition to becoming acquainted with the campus, you will receive general information about the college and the University and have an opportunity to meet with a faculty adviser in the major you have chosen. He or she will help you select and register for your courses. Although attendance at the orientation program is voluntary, you are urged to participate.

Registration

Each quarter you and the University complete a contract through the registration and payment process. The University agrees to provide certain instruction and facilities; you agree to attend and pay tuition and fees for the classes you have chosen. Although changes sometimes occur in course listings, the responsibility for accurate, timely registration and payment rests primarily with you. Copying errors, excessive changes, failure to observe procedures, and late registration and payment can create an imposition on University personnel and can also be costly and time consuming for you.

Special Registration Procedures—Certain special registration procedures allow you to audit courses, to take them as independent study or reading courses, or to take them for extra credit.

Auditing—Auditors attend and complete all work for a course, but do not take the final examination or receive credit. As an auditor, you must enroll officially in a course and pay regular tuition and fees. Both your adviser and the course instructor must approve your registration. Enter a course you are going to audit on your registration card with a "V" after the course number (e.g., Rhet 3280V).

Independent Study—You have two options for obtaining credit through independent study. In some University courses, you may request an examination (or other evaluation) after preparing for it in any way you choose. If you pass the examination, you will receive credit for the course. You must pay a fee of \$30 for each examination attempted. Check with the college office for further information and for Request for Special Examination application forms.

A second method of independent study is to take a course without attending classes. Under this method, you pay the usual tuition and fees for the course, meet all deadlines, and take the final examination at the regular time. All usual regulations concerning grades, incompletes, and cancellations apply to students taking independent study in this manner. A course completed under independent study counts as part of the total credit load for the quarter. Check with the department offering the course concerning permission to take it for

General Information

independent study. You will usually also need approval of the course instructor. Pick up a permission to register form in the department office, and return the completed form to the Office of Admissions and Records, 130 Coffey Hall. Enter a course you are going to take by independent study on your course enrollment request form with a "Y" after the course number (e.g., Rhet 3280Y).

Extra Credit—With the course instructor's approval, you may earn 1 to 3 additional credits for a course you are taking or have taken. You may, for example, explore a course topic intensively or extend it to a related topic. You will do the extra work on your own according to standards set by the instructor. You should not register for extra credit when the department offers a regular course with the same objectives.

Obtain a permission to register form for extra credit registration at the department office, and, after having it signed by the instructor, take it to the Office of Admissions and Records, 130 Coffey Hall. The usual regulations concerning tuition and fees, grades, and cancellations apply. Enter a course you are going to take for extra credit on your course enrollment request form with an "X" after the course number (e.g., Rhet 3280X).

Cancel-Add Procedures—Use a course enrollment request form, available from the Office of Admission and Records or the college office, to change registration. Make all such changes as early as possible in the quarter.

When you cancel a course, you are subject to the following procedures and requirements:

1. Cancellations during the first two weeks of a quarter require your adviser's signature on the course enrollment request form; a bracketed W is assigned.
2. Cancellations during the third through sixth weeks of a quarter require your adviser's and instructor's signatures on the course enrollment request form. A bracketed W is assigned.
3. Withdrawal from a course after the sixth week of a quarter is strongly discouraged unless there are extenuating circumstances. Cancellations after the sixth week require the signatures of the adviser, instructor, and Scholastic Standing Committee representative on the course enrollment request form.¹ *Cancellations during the ninth and tenth week of a quarter are seldom approved by the Scholastic Standing Committee. If a cancellation is approved, a W is assigned.*

You must have your adviser's signature to add a class during the first week of a quarter. You must have both your adviser's and instructor's signatures during the second through eighth weeks of the quarter. After the eighth week of the quarter, adding a course requires the signatures of your adviser, instructor, and the Scholastic Standing Committee representative. *Approval after the eighth week of the quarter is rarely granted.*

A change from one grading system selected for a course to another (e.g., from A-N to S-N or Audit) must be made during the first two weeks of a quarter and requires your adviser's signature on the form. The choice of grading system may not be changed after the end of the second week.

Cancellation of Entire Registration—If you leave the University before the end of a quarter, you must cancel your registration when you stop attending classes. Submit a course enrollment request form to the Office of Admissions and Records, 130 Coffey Hall. Tuition refunds are prorated according to the number of weeks elapsed in the quarter. You are entitled to a full refund if you cancel before the first day of classes and no refund after the sixth week of classes. See Cancel-Add Procedures above for specific requirements.

¹See Scholastic Requirements later in this section of the bulletin for information concerning the honor point deficiency incurred with cancellation.

Petition Procedures

Petitions are required for departures from either college or major requirements. Submit petitions for departures from college requirements to the college office; for major requirements, to the department.

If you wish to substitute another course for a requirement, have your petition approved *before* you register for the course. Do not assume that it will be approved; find out for sure.

Credits and Class Attendance

Course Load—The typical course load per quarter is 14 to 18 credits. A credit requires an average of three hours of work each week. To carry more than 18 credits, a C average (that is, a cumulative grade point average of not less than 2.00) is required. To carry more than 21 credits, a B average (3.00 GPA) in work of the previous quarter and permission from the Scholastic Standing Committee are required. Undergraduates must carry at least 12 credits each quarter to be considered full-time students.

Class Attendance—Attendance for certain classes in the College of Agriculture is compulsory because of the nature of such classes. If you miss a class for a valid reason, you may request the instructor's assistance in making up the work missed. Instructors are under no obligation to give assistance if the absence is deliberate.

The following four situations are accepted by instructors as justifiable reasons for absence from class and for a request for assistance in making up work: (a) illnesses certified by the University Health Service or by your family physician; (b) emergencies caused by a death or serious illness in your immediate family; (c) absences approved by the Scholastic Standing Committee; and (d) participation, certified by the Office of Student Affairs, in University-approved, cocurricular activities.

To make up classwork, you should confer directly with instructors concerning the reason for the absence and the possibility and ways of completing work missed. The Scholastic Standing Committee intervenes as an appeal agency only when emergencies (items b and c above) are involved.

College Level Examination Program—An alternative method of earning credit is through the College Level Examination Program (CLEP). Inquire at the college office for details.

Use of Elective Credits—*Use in the Graduate School of Credits Earned While an Undergraduate*—Students who wish to use excess credits earned as an undergraduate for credit in the Graduate School should consult the *Graduate School Bulletin* for current policies. If further information is needed, contact the Graduate School Office, 316 Johnston Hall, University of Minnesota, 101 Pleasant Street S.E., Minneapolis, MN 55455.

Withholding Elective Credit From Courses Offered for Graduation—With the approval of your adviser and the Scholastic Standing Committee, you may request that some elective courses you have completed be omitted from the list of courses counted toward your degree. A maximum of 10 credits of elective courses may be withheld to raise your grade point average, but only in order to satisfy the graduation requirement of a 2.00 grade point average. When a course is withheld from the undergraduate record, it can be reinstated only by an examination for credit or by repeating the course.

Limitations on the Use of Elective Credit in Physical Education and Music—Students in agriculture are not required to take courses in physical education or music. A maximum of 9 credits in physical education and a maximum of 6 credits in chorus or concert band may be counted as elective credits toward graduation.

Special Study Opportunities

Several study opportunities that allow you to earn credits in special ways are described below. In addition to the programs described, many majors offer internship or work-study opportunities. Check with your adviser.

Academic Enrichment and Honors Program—Special Projects—Ag 1000, Special Projects Opportunity, is an alternative to regular classes that allows you to pursue a special interest in depth; to design your own project and earn up to 15 credits for it; to complete research, study, and travel with help from the College of Agriculture; to set your own deadlines and work schedule; and to reach beyond the University for knowledge, resources, and advice. For further information, check with the college office.

Study-Travel—The Study-Travel Opportunity Program offers financial assistance to undergraduate agriculture students who plan to visit a site of professional interest. If you plan a study-travel project, it should complement your academic program but provide a different experience from course field trips. You must initiate and plan the project yourself with the aid of a faculty sponsor. Money is not granted for trips to professional meetings, seminars, short courses, conventions, job interviews, or similar events. For further information, check with the college office.

Enrichment Program in International Agriculture—The University of Minnesota is deeply committed to offering an international dimension in its training, research, and extension programs. The problems of the world's agriculture and food supply are urgent and important. Increasing numbers of students are interested in careers in international agriculture or in opportunities to expand their knowledge of agriculture outside the United States. A special enrichment program in international agriculture is offered by the College of Agriculture, and a certificate in international agriculture is awarded to students completing the program.

The certificate is awarded upon completion of 18 credits of course work related to the international dimension of agriculture. These credits may not include courses used to meet all-college or major requirements. However, courses used to fulfill liberal education distribution requirements or other elective requirements may be used. Some of the courses selected for the enrichment program may be taken outside of the College of Agriculture. The program of study is designed in collaboration with a faculty member. You must submit the program for approval to the Assistant Dean for International Agricultural Programs at least one full academic quarter prior to graduation. Forms for submitting the program, as well as a listing of courses that deal with international agriculture, are available in the college office.

Professional Experience Program (PEP)—Junior and senior students enrolled in curricula offered by the College of Agriculture may voluntarily participate in the Professional Experience Program (PEP). This program is designed for students who wish to reinforce their academic experience by working in an area related to their course of study. Students work full time for 12 weeks during fall, winter, or spring quarter or during the summer. They earn 4 credits for satisfactory completion of a PEP program, and may enroll in two PEP programs for a total of 8 credits. Salaries are paid by the cooperating industries, producers, agencies, and farm families participating in the program. For more information, consult your adviser or the Career Services Office, 272 Coffey Hall.

Enrichment Program in Journalism—Students in the College of Agriculture may select one of several enrichment programs in journalism. The program selected must be approved by an adviser in agricultural journalism in the College of Agriculture. Among the programs available are advertising, news-editorial, science writing, broadcasting, magazine journalism, photography, public relations, and other journalism-related fields. For more information, consult an adviser in agricultural journalism.

Reserve Officers' Training Corps—The ROTC, through its three services—Army, Navy, and Air Force—gives you an opportunity to combine military or naval training with your academic work. You are eligible for ROTC enrollment if you are a U.S. citizen, and if you meet certain physical and other qualifications. The general requirements of the programs of the three services and their special characteristics are described in the *Army-Navy-Air Force ROTC Bulletin*. Inquiries may also be made in person or by letter at the following offices in the Armory Building, University of Minnesota, 15 Church Street S.E., Minneapolis, MN 55455: Military Science, room 108; Naval Science, room 203; Aerospace Studies, room 3.

Double Major

You may find it advantageous to complete the requirements for a second major as part of your undergraduate program. Often this can be done by concentrating electives in the second area, thus permitting you to earn a second major without having to take more than the minimum number of credits required for the bachelor's degree. If you are interested in completing a double major, come to the college office for further information and an application form. You must file the form before you complete the required course work for your second major.

Grading

Academic progress in the College of Agriculture is evaluated by one of two grading systems: the letter grade (A-N) system or the satisfactory-no credit (S-N) system.

A-N System—Under the A-N (A-B-C-D-N) system, each letter grade carries the following meaning:

- A—Represents achievement that is outstanding relative to the level necessary to meet course requirements.
- B—Represents achievement that is significantly above the level necessary to meet course requirements.
- C—Represents achievement that meets the basic course requirements in every respect.
- D—Represents achievement that is worthy of credit even though it does not fully meet the basic course requirements in every respect.
- N—Assigned when the student does not earn a D or higher. It stands for no credit.

The grade point average is determined by dividing the sum of the grade points earned (A = 4.00, B = 3.00, C = 2.00, D = 1.00) by the sum of the credits completed. (Credits of F received prior to fall quarter 1972 are included in the sum of the credits.) A cumulative average of 2.00 (C) is required for graduation. Additional grade point average requirements may be found under the individual curricular listings in section II of this bulletin.

S-N System—The S-N system is an alternative to the traditional grading system designed to encourage students to seek greater breadth in their educational experience.

Under the S-N system, the grade S stands for satisfactory and the grade N for no credit. The S represents achievement that is satisfactory to the instructor, for the program in which you are registered. This definition is intended to imply that the standards for S may vary from one program to another. The instructor is obligated to define to a class in its early meetings, as explicitly as possible, the performance necessary to earn an S. An N is assigned if you do not earn an S.

The following principles have been adopted as a guide for use of the S-N grading system by College of Agriculture students:

1. All courses open to undergraduate students (those numbered below 8000) may be taken on the S-N or A-N basis, except where specifically restricted by the

General Information

department offering the course. Consult the course descriptions in section III of this bulletin for courses with restricted grading.

2. Candidates for the baccalaureate degree from the college may present a maximum of 25% of the residence credits offered for graduation in courses in which they received grades of S.
3. S-N grading may be selected by students of the college regardless of their academic standing.
4. The choice of S-N grading must be declared at the time of registration and may be changed only up to the opening day of the third week of classes.
5. Courses identified by number and title as being required must be taken under the A-N system. Prerequisites for required courses and courses in the major must also be taken under the A-N system, unless exceptions are established. Generally, you may take under S-N grading only elective courses and courses used to satisfy all-college requirements that are not specified by number and title for your major requirements.

Your adviser or staff members in the college office can answer questions concerning the use of the S-N system.

Other Symbols

- I—Assigned by an instructor to indicate incomplete work, in accordance with provisions announced in class at the beginning of the quarter, when in the instructor's opinion there is a reasonable expectation that the student can complete successfully the work of the course. An I that is not made up by the end of the next quarter in residence becomes an N; instructors may set dates within the quarter for make up of examinations or work. When an I is changed to a grade, the I is removed from the record.
- W—Indicates official withdrawal from a course without grade. The W is assigned in all cases of official cancellation during the first six weeks of a quarter. After the second week, the approval of the instructor and adviser are required for withdrawal. Withdrawal from a course after the sixth week is strongly discouraged unless extenuating circumstances exist. Cancellations after the eighth week of a quarter are seldom approved.
- V—Indicates registration as an auditor or visitor, a noncredit, nongrade registration.
- T—Posted on the transcript as a preceding supplement to the original grade to indicate credits transferred from another institution or from one college or campus to another within the University when reevaluation is required.
- X—Reported in a two- or three-quarter continuing course in which a grade cannot be determined until the full sequence is completed. The instructor submits a grade for each X when the student has completed the sequence.

Dean's List—The Dean's List, published at the end of fall, winter, and spring quarters, is one way that the College of Agriculture recognizes outstanding academic performance by its students. To qualify, you must complete at least 12 credits for the quarter with a grade point average of 3.70 or better. It is noted on your transcript when you qualify.

Scholastic Requirements

Honor Point System—College of Agriculture students are expected to maintain an academic standing that will enable them to meet minimum requirements for graduation upon completion of the required number of credits in the major that they have selected. To aid in the early identification of students who are not making satisfactory progress so that appropriate assistance can be provided, the following system has been developed.

An honor point total (HPT) is calculated for each student at the end of each quarter based on points assigned to the letter grades earned (A = 2 honor points per credit, B = 1, C or S = 0, D = -1, N = -2, W [after sixth week of quarter] = -2).

Students whose HPT for a given quarter is a negative figure are referred to an adviser or a department scholastic standing committee for action. If a student's honor point deficiency is less than 10, the matter is handled by the adviser; if it is 10 or more, by a committee. In either case, the purpose of the meeting is to determine the causes for the poor performance and to establish reasonable goals that the student will be expected to meet during the next quarter in residence. Students who do not meet these goals are referred to the college Scholastic Standing Committee for appropriate action, which may involve suspension from the college.

Students whose cumulative honor point deficiencies at the end of spring quarter are 15 or more will not be permitted to register in the college until they have received permission to do so from the Scholastic Standing Committee. If this approval is granted, specific goals will be established and the student will be expected to meet them. Students who do not meet these goals may be suspended from the college.

Students who entered the College of Agriculture for the first time in or after fall quarter 1977 will not be permitted to graduate with an overall negative honor point total. Students who enter the college for the first time in or after fall quarter 1981 will not be permitted to graduate with a negative honor point total either overall or in the major.

Appeal System—Decisions by the adviser, department scholastic standing committee, and subcommittees of the college Scholastic Standing Committee may be appealed to the college Scholastic Standing Committee, whose decisions in turn may be appealed to the dean of the College of Agriculture.

Repeating Courses—Students may repeat, for credit, courses in which they have received grades of N or D, and only the credits and grades earned in the last attempt will be counted toward graduation. (The grades previously earned, however, will remain on the transcript.) Students who want to repeat courses in which they received grades of C or S must petition the Scholastic Standing Committee for approval to do so. Repeating for credit courses in which grades of A or B have been received is not permitted.

Honor System—Under review at the present time.

Scholastic Conduct

The college has defined scholastic dishonesty broadly as any act that violates the rights of another student in academic work or that involves misrepresentation of a student's own work. Scholastic dishonesty includes (but is not necessarily limited to) cheating on assignments or examinations; plagiarizing, which means misrepresenting, as a student's own work, any part of work done by another; submitting the same paper, or substantially similar papers, to meet the requirements of more than one course without the approval and consent of all instructors concerned; depriving another of necessary course materials; or interfering with another student's work.

When a case of scholastic dishonesty arises, the College of Agriculture faculty member who is the instructor for the course may modify the grade for the exam or piece of work in question or the course grade, or refer the incident to the Scholastic Standing Committee for disposition. In any case, the instructor must report the incident and the action taken by the instructor to the college Scholastic Standing Committee. At the time of the action, the student is informed by the instructor of his or her right to ask for a hearing by the Scholastic Standing Committee. Information on this process is available from the College of Agriculture Office.

The Scholastic Standing Committee reviews all reports of academic dishonesty filed with it by faculty members. The committee maintains confidential records of such reports for five years. These records are separate from students' academic records and are used only by the committee and in consideration of cases of scholastic dishonesty.

General Information

If the student involved is a College of Agriculture student, then the Scholastic Standing Committee may also, in addition to the actions available to the instructor, place the student on disciplinary probation or suspend the student from the college. If the case involves students or faculty from another college, the committee refers the matter to the Campus Committee on Student Behavior.

The student may appeal the decision of the instructor to the Scholastic Standing Committee, and may appeal the decision of the Scholastic Standing Committee to the Campus Committee on Student Behavior. This may lead to the President's Student Behavior Review Panel, which has final jurisdiction.

Graduation Requirements

Bachelor's Degrees—Candidates are recommended for graduation after they:

1. Complete the prescribed curriculum, including required and elective courses to meet the total number of credits required;
2. Earn a minimum cumulative grade point average of 2.00 overall and in the major; (GPA requirement of 2.00 in the major is effective for students who enter the college for the first time in or after fall quarter 1981); and
3. Meet the honor point total requirements as stated under Scholastic Requirements above.

Graduation application deadlines are set by the college office and are two quarters before your expected graduation. The deadline will be published in the college *Kiosk*, an information sheet that you will receive each quarter with your registration materials. You will be responsible for knowing these deadlines. *Extensions of deadlines are rarely granted.* You will turn in your application to the Office of Admissions and Records, 130 Coffey Hall.

Residency Requirements—In addition to meeting University residency requirements as outlined in the *General Information Bulletin*, baccalaureate degree candidates in the College of Agriculture must earn 30 of their last 45 credits while enrolled in the College of Agriculture as a student in good standing.

Graduation With Distinction and High Distinction—Graduation "with high distinction" is limited to the top 3% of the graduating class; "with distinction" to the next 7% of the graduating class.

The calculation of the grade point average to determine the class rank is based on the last 90 credits taken prior to graduation. Only graduating students who have completed at least 90 credits as a student in the College of Agriculture are eligible for honors designations, regardless of the level of their academic performance.

Career Services Office

To help you secure employment after graduation, the Career Services Office, 272 Coffey Hall, announces job opportunities and assists in arranging interviews with employer representatives. Although the Career Services Office concentrates on full-time jobs for graduates, the Professional Experience Program—an intern program—is also offered to juniors and seniors currently enrolled in the college.

All-University Personnel Services

Numerous specialized personnel services are provided by the University for all students. You will be given additional information about many of these organizations at your orientation-registration program.

Student Organizations

College of Agriculture Student Board—The College of Agriculture Student Board promotes student involvement in issues related to the quality and content of education both in and out of the classroom. This purpose is achieved through channels of communication created by the board between the students, faculty, and administration of the College of Agriculture. Through the board, students participate in such matters as consideration of proposed curricula, questions related to instruction, improvement of educational facilities, development of administrative policy, and establishment of the goals of the College of Agriculture. Further information related to the board and its operation may be obtained in 277 Coffey Hall.

St. Paul Campus Board of Colleges—The St. Paul Campus Board of Colleges directs and coordinates student activities and encourages student leadership throughout the St. Paul campus. Its membership is drawn from the Colleges of Agriculture, Biological Sciences, Forestry, Home Economics, and Veterinary Medicine. The board brings questions from the student bodies to the administration of the colleges and discusses problems and reaches decisions on matters of general interest. The board cooperates with the Twin Cities Student Association (TCSA) and the Senate Committee on Student Affairs.

As a student in the College of Agriculture, you may file for election to this board. Inquire at the Office for Student Affairs, 190 Coffey Hall, for more information.

Student Center Board of Governors—The St. Paul Student Center provides a varied program of social, cultural, and recreational activities and contributes in many ways to the educational objectives of the campus. The St. Paul Student Center Board of Governors, composed of students elected to represent the academic units on the St. Paul campus, formulates policies for operation of the student center and establishes its budget. For information about the St. Paul Student Center, its operation, and opportunities to serve on its various planning and programming committees, inquire at the information desk on the first floor of the student center.

Freshman Board—This group, which meets in the homes of St. Paul campus faculty members, gives you an opportunity to learn about the University—its organization and administration, its governance procedures, and students' roles in decision making. Freshman students may apply for membership during the two-week orientation-registration program in August or during Welcome Week in September. For further information, inquire at the Office for Student Affairs, 190 Coffey Hall.

Student Representation on College and University Committees—All College of Agriculture committees and most all-University committees have student representatives. For college committees, selection is made by the College of Agriculture Student Board. For all-University committees, watch for announcements in the *Minnesota Daily* and on bulletin boards around the campuses about filing for positions.

Other College of Agriculture Student Organizations—Many of the undergraduate programs sponsor student clubs. Membership and participation in these organizations can add a valuable dimension to your academic program and contribute a great deal to your professional development. Check with your adviser for further information.



The Hort Club sponsors an annual spring plant sale.

II. PROGRAMS

The requirements for the College of Agriculture programs presented in alphabetical order below are for high school graduates directly entering the college. Students planning to transfer to the college should check with their counselors to be sure they complete courses equivalent to those required.

At the end of this section is information on *All-College Requirements* and on *Agricultural Science and Industries Curriculum Requirements*.

Agricultural Business Administration

Department of Agricultural and Applied Economics
231 Classroom-Office Building (612/373-1755)

The agricultural business administration curriculum is offered jointly by the Department of Agricultural and Applied Economics and the School of Management. Work in the curriculum emphasizes economic analysis and business organization and management principles relating to agricultural businesses and industries that manufacture and supply materials for farm production (feed, seed, fertilizers, machinery, equipment, pharmaceuticals), and assemble, process, market, transport, and distribute food and fiber products. The program provides a balance between agricultural and applied economics and business administration studies, with a limited amount of agricultural science. You may elect a variety of courses in your junior and senior years to accommodate your interests and career goals.

As a graduate of the curriculum you will be prepared for employment as a manager or administrator or for managerial-related positions in agribusiness. Examples of employment areas include commodity trading and analysis, finance, management, marketing, sales management, administration, public and industrial relations, production management, economic and statistical analysis, operations research and reporting, managerial accounting, and transportation analysis. After graduation you may seek employment in one of these areas, or you may enter graduate study in preparation for research, teaching, or continuing education positions in academic institutions or for positions in research agencies or industry.

Major Requirements

Agricultural business administration students must complete the requirements listed below. Consult with your adviser to determine a suitable sequence for completing the required courses. Course substitutions in categories A, B, C, and D may be made only with the approval of the college office, and in categories E and F only with the approval of your adviser and the Department of Agricultural and Applied Economics.

A. Communication, Language, Symbolic Systems

- Math 1131—Finite Mathematics
 - Rhet 1101—Writing to Inform and Persuade (4)
 - Rhet 1104—Library Laboratory (1) S-N
 - Rhet 1151—Writing in Your Major (4)
 - Rhet 1222—Public Speaking (4)
 - Rhet 3562—Writing in Your Profession (4)
- One of the following courses:
- Rhet 3254—Advanced Public Speaking (4)
 - Rhet 3266—Discussion Methods (4)
 - Rhet 5561—Writing for Publication (4)
- Math 1142—Short Calculus (5) is recommended.

B. Physical and Biological Sciences—20 credits minimum, to be selected from the following courses:

- BioC 1301—Elementary Biochemistry I (5)
- BioC 1302—Elementary Biochemistry II (3)

Programs

Biol 1009—General Biology (5)
Biol 1103—General Botany (5)
Biol 1106—General Zoology (5)
Chem 1001—Chemical Principles and Covalent Systems (5)
Chem 1002—Chemical Principles and Covalent Systems (5)
Chem 1004—General Principles of Chemistry (5)
Chem 1005—General Principles of Chemistry (5)
EBB 3001—Introduction to Ecology (4)
(or) EBB 3004—Fundamentals of Ecology (4)
Geo 1001—Physical Geology (5)
MicB 3103—General Microbiology (5)
Phys 1001, 1005—The Physical World and Laboratory (4, 1)
Phys 1041, 1045—Introductory Physics and Laboratory (4, 1)
Phys 1042, 1046—Introductory Physics and Laboratory (4, 1)
BioC 1301, Biol 1009, Chem 1001 are strongly recommended.

C. The Individual and Society—15 credits minimum

See All-College Requirements (end of section II). One course required in the area of Development of Civilization.

Psy 1001—General Psychology (5)
Soc 1001—Introduction to Sociology (4)
(or) Soc 1651—Rural Sociology (4)

Note: No courses in agricultural economics or economics may be used to meet this requirement except AgEc 3040—Economic Development of American Agriculture (4).

D. Literature, Humanities, and Fine Arts—8 credits minimum

See All-College Requirements (end of section II).

E. Professional Courses in the Major

Business Administration

Mgmt 3001—Fundamentals of Management (4)
Mgmt 3004—Business Policy: Strategy Formulation and Implementation (5)
(or) AgEc 3290—Agribusiness Management (4)
QA 1050—Elementary Managerial Statistics (4)
(or) Stat 1051—Introduction to Ideas of Statistics (4)
MIS 3098—Elementary COBOL (1)
(or) MIS 3099—Elementary FORTRAN (1)
(or) CSci 3101—A FORTRAN Introduction to Computer Programming (4)
(or) CSci 3102—Introduction to Pascal Programming (4)
(or) CSci 3104—Introduction to Programming and Problem Solving (5)
(or) PsyF 5330—Computer Programming (3)

Plus 16 credits to be selected from the courses listed below:

At least two of these courses:

OM 3000—Introduction to Operations Management (4)
QA 3055—Introduction to Management Sciences (4)
BLaw 3058—Introduction to Law, and the Law of Contracts and Agency (4)
MIS 3300—Introduction to Computers and Management Information Systems (4)
(or) MIS 3100—Introduction to Computers and Computer Data Processing (4)
(and) MIS 3101—Introduction to Management Information Systems (4)

Other courses that may be used to fulfill the 16-credit requirement are:

Mktg 3000—Principles of Marketing (4)
Ins 3100—Risk Management and Insurance (4)
Tran 3054—Fundamentals of Transportation (4)
IR 3002—Industrial Relations Systems: Labor Markets and the Management of Human Resources (4)
(or) IR 3010—Human Relations and Applied Organization Theory (4)

Economics and Accounting

Acct 1024—Principles of Financial Accounting I (3)
Acct 1025—Principles of Financial Accounting II (3)
Acct 3001—Principles of Managerial Accounting (4)
AgEc 1000—Orientation to Agricultural and Applied Economics (1)
AgEc 1020—Principles of Macroeconomics (5)
AgEc 1030—Principles of Microeconomics (4)
AgEc 1400—Agricultural Markets and Prices (4)
AgEc 3101—Microeconomic Theory (4)
AgEc 3102—Macroeconomic Theory (4)
AgEc 3500—Farm and Agribusiness Finance (5)
(or) BFin 3000—Finance Fundamentals (4)
AgEc 3710—Agricultural and Market Policies (4)
Plus 11 additional credits in agricultural economics

F. Agricultural Science Courses

A minimum of 20 credits in agricultural science courses including at least 4 credits in animal science and 4 credits in agronomy. Courses in agricultural education, agricultural journalism, fisheries and wildlife, landscape architecture, rhetoric, or the physical and biological sciences may not be used to meet this requirement. In agricultural engineering, only AgET 3205, 3215, 3410, 3606, 3610, and 3615 may be used.

G. Electives to complete the 192 credits required for graduation with the bachelor of agricultural business administration degree.

Agricultural Economics

*Department of Agricultural and Applied Economics
231 Classroom-Office Building (612/373-1755)*

Students who plan to work in economic or business management phases of agricultural production or industries related to agriculture where a rather extensive knowledge of the technical aspects of the work is involved will find a concentration in agricultural economics useful. (If you expect to be employed in business management and desire less technical training in agriculture, you may find the curriculum in agricultural business administration more suitable. Either program is appropriate if you plan to pursue graduate work in agricultural economics.)

In this curriculum, you may complete studies in one of three areas of emphasis within agricultural economics: agricultural finance, agricultural marketing, or farm management. Other areas of emphasis are possible and may be developed by the individual student.

Major Requirements

All students in the agricultural economics major must complete the requirements listed below. Course substitutions in categories A, B, C, and D may be made only with the approval of the college office, and in categories E and F only with the approval of your adviser and the Department of Agricultural and Applied Economics.

A. Communication, Language, Symbolic Systems

- Math 1111—College Algebra and Analytical Geometry (5)
- (or) Math 1201—Pre-Calculus (5)
- Rhet 1101—Writing to Inform and Persuade (4)
- Rhet 1104—Library Laboratory (1) S-N
- Rhet 1151—Writing in Your Major
- Rhet 1222—Public Speaking (4)
- Rhet 3562—Writing in Your Profession (4)
- Stat 1051—Introduction to Ideas of Statistics (4)
- (or) QA 1050—Elementary Managerial Statistics (4)

B. Physical, Biological, and Analytical Sciences

See Agricultural Science and Industries Curriculum Requirements (end of section II).

C. The Individual and Society—15 credits minimum

See All-College Requirements (end of section II). One course required in the area of Development of Civilization.

Note: No course in agricultural economics or economics may be used to meet this requirement except AgEc 3040—Economic Development of American Agriculture (4).

D. Literature, Humanities, and Fine Arts—8 credits minimum

See All-College Requirements (end of section II).

E. Professional Courses in the Major

- AgEc 1000—Orientation to Agricultural and Applied Economics (1)
- AgEc 1020—Principles of Macroeconomics (5)
- AgEc 1030—Principles of Microeconomics (4)
- AgEc 1250—Principles of Accounting (5)
- AgEc 1400—Agricultural Markets and Prices (4)
- AgEc 3101—Microeconomic Theory (4)

Programs

AgEc 3102—Macroeconomic Theory (4)
AgEc 3710—Agricultural and Market Policies (4)
AgEc 3820—Farm Management Economics (4)
Plus 11 additional credits in agricultural economics

Courses suggested to fulfill the areas of emphasis are listed below.

Agricultural Finance

AgEc 3500—Farm and Agribusiness Finance (5)
AgEc 5500—Advanced Agricultural Finance (4)

At least one of the following courses:

AgEc 3290—Agribusiness Management (4)
AgEc 3830—Organizing the Farm Business for Entry, Growth, and Transfer (4)
AgEc 3850—Farm Business and Enterprise Analysis (4)
AgEc 5440—Cooperatives and Agribusiness Organization (4)
AgEc 5480—Futures, Markets, and Prices (4)
AgEc 5600—Land Economics (4)
AgEc 5840—Management of the Farm Business (4)

Agricultural Marketing

At least 11 credits selected from:

AgEc 3420—Grain Marketing Economics (3)
AgEc 3430—Dairy Marketing Economics (3)
AgEc 3440—Livestock Marketing Economics (3)
AgEc 5400—Intermediate Market and Price Analysis (4)
AgEc 5440—Cooperatives and Agribusiness Organization (4)
AgEc 5480—Futures, Markets, and Prices (4)

Farm Management

AgEc 3500—Farm and Agribusiness Finance (5)
AgEc 3830—Organizing the Farm Business for Entry, Growth, and Transfer (4)

At least one of the following courses:

AgEc 3420—Grain Marketing Economics (3)
AgEc 3430—Dairy Marketing Economics (3)
AgEc 3440—Livestock Marketing Economics (3)
AgEc 3831—Organizing the Farm Business for Entry, Growth, and Transfer Lab (1-3)
AgEc 3850—Farm Business and Enterprise Analysis (4)
AgEc 5020—Applied Linear Programming (4)
AgEc 5480—Futures Markets and Prices (4)
AgEc 5840—Management of the Farm Business (4)

Pregraduate¹

At least 11 credits selected from (in lieu of 11 credits in AgEc):

Econ 3103—Welfare Economics (4)
Econ 5151—Elements of Economic Analysis: Firm and Household (3)
Econ 5152—Elements of Economic Analysis: Income and Employment (3)
AgEc 5750—Agricultural Trade (4)
AgEc 5860—Economics of Agricultural Production (4)

Plus four courses from the following:

Math 1211—Calculus I (5)
Math 1221—Calculus II (5)
Math 1231—Calculus III (5)
Math 3142—Introduction to Linear Algebra (4)
Math 3211—Multivariable Calculus (5)
Stat 5021—Statistical Analysis I (5)
Stat 5022—Statistical Analysis II (5)
Stat 5121—Theory of Statistics (4)
Stat 5122—Theory of Statistics (4)

F. Agricultural Science Courses

A minimum of 27 credits in agricultural science courses including at least 4 credits in animal science and 4 credits in agronomy. Courses in agricultural education, agricultural journalism, fisheries and wildlife, landscape architecture, rhetoric, or the physical and biological sciences may not be used to meet this requirement. In agricultural engineering, only AgET 3205, 3215, 3410, 3606, 3610, and 3615 may be used.

G. Electives to complete the 192 credits required for graduation with the bachelor of science degree.

¹This option is recommended for students who plan to enter graduate school.

Minor Requirements

The department offers two minors. The minor in agricultural economics is highly structured to require minimal advising by department faculty. The minor in applied economics is much more flexible and must be developed with the assistance of an adviser from the department. (These minors are not available to majors in the Department of Agricultural and Applied Economics.)

A. Agricultural Economics Minor

Required Courses:

- AgEc 1020—Principles of Macroeconomics (5)
- (or) Econ 1001—Principles of Macroeconomics (4)
- AgEc 1030—Principles of Microeconomics (4)
- (or) Econ 1002—Principles of Microeconomics (4)
- AgEc 1250—Principles of Accounting (5)
- AgEc 1400—Agricultural Markets and Prices (4)
- (or) AgEc 3820—Farm Management Economics (4)
- AgEc 3101—Microeconomic Theory (4)
- (or) Econ 3101—Microeconomic Theory (4)

Optional Courses (at least two):

- AgEc 1400—Agricultural Markets and Prices (4)
- AgEc 3420—Grain Marketing Economics (3)
- AgEc 3430—Dairy Marketing Economics (3)
- AgEc 3440—Livestock Marketing Economics (3)
- AgEc 3500—Farm and Agribusiness Finance (5)
- AgEc 3820—Farm Management Economics (4)
- AgEc 3830—Organizing the Farm Business for Entry, Growth, and Transfer (4)
- AgEc 3850—Farm Business and Enterprise Analysis (4)
- AgEc 5400—Intermediate Market and Price Analysis (4)
- AgEc 5440—Cooperatives and Agribusiness Organization (4)
- AgEc 5480—Futures, Markets, and Prices (4)
- AgEc 5840—Management of the Farm Business (4)

B. Applied Economics Minor

- AgEc 1020—Principles of Macroeconomics (5)
- (or) Econ 1001—Principles of Macroeconomics (4)
- AgEc 1030—Principles of Microeconomics (4)
- (or) Econ 1002—Principles of Microeconomics (4)
- AgEc 3101—Microeconomic Theory (4)
- (or) Econ 3101—Microeconomic Theory (4)

Plus 16 credits in agricultural economics or economics agreed upon by the student and an adviser from agricultural and applied economics.

Agricultural Education

*Department of Vocational and Technical Education
320 Vocational-Technical Education Building (612-373-1021)*

The major in agricultural education, offered jointly with the College of Education, is designed for students who plan to teach agriculture or horticulture in public schools, area vocational-technical institutes, or community colleges in Minnesota. The program provides comprehensive training in agriculture and permits emphasis in animal science, agronomy, agricultural economics, horticulture, soils, or mechanized agriculture for those preparing for extension work, other professional careers in the field, or farming. It also offers the special training in education necessary for recommendation for licensure as an instructor of agriculture or horticulture.

Students should apply for admission to the College of Education in the final quarter of their sophomore year. This application may be completed in the Division of Agricultural Education, 320 Vocational-Technical Education Building. Students must complete the application requirements as directed by the Agricultural Education staff. To be eligible for admission, you must have a grade point average of at least C (2.00) for all courses taken at the University of Minnesota, Twin Cities campus.

Programs

Transfer students who have completed fewer than two years of college work apply for admission to the College of Agriculture. These students will then apply to the College of Education in the quarter in which they complete their sophomore year.

Transfer students who have completed two or more years of college work apply for joint admission to the College of Agriculture and the College of Education at the Office of Admissions and Records, 130 Coffey Hall, University of Minnesota, 1420 Eckles Avenue, St. Paul, MN 55108. The College of Agriculture will review the application. Upon acceptance into the College of Agriculture, these students will be accepted by the College of Education.

To be eligible for student teaching, you must have a grade point average for course work taken on the Twin Cities campus of at least 2.00 overall and at least 2.30 in technical agriculture courses in your area of specialization, as follows:

Vocational Agriculture Specialization

2.30 GPA in courses in agricultural economics, agronomy, animal science, entomology, food science, forestry, horticulture, agricultural journalism, agricultural engineering technology, plant pathology, soils, and veterinary medicine.

Vocational Horticulture Specialization

2.30 GPA in entomology, forestry, plant physiology, horticulture, agricultural engineering technology, plant pathology, agricultural economics, and soils.

Agricultural Education (Non-licensure) Specialization

2.30 GPA overall. 80 credits minimum in technical agriculture and 192 credits total for graduation.

Students applying for the agricultural education specialization must have a satisfactory background in agriculture. Those entering the horticultural education specialization must have a satisfactory background in horticulture. The Division of Agricultural Education Occupational Experience Committee evaluates student experience. Both curricula require a minimum of 80 credits in technical agriculture course work and a total of 192 credits for graduation.

Each student is expected to complete the liberal education distribution requirements as detailed under Agricultural Science and Industries Curriculum Requirements near the end of section II.

Major Requirements

Students majoring in agricultural education must complete the requirements listed below. Course substitutions in categories A, B, C, and D may be made only with the approval of the college office, and in categories E and F only with the approval of your adviser and the Division of Agricultural Education.

A. Communication, Language, Symbolic Systems

See Agricultural Science and Industries Curriculum Requirements (end of section II).

B. Physical, Biological, and Analytical Sciences

See Agricultural Science and Industries Curriculum Requirements (end of section II).

Note: Agricultural Education majors may complete the one-quarter physics sequence, Phys 1001 and 1005—The Physical World and Laboratory.

C. The Individual and Society—14 credits minimum

See All-College Requirements (end of section II). One course required in the area of Development of Civilization.

AgEc 1020—Principles of Macroeconomics (5)

AgEc 1030—Principles of Microeconomics (4)

Psy 1001—General Psychology (5)

D. Literature, Humanities, and Fine Arts—8 credits minimum

See All-College Requirements (end of section II).

E. Professional and Supporting Courses in the Major—46 credits minimum (applies only to Vocational Agriculture and Horticulture specializations)

- AgEd 1001—Introduction to Agricultural Education (1)
- AgEd 1010—History and Philosophy of Vocational and Community Education (3)
- AgEd 3010—Organization and Direction of FFA Activities (2)
- AgEd 3031—Student Teaching in Agriculture (8)
- AgEd 5028—Teaching Methods in Agricultural Education (5)
- AgEd 5049—Agricultural Education for Adults (5)
- AgEd 5061—Program Planning and Evaluation (3)
- AgEd 5071—Supervised Occupational Experiences in Agriculture (3)
- PsyF 3380—Introduction to Human Relations (3)
- PubH 3004—Basic Concepts in Personal and Community Health (5)
- VoEd 5800—Working With Special Needs Students (3)
- (or, with permission of adviser) PsyS 3106—Exceptional Students in Regular Classes (2)
- SeEd 3155—Psychological Foundations of Secondary Education (5)
- AgEd 3041—Practicum: Agricultural Education Technology Supervised Occupational Experience (1-3; 1 credit required)

F. Specializations

In addition to the requirements listed in category E above, you must complete requirements for one of the specializations listed below:

Vocational Agriculture Specialization—80 credits minimum

- AgEc 1020—Principles of Macroeconomics (5)
- AgEc 1030—Principles of Microeconomics (4)
- AgEc 3820—Farm Management Economics (4)
- AgEc 3850—Farm Business and Enterprise Analysis (4)
- AgEd 5072—Practicum: Agricultural Business and Industry (3)
- AgET 1020—Agricultural Shop—Metalwork (4)
- AgET 5020—Program Planning and Instructional Methods in Agricultural Mechanics (4)
- Agro 1010—Principles of Agronomy (4)
- AnSc 1100—Introductory Animal Science (5)
- AnSc 3401—Principles of Animal Nutrition (3)
- AnSc 3402—Applied Animal Nutrition (3)
- (or) AnSc 5601—Swine Production (4)
- (or) AnSc 5602—Sheep Production (4)
- (or) AnSc 5603—Beef Cattle Production (4)
- (or) AnSc 5604—Dairy Farm Management (4)
- (or) AnSc 5605—Poultry Production (4)
- Ent 1005—Economic Entomology (4)
- Hort 1010—Home Horticulture (4)
- Soil 1122—Introductory Soil Science (4)
- Plus 24-26 additional credits in technical agriculture

Vocational Horticulture Specialization—80 credits minimum

- AgEc 1020—Principles of Macroeconomics (5)
- AgEc 1030—Principles of Microeconomics (4)
- AgEd 5072—Practicum: Agricultural Business and Industry (3)
- AgET 3205—Power and Power Use (4)
- AgET 5020—Program Planning and Instructional Methods in Agricultural Mechanics (4)
- Ent 1005—Economic Entomology (4)
- Hort 1100—Biology of Horticultural Production (4)
- Hort 1016—Greenhouse Management (3)
- Hort 1036—Plant Propagation (4)
- PIPa 1001—Introductory Plant Pathology (5)
- PIPh 3131—Survey of Plant Physiology (4)
- Soil 1122—Introductory Soil Science (4)
- Plus 18 additional credits in horticulture and 13 additional credits in technical agriculture

Agricultural Education (Non-licensure) Specialization—80 credits minimum

Required Courses (41 credits):

- AgEc 1020—Principles of Macroeconomics (5)
- AgEc 1030—Principles of Microeconomics (4)
- AgET 1020—Agricultural Shop—Metalwork (4)
- Agro 1010—Principles of Agronomy (4)
- Agro 1100—Morphology and Identification of Crops and Weeds (4)
- AnSc 1100—Introductory Animal Science (5)
- AnSc 3401—Principles of Animal Nutrition (3)
- Ent 1005—Economic Entomology (4)

Programs

- PIPa 1001—Introductory Plant Pathology (4)
Elective Courses (39 credits)—Five courses from the following:
AgEc 1400—Agricultural Markets and Prices (4)
AgEc 3820—Farm Management Economics (4)
AgEc 3850—Farm Business and Enterprise Analysis (4)
AgET 3205—Power and Power Use (4)
AgET 3215—Machinery and Equipment (4)
AgET 3610—Electricity in Agriculture (4)
Agro 1110—Seed Analysis and Grain Grading (3)
AnSc 1110—Dairy Cattle Evaluation (2)
AnSc 1120—Livestock and Meat Evaluation (4)
AnSc 1520—Milk Production (3)
AnSc 3131—Live Animal Performance and Selection (3)
AnSc 3402—Applied Animal Nutrition (2)
Ent 5210—Integrated Pest Management (5)
Soils 3518—Seminar: FFA Land Judging (1)
Professional and Supporting Courses in Specialization (23 credits minimum):

- AgEd 1001—Introduction to Agricultural Education (1)
AgEd 1010—History and Philosophy of Vocational and Community Education (3)
AgEd 5021—Education Through Extension Methods (3)
(or) AgEd 5128—Methods of Teaching (3)
AgEd 5025—Extension Program Development (3)
(or) AgEd 5061—Program Planning and Evaluation (3)
AgEd 3010—Organization and Direction of FFA Activities (2)
(or) AgEd 5200—Seminar: Working With Youth Through Adults (1-3)
3 credits minimum in one of the following courses:
AgEd 5072—Practicum: Agricultural Business and Industry (1-3)
(or) AgEd 5027—Practicum: Extension Experiences (2-6)
(or) AgEd 3029—Directed Experience in Agricultural Education (1-3)
Plus additional education credits, chosen with consent of adviser, to meet the 23-credit total.

G. Electives to complete the 192 credits required for graduation with the bachelor of science degree.

Agricultural Engineering

A four-year professional curriculum leading to the degree of bachelor of agricultural engineering, B.Ag.E., is offered jointly with the Institute of Technology. Students register in the Institute of Technology. Emphasis in the curriculum is on the physical sciences and engineering design, but economics, agricultural science, and other subjects are included. The objective is to prepare students for careers in developing and applying new and improved machines, structures, and systems in order to expand production of crops and livestock in the United States and abroad, reduce the dependence of agriculture on labor, and use soil, water, and energy resources wisely.

For more information, write to the Department of Agricultural Engineering, 213 Agricultural Engineering, University of Minnesota, 1390 Eckles Avenue, St. Paul, MN 55108.

Curriculum and course information is printed in the *Institute of Technology Bulletin*.

Agricultural Engineering Technology

Department of Agricultural Engineering
213 Agricultural Engineering (612/373-1304)

Agricultural engineering technology is an undergraduate curriculum offered by the Department of Agricultural Engineering. Within the curriculum, you may choose a program emphasizing the use and development of farm machines, equipment, structures, and processing as related to your interests in animals, plants, soils, water, and wastes. Your program can stress either management or technology in production agriculture and related industries, but students usually combine studies in both. Programs emphasize studies in the biological sciences and in principles derived from the engineering sciences. This background can help you to develop useful solutions to agricultural and biological problems.

You develop an individualized program in cooperation with your adviser. The program is built on a foundation of required and suggested courses. In addition, you may take

courses in another discipline to give your program of study a secondary emphasis, or you may construct a broad program composed of closely related subject matter from several disciplines.

As a graduate, you may find employment in the technical phases of agricultural production and related industries where you can apply the principles of engineering technology to solving problems.

Major Requirements

Students selecting the agricultural engineering technology major must complete the requirements listed below. Course substitutions in categories A, B, C, and D may be made only with the approval of the college office, and in categories E and F only with the approval of your adviser and the Department of Agricultural Engineering.

A. Communication, Language, Symbolic Systems

- Math 1111—College Algebra and Analytical Geometry (5)
- Math 1142—Short Calculus (5)
- Rhet 1101—Writing to Inform and Persuade (4)
- Rhet 1104—Library Laboratory (1) S-N
- Rhet 1151—Writing in Your Major (4)
- Rhet 1222—Public Speaking (4)
- Rhet 3562—Writing in Your Profession (4)

B. Physical, Biological, and Analytical Sciences

- BioC 1301—Elementary Biochemistry I (5)
- Biol 1009—General Biology (5)
- Biol 1103—General Botany (5)
- (or) Biol 1106—General Zoology (5)
- Chem 1004—General Principles of Chemistry (5)
- Chem 1005—General Principles of Chemistry (5)
- Phys 1041, 1045—Introductory Physics and Laboratory (4, 1)
- Phys 1042, 1046—Introductory Physics and Laboratory (4, 1)
- Plus one additional course selected from category B of the Agricultural Science and Industries Curriculum Requirements (end of section II).

C. The Individual and Society—14 credits minimum

- See All-College Requirements (end of section II). One course required in the area of Development of Civilization.
- AgEc 1020—Principles of Macroeconomics (5)
- AgEc 1030—Principles of Microeconomics (4)

D. Literature, Humanities, and Fine Arts—8 credits minimum

- See All-College Requirements (end of section II).

E. Professional Courses in the Major

- AgET 3610—Electricity in Agriculture (4)
- AgET 5021—Mechanics of Agricultural Systems (4)
- AgET 5022—Energy Systems in Agriculture (4)
- AgET 5023—Fluids—Principles and Systems (4)
- CSci 3101—A FORTRAN Introduction to Computer Programming (4)
- (or) CSci 3102—Introduction to Pascal Programming (4)
- IND 1600—Drafting (3)

Plus a minimum of five courses from groups 1, 2, 3, and 4 below. At least one course must be selected from each of the first three groups.

Group 1

- AgET 3205—Power and Power Use (4)
- AgET 3215—Machinery and Equipment (4)

Group 2

- AgET 3410—Hydrology, Water Control (4)
- AgET 5400—Drainage and Irrigation (4)

Group 3

- AgET 3606—Farm Building Design, Layout, Systems (4)
- AgET 3615—Crop Processing and Storage (4)

Group 4

- AgET 5027—Appropriate Technology for International Development (4)
- AgET 3800—Rural Sanitation and Water Supply (4)

Programs

F. Supporting Courses

A minimum of 20 credits in agricultural science courses. Courses in agricultural education, fisheries and wildlife, landscape architecture, or rhetoric may not be used to meet this requirement.

G. Electives to complete the 192 credits required for graduation with the bachelor of science degree.

Minor Requirements

The department offers two minors for students seeking stronger backgrounds in applications of technology to production agriculture and related industries. The minor in agricultural engineering technology emphasizes principles from the engineering sciences. An introductory course in calculus and two quarters of physics are prerequisites for courses in this minor. The minor in agricultural mechanization emphasizes a broad range of applications of technology in agriculture and related industries. You may specialize in one or more of these areas. Specific requirements for these minors are listed below.

A. Agricultural Engineering Technology Minor (at least five courses and 20 credits required)

Required Courses:

- AgET 3610—Electricity in Agriculture (4)
- AgET 5021—Mechanics of Agricultural Systems (4)
- AgET 5022—Energy Systems in Agriculture (4)
- AgET 5023—Fluids—Principles and Systems (4)

Optional Courses (at least one course):

- AgET 3205—Power and Power Use (4)
- AgET 3215—Machinery and Equipment (4)
- AgET 3410—Hydrology, Water Control (4)
- AgET 3606—Farm Building Design, Layout, Systems (4)
- AgET 3615—Crop Processing and Storage (4)
- AgET 3800—Rural Sanitation and Water Supply (4)
- AgET 5400—Drainage and Irrigation (4)

B. Agricultural Mechanization Minor (at least five courses and 20 credits required). At least one course must be selected from each group.

Group 1

- AgET 3205—Power and Power Use (4)
- AgET 3215—Machinery and Equipment (4)
- AgET 3610—Electricity in Agriculture (4)

Group 2

- AgET 3410—Hydrology, Water Control (4)
- AgET 3800—Rural Sanitation and Water Supply (4)
- AgET 5400—Drainage and Irrigation (4)

Group 3

- AgET 3606—Farm Building Design, Layout, Systems (4)
- AgET 3615—Crop Processing and Storage (4)

Agricultural Journalism

Department of Information and Agricultural Journalism
326 Haecker Hall (612/373-0713)

The program in agricultural journalism is offered by the College of Agriculture in cooperation with the School of Journalism and Mass Communication of the College of Liberal Arts. It is intended for those who wish to prepare for any branch of journalism that relates to agriculture, forestry, conservation, or other industries closely related to agriculture. Employment possibilities include working on staffs of magazines, newspapers, trade papers, and house organs; editing and writing publications for state and federal departments of agriculture and experiment stations; serving on public relations and promotional staffs in industry and government; working as farm service directors for radio and TV stations; serving on advertising and marketing staffs of mass media agencies or industries; working as photojournalists; and serving as scientific or technical communicators in agricultural or related fields.

Students must meet the entrance requirements of the School of Journalism and Mass Communication in addition to those of the College of Agriculture. (Requirements for the journalism school include completing 75 credits before applying for acceptance as a special student in the school, passing the CEEB English test, scoring at least 25 wpm on a typing test, and completing four required prejournalism courses with a grade point average of 2.50.) Information about procedures and scheduling to meet these requirements is available from advisers in agricultural journalism.

This newly revised agricultural journalism curriculum is flexible, offering a wide variety of professional journalism specializations that can be planned in consultation with the adviser. Examples are public affairs journalism, international communication, community newspaper management, graphic arts, communications research, cinematography, newspaper design, public relations, broadcast advertising, magazine editing, news reporting, and science writing and editing.

Major Requirements

Students selecting the agricultural journalism major must complete the requirements listed below. Course substitutions in categories A, B, C, and D may be made only with the approval of the college office, and in categories E and F only with the approval of your adviser and the Agricultural Journalism staff.

A. Communication, Language, Symbolic Systems—28 credits minimum (including Journalism Preparatory)

Journalism Preparatory

- Jour 1001—Introduction to Mass Communication (2)
- Jour 1002—Visual Communication (2)
- Jour 1003—Producing Mass Media Messages (4)
- Jour 1004—Information for Mass Communication (4)

General Communication

- Rhet 1101—Writing to Inform and Persuade (4)
- Rhet 1104—Library Laboratory (1) S-N
- Rhet 1151—Writing in Your Major (4)
- Rhet 1222—Public Speaking (4)
- (or) Spch 1101—Fundamentals of Speech-Communication: Oral Communication (4)
- Rhet 3562—Writing in Your Profession (4) (or equivalent course)
- One course in statistics is recommended.

B. Physical and Biological Sciences—15 credits minimum

Credits should be selected from the following courses or from comparable courses in two different fields. See your adviser if you have questions.

- BioC 1301—Elementary Biochemistry I (5)
- BioC 1302—Elementary Biochemistry II (3)
- Biol 1009—General Biology (5)
- Biol 1103—General Botany (5)
- Biol 1106—General Zoology (5)
- Chem 1001—Chemical Principles and Covalent Systems (5)
- Chem 1004—General Principles of Chemistry (5)
- Chem 1005—General Principles of Chemistry (5)
- Geo 1001—Physical Geology (5)
- NSci 1004—Physical World: Physics (4)
- NSci 1005—Physical World: Chemistry (4)
- Phys 1041, 1045—Introductory Physics and Laboratory (4, 1)
- Phys 1042, 1046—Introductory Physics and Laboratory (4, 1)

C. The Individual and Society—21 credits minimum

See All-College Requirements (end of section II). One course required in the area of Development of Civilization.

- AgEc 1020—Principles of Macroeconomics (5)
- (or) Econ 1001—Principles of Macroeconomics (4)
- (or) Econ 1001H—Honors Course: Principles of Macroeconomics (5)
- AgEc 1030—Principles of Microeconomics (4)
- Soc 1651—Rural Sociology (4)
- Plus 4 credits in 20th-century American history and 5 credits in American government or politics

Programs

D. Literature, Humanities, and Fine Arts—8 credits minimum

See All-College Requirements (end of section II).

E. Professional Courses in the Major (no more than 48 credits, including Preparatory)

Preparatory (see Communication, Language, Symbolic Systems—Jour 1001, 1002, 1003, and 1004)

Core

Jour 3007—The Media in American History and Law: Case Studies (4)

Jour 3008—Mass Communication Processes and Structure (4)

Other courses

Students have a wide selection of courses from which to devise a program to fit their needs and professional aspirations. These must include one course from Group IA; two courses from Group II; and 16 credits from Groups I, II, and III. The more commonly used courses to meet these requirements are listed here, but your adviser has a more extensive list. **(Most courses require preregistration due to limited enrollment.)**

I. Professional

Group A (one required)

Jour 3101—Reporting

Jour 3201—Principles of Advertising

Jour 3301—Photography

Group B

AgJo 3530—Publicity

AgJo 3122—Agricultural Rural Affairs Reporting

(or) Jour 3121—Public Affairs Reporting

AgJo 3159—Publications Editing

(or) Jour 3155—Publications Editing

AgJo 5561—Writing for Publication

(or) Jour 3173—Magazine Writing and Editing

Jour 3193—Community Newspaper

Jour 3321—Media Graphics

Jour 3241—Advertising Copywriting

Jour 3401—Basic Cinematography

Jour 3451—Television and Radio News

Jour 3486—Radio and Television Script Writing

Group C

AgJo 5180—Agri-Marketing Communications

AgJo 5301—Functional Photography

AgJo 5534—Rural Communication Media

Jour 5131—Interpretative Reporting

Jour 5133—Science Communication

Jour 5143—Interpretative Writing About Science

Jour 5174—Magazine Editing and Production

Jour 5233—Graphic Design Analysis

Jour 5261—Advertising: Media Analysis

Jour 5263—Advertising: Campaign Planning and Strategy

Jour 5272—Advertising: Copy Graphics

Jour 5353—Photographic Communication

Jour 5402—Film Production

II. Enrichment (two required)

Jour 3776—Mass Communication Law

Jour 5221—Publications Graphics

Jour 5251—Psychology of Advertising

Jour 5501—Communication and Public Opinion

Jour 5549—Public Relations

AgJo 5100—Seminar in Agricultural Communication

AgJo 5500—Research in Communication Strategies (same as Rhet 5500)

AgJo 5600—Transfer of Technology (same as Rhet 5600)

III. Independent Study (4-credit limit)

AgJo 3936—Special Problems

AgJo 5936—Special Problems in Agricultural Communications

AgJo 5000—Professional Experience Program

Major Project

All majors are required to complete a major project prior to graduation. Many of the courses listed previously will partially meet this requirement with an added assignment (1 credit) to give greater depth to the report. See your adviser for details.

F. Supporting Courses—39 credits minimum

15 credits in beginning courses in agriculture or forestry in addition to AgEc 1020 and AgEc 1030. AnSc 1100, Soil 1222, and Agro 1010 are recommended for most majors.

24 credits in an agricultural or a forestry field of specialization or divided between the two fields. These credits must be in advanced courses. Several areas in the College of Agriculture offer minors that can help you meet this requirement and prepare for specialized journalism in areas such as horticulture, fisheries and wildlife, agricultural engineering, and plant and animal sciences.

G. Electives to complete the 180 credits required for graduation with the bachelor of science degree.

Minor Requirements

The department offers two minors in agricultural journalism, one focusing on the preparation of news materials for the mass media and the other on advertising. Both are designed to prepare students in other subject matter areas for professional work that may require those skills. Students interested in public relations should consult an adviser in agricultural journalism to adapt the minor program.

A. Preparation of News Materials for the Mass Media (27-28 credits)

Required Courses:

- Jour 1001—Introduction to Mass Communication (2)
- Jour 1002—Visual Communication (2)
- AgJo 3530—Publicity (4)
- (or) AgJo 3111—Journalistic Techniques (5)
- AgJo 3159—Publications Editing (4)¹
- AgJo 5561—Writing for Publication (4)¹
- AgJo 5301—Functional Photography (4)

Optional Courses (at least two):

- AgJo 3122—Agricultural and Rural Affairs Reporting (4)
- AgJo 3430—Broadcasting in Rural America (4)
- AgJo 5534—Rural Communication Media (4)
- AgJo 5100—Seminar in Agricultural Communication (3)
- AgJo 5500—Research in Communication Strategies (4)
- AgJo 5600—Transfer of Technology (4)

For public relations emphasis:

- Jour 5549—Public Relations (4)
- Jour 5559—Case Studies in Public Relations (4)

B. Advertising (27-28 credits)

Required Courses:

- Jour 1001—Introduction to Mass Communication (2)
- Jour 1002—Visual Communication (2)
- Jour 3201—Principles of Advertising (4)
- Jour 3231—Advertising Graphics (4)¹
- Jour 3241—Advertising Copywriting (4)¹
- Mktg 3000—Principles of Marketing (4)
- AgJo 5180—Agri-Marketing Communications (4)

Optional Courses (at least one):

- AgJo 5561—Writing for Publication (4)¹
- AgJo 5534—Rural Communication Media (4)
- AgJo 3430—Broadcasting in Rural America (4)
- AgJo 5301—Functional Photography (4)
- AgJo 3530—Publicity (4)
- AgJo 5100—Seminar in Agricultural Communication (3)¹

You may supplement these with other advertising courses such as:

- Jour 5251—Psychology of Advertising (4)
- Jour 5261—Advertising: Media Analysis (4)¹

¹Preregistration is required because enrollment is limited and restricted.



Agronomy students observe experimental crop methods.

Agronomy

Department of Agronomy and Plant Genetics
303 Agronomy (612/373-0855)

Agronomists deal with the principles underlying the growth, management, and improvement of field crops. Field crops are the large acreage crops of the world such as corn, barley, soybeans, sorghum, wheat, and forages. Increases in their productivity add significantly to the world's supply of food and fiber. You should consider a major in agronomy if you are interested in the process of growth and development in plants, the influence of our environment on crop adaptation and productivity, the role of herbicides in controlling plant competition and increasing crop productivity, and the development of crop varieties with increased resistance to disease and insects, greater yield potential, and high nutritional quality.

As a graduate in agronomy you will be qualified for many positions involved with the production and improvement of field crops. Career opportunities include positions as technical representatives for agricultural chemical and seed companies, field agronomists for specialty crops such as sugar beets, dry beans, and peas, state and federal crop regulatory agents, grain buyers and merchandisers, agricultural extension workers, storage elevator operators, field agronomists for crop production consulting firms, and numerous others. Students interested in farming can acquire a solid background in crop production principles.

If your interests are research, and you plan to continue your studies in graduate school, you should develop a suitable course program with your adviser to obtain the background necessary to undertake graduate studies in the specialization of your choice.

Major Requirements

All students in the agronomy major must complete the requirements listed below. See your adviser to determine a suitable sequence for completion of the required courses. Course substitutions in categories A, B, C, and D may be made only with the approval of the college office, and in categories E and F only with the approval of your adviser and the Department of Agronomy and Plant Genetics.

A. Communication, Language, Symbolic Systems

See Agricultural Science and Industries Curriculum Requirements (end of section II).

B. Physical, Biological, and Analytical Sciences

BioC 1301—Elementary Biochemistry I (5)

BioC 1302, 1303—Elementary Biochemistry II and Laboratory (3, 2)

Biol 1009—General Biology (5)

Biol 1103—General Botany (5)

Chem 1001—Chemical Principles and Covalent Systems (5)

(or) Chem 1004—General Principles of Chemistry (5)

(and) Chem 1005—General Principles of Chemistry (5)

Phys 1001, 1005—The Physical World and Laboratory (4, 1)

Two additional courses selected from category B of the Agricultural Science and Industries Curriculum Requirements (end of section II).

C. The Individual and Society—14 credits minimum

See All-College Requirements (end of section II). One course required in the area of Development of Civilization.

AgEc 1020—Principles of Macroeconomics (5)

D. Literature, Humanities, and Fine Arts—8 credits minimum

See All-College Requirements (end of section II).

E. Professional Courses in the Major

Agro 1100—Morphology and Identification of Crops and Weeds (4)

Agro 3010—Adaptation, Distribution, and Production of Field Crops (4)

Agro 3020—Growth, Development, and Culture of Field Crops (5)

Programs

Agro 3030—Maturation, Harvest, and Storage of Field Crops (4)

Agro 3060—Field Plot Design in Agronomy (3)

Agro 3200—Seminar (1)

Agro 5020—Introduction to Plant Breeding (4)

Agro 5030—Weed Control (5)

One of the following:

Agro 5010—Forage Production and Utilization (4)

Agro 5040—Corn and Soybean Management (3)

Agro 5060—Small Grains, Sunflower, and Sugar Beet Management (3)

Two of the following (must include one Soil course):

Agro 1010—Principles of Agronomy (4)

Agro 1020—Special Problems (3)

Agro 1110—Seed Analysis and Grain Grading (3)

Agro 3150—Advanced Seed and Grain Evaluation (4)

Agro 5000—Professional Experience Program (4)

Agro 5001—Problems in Agronomy for Advanced Students (3-5)

Agro 5010—Forage Production and Utilization (4)

Agro 5040—Corn and Soybean Management (3)

Agro 5050—Herbicides (3)

Agro 5060—Small Grains, Sunflower, and Sugar Beet Management (3)

Agro 5200—World Food Supply Problems (4)

AgET 3615—Crop Processing and Storage (4)

AgET 5400—Irrigation and Drainage (4)

AnSc 3401—Principles of Animal Nutrition (3)

Soil 3210—Soil Physical Properties (4)

Soil 3220—Soil, Water Management, and Conservation (3)

Soil 3416—Soil Fertility (5)

Soil 3520—Soil Morphology, Classification, and Genesis (4)

Soil 3610—Soil Biology (3)

Soil 5230—Soil-Plant-Water Relations (3)

F. Supporting Courses

Ent 1005—Economic Entomology (4)

GCB 3022—Genetics (4)

PIPa 3001—Introductory Plant Pathology (6)

PIPh 3131—Survey: Plant Physiology (4)

Soil 1122—Introductory Soil Science (4)

G. Electives to complete the 192 credits required for graduation with the bachelor of science degree.

Minor Requirements

The department offers two minors, one in agronomy and one in integrated crop-pest management. The minor in agronomy is designed for students seeking a thorough understanding of the principles of crop science and their application to the production and improvement of field crops. These principles are used to solve problems facing farmers, seed suppliers, fertilizer dealers, industrial representatives, crop production consultants, and others seeking to improve the production and quality of food, feed, and fiber.

The minor in integrated crop-pest management (ICPM), an interdisciplinary program combining course work and field experience, is for students who wish to develop competence in this area in addition to their majors.

In addition to 32 credits, the program requires at least one quarter of field experience. The intent of a training session and the field experience is to show the relationships among the disciplines of agronomy, entomology, horticulture, plant pathology, and soil science as they relate to the control of pests during the production of crops. You should plan the fieldwork as early as possible, preferably before you complete much course work for the program. Experience as a scout in an ICPM program is highly recommended as a means of meeting this requirement.

Students seeking a minor in agronomy or ICPM should develop their course of study in cooperation with an adviser in the Department of Agronomy and Plant Genetics.

Course substitutions may be made only with the consent of your adviser and the Department of Agronomy and Plant Genetics.

A. Agronomy Minor

Required Courses (20 credits minimum):

- Agro 3010—Adaptation, Distribution, and Production of Field Crops (4)
- Agro 3020—Growth, Development, and Culture of Field Crops (5)
- Agro 3030—Maturation, Harvest, and Storage of Field Crops (4)
- Agro 3200—Undergraduate Seminar (1)

One of the following:

- Agro 5010—Forage Production and Utilization (4)
- Agro 5040—Corn and Soybean Management (3)
- Agro 5060—Small Grains, Sunflower, and Sugar Beet Management (3)

Additional Courses (at least one):

- Agro 1010—Principles of Agronomy (4)
- Agro 1100—Morphology and Identification of Crops and Weeds (4)
- Agro 1110—Seed Analysis and Grain Grading (3)
- Agro 5010—Forage Production and Utilization (4)
- Agro 5020—Introduction to Crop Breeding (4)
- Agro 5030—Weed Control (5)
- Agro 5040—Corn and Soybean Management (3)
- Agro 5060—Small Grains, Sunflower, and Sugar Beet Management (3)

B. Integrated Crop-Pest Management Minor

Required Background Courses (these are not considered as part of the minor):

- Ent 1005—Economic Entomology (4)
- PIPa 3001—Introductory Plant Pathology (6)
- Soil 1122—Introductory Soil Science (4)
- Agro 1100—Morphology and Identification of Crops and Weeds (4)
- AgEc 3820—Farm Management Economics (4)

Required Courses:

- Agro 5030—Weed Control (5)
- Ent 5210—Integrated Pest Management (5)
- PIPa 5006—Fungi, Algae, and Parasitic Seed Plants in Plant Disease (4)

Additional Courses:

A minimum of 16 credits must be selected from this list of courses. The courses must be selected from among those offered by three departments outside the student's major department.

- AgEc 3610—Community Resource Development (4)
- (or) AgEc 5650—Economics of Natural Resource Policy (4)
- AgEc 3850—Farm Business and Enterprise Analysis (4)
- AgET 3215—Machinery and Equipment (4)
- Agro 3020—Growth, Development, and Culture of Field Crops (5)
- Agro 5010—Forage Production and Utilization (4)
- Agro 5040—Corn and Soybean Management (3)
- Agro 5060—Small Grains, Sunflower, and Sugar Beet Management (3)
- Ent 5215—Insects in Relation to Plant Diseases (4)
- Hort 3031—Fruit Science (4)
- Hort 3072—Turf Management (4)
- Hort 5034—Commercial Vegetable Production (3)
- Hort 5035—Commercial Vegetable Production (3)
- PIPa 5005—Viruses and Bacteria in Plant Disease (4)
- PIPa 5007—Nematodes and Abiotic Agents in Plant Disease (4)
- PIPa 5700—Contemporary Chemical Control of Plant Diseases (4)
- Soil 3210—Soil Physical Properties (4)
- Soil 3416—Soil Fertility (5)
- Soil 3520—Soil Morphology, Classification, and Genesis (4)
- Soil 3610—Soil Biology (3)
- Soil 5230—Soil-Plant-Water Relations (3)

Animal Science

Department of Animal Science
120 Peters Hall (612/373-1485)

Animal science specialists study the physical, biological, social, and economic factors involved in the production of farm animals and poultry. Animal science graduates are employed as farmers, farm managers, county extension agents and livestock buyers, and in a variety of other positions in the meat packing industry, dairy industry, feed industry,

Programs

farm supply industry, banks and other finance agencies, consulting organizations, breed associations, government agencies, and artificial insemination organizations.

If you plan to pursue graduate studies in animal science, consult your adviser concerning completion of additional work in biology, chemistry, physics, and mathematics.

Major Requirements

All students in the animal science major must complete the requirements listed below. Course substitutions in categories A, B, C, and D may be made only with the approval of the college office, and in category E only with the approval of your adviser and the Department of Animal Science.

A. Communication, Language, Symbolic Systems

See Agricultural Science and Industries Curriculum Requirements (end of section II).

B. Physical, Biological, and Analytical Sciences

See Agricultural Science and Industries Curriculum Requirements (end of section II).

C. The Individual and Society—14 credits minimum

See All-College Requirements (end of section II). One course required in the area of Development of Civilization.

AgEc 1020—Principles of Macroeconomics (5)

D. Literature, Humanities, and Fine Arts—8 credits minimum

See All-College Requirements (end of section II).

E. Professional Courses in the Major

AnSc 1100—Introductory Animal Science (5)

AnSc 1500—Meat Science (4)

AnSc 3220—Principles of Animal Breeding (5)

AnSc 3301—Systemic Physiology (6)

AnSc 3401—Principles of Animal Nutrition (3)

AnSc 5703—Literature and Seminar (2-3)

GCB 3022—Genetics (cannot also be counted toward category B)

Stat 3081—Experimental Techniques, Statistical Inference (5)

One of the following courses:

AnSc 5601—Swine Production (4)

AnSc 5602—Sheep Production (4)

AnSc 5603—Beef Cattle Production (4)

AnSc 5604—Dairy Farm Management (4)

AnSc 5605—Poultry Production (4)

One of the following courses:

AnSc 5401—Swine Nutrition and Feeding (4)

AnSc 5403—Ruminant Nutrition (4)

AnSc 5405—Poultry Nutrition (3)

F. Electives to complete 192 credits required for graduation with the bachelor of science degree. Recommended electives include:

AgEc 1250—Principles of Accounting (5)

AgEc 1400—Agricultural Markets and Prices (4)

AgEc 3440—Livestock Marketing Economics (3)

AgEc 3710—Agricultural and Market Policies (4)

AgEc 3820—Farm Management Economics (4)

AgEc 3830—Organizing the Farm Business for Entry, Growth, and Transfer (4)

AgEc 5400—Intermediate Market and Price Analysis (4)

AgEc 5480—Futures, Markets, Prices (4)

AgEc 5840—Management of the Farm Business (4)

AgET 3205—Power and Power Use (4)

AgET 3606—Farm Building Design, Layout, Systems (4)

AgJo 3530—Publicity (4)

Agro 1010—Principles of Agronomy (4)

Agro 3010—Adaptation, Distribution, and Production of Field Crops (3)

Agro 3020—Growth, Development, and Culture of Field Crops (5)

Agro 3030—Maturation, Harvest, and Storage of Field Crops (4)

Agro 5010—Forage Production and Utilization (4)

FR 5231—Range Management (3)

- FScN 1010—Man's Food (4)
- RCD 1010—Issues in the Environment (3)
- Rhet 1147—Efficient Reading (3)
- Rhet 1251—Effective Listening (3)
- Soil 1122—Introductory Soil Science (4)

Biological Sciences

Freshman and sophomore students interested in earning a degree in the biological sciences may complete their prerequisite work in the College of Agriculture, since the College of Biological Sciences (CBS) accepts junior and senior students only. They will be assisted in program planning by an adviser in CBS and can transfer to CBS when they have met the requirements for entry. Pre-CBS students may apply directly to the College of Agriculture for admission.

For further information about biological sciences programs, see the *College of Biological Sciences Bulletin*, or contact the College of Biological Sciences, 223 Snyder Hall, University of Minnesota, 1475 Gortner Avenue, St. Paul, MN 55108 (612/373-3648).

Consumer Food Science

Department of Food Science and Nutrition
225 Food Science and Nutrition (612/373-1071)

This program is designed to prepare students for employment in the areas of promotion, product development, marketing, and consumption of food. Upon completing the program you should have a sound knowledge of basic scientific principles of food science, consumer aspects of food product development, testing, marketing, advertising, and communication. Required course work includes studies in marketing, agricultural and applied economics, and statistics. In addition, you will select a concentration in one of five collateral areas of emphasis—economics and business administration, sociopsychology, communication, food product development, and nutrition. Through choice of the collateral area, you can help prepare for a particular job emphasis after earning the bachelor's degree, or for graduate study in a specific area such as business administration, agricultural and applied economics, or food science.

This program is open to students registered in either the College of Agriculture or the College of Home Economics. Faculty advisers are normally from the Department of Food Science and Nutrition, which is jointly administered by the two colleges.

Major Requirements

Listed below are the requirements for the major in consumer food science. Course substitutions in categories A, C, and D may be made only with the approval of the college office, and in categories B, E, and F only with the approval of your adviser and the Department of Food Science and Nutrition. Work closely with your adviser to select appropriate courses in biochemistry and chemistry if you are considering a food and product development or a nutrition collateral area or graduate work in food science.

A. Communication, Language, Symbolic Systems

- Math 1142—Short Calculus (5)
- Rhet 1101—Writing to Inform and Persuade (or equivalent course) (4)
- Rhet 1104—Library Laboratory (1) S-N
- Rhet 1151—Writing in Your Major (4)
- Rhet 1222—Public Speaking (4)
- Rhet 3562—Writing in Your Profession (4)

B. Physical and Biological Sciences

- Biol 1009—General Biology (5)
- Biol 5001—Biochemistry (4)
- Chem 1004—General Principles of Chemistry (5)
- Chem 1005—General Principles of Chemistry (5)

Programs

- Chem 3301—Elementary Organic Chemistry I (4)
- Chem 3302—Elementary Organic Chemistry II (4)
- Chem 3305—Elementary Organic Chemistry Laboratory I (2)
- Chem 3306—Elementary Organic Chemistry Laboratory II (2)

C. The Individual and Society

See All-College Requirements (end of section II). One course required in the area of Development of Civilization.

- AgEc 1020—Principles of Macroeconomics (5)
- (or) Econ 1001—Principles of Macroeconomics (4)
- AgEc 1030—Principles of Microeconomics (4)
- (or) Econ 1002—Principles of Microeconomics (4)
- Psy 1001—General Psychology (5)
- Soc 1001—Introduction to Sociology (4)

D. Literature, Humanities, and Fine Arts—9 credits minimum

See All-College Requirements (end of section II).

E. Professional Courses in the Major

- AgEc 3101—Microeconomic Theory (4)
- AgEc 3102—Macroeconomic Theory (4)
- FScN 1102—Technology of Food Processing (4)
- FScN 3110—Food Chemistry (4)
- FScN 3112—Food Chemistry Laboratory (2)
- FScN 3123—Microbiology of Foods (5)
- FScN 3272—Introduction to Food Decision Making (2)
- FScN 3403—Experimental Foods (4)
- FScN 3472—Principles of Food Purchasing (4)
- FScN 3600—Principles of Nutrition (4)
- FScN 3622—Nutrition in the Life Cycle (4)
- (or) FScN 5622—Human Nutrition (5)
- FScN 5100—General Seminar (1)
- FScN 5360—Sensory Evaluation of Food Quality (4)
- FScN 5403—Experimental Study of Foods (5)
- FScN 5412—Physicochemistry of Foods (3)
- FScN 5413—Structural-Functional Relations in Food Systems (3)
- Mktg 3000—Principles of Marketing (4)
- Stat 5021—Statistical Analysis I (4)

F. Collateral Area

In addition to the above requirements, you must select one of the following fields as an area of emphasis and complete a minimum of 20 credits in this collateral area. Courses are usually selected from those listed below, but you may select others in consultation with your adviser. You may select more than one collateral area. Most journalism courses have special entry requirements; check with your adviser.

Economics and Business Administration

- Acct 1024—Principles of Financial Accounting I (3)
- Acct 1025—Principles of Financial Accounting II (3)
- Acct 3001—Principles of Managerial Accounting (4)
- AgEc 1250—Principles of Accounting (5)
- AgEc 5560—Economics of Consumer Policies (4)
- AgEc 5580—Economic Organization of the Household (4)
- BGS 3001—Managerial Economics (4)
- BFin 3000—Finance Fundamentals (4)
- FScN 5390—Introduction to Food Law (4)
- FScN 5474—Food Consumption Economics (4)
- Mgmt 3001—Fundamentals of Management (4)
- Mktg 3010—Buyer Behavior, Marketing Analysis (4)
- Mktg 3020—Marketing Operations Management (4)
- Mktg 3050—Marketing Communications (4)
- Psy 5751—Psychology of Advertising (4)
- (or) Jour 5251—Psychology of Advertising (4)
- QA 3055—Introduction to Management Sciences (4)
- Soc 5201—Introduction to Social Psychology
- Soc 5411—Formal Organizations (4)
- Stat 5022—Statistical Analysis II (5)

Sociopsychology¹

- Mktg 3010—Buyer Behavior, Marketing Analysis (4)
- Psy 3031—Sensation and Perception (4)
- Psy 3201—Introduction to Social Psychology (4)
- Psy 3401—Social Organization (4)
- Soc 5201—Introduction to Social Psychology (4)
- Soc 5355—Opinion and Communication: Social Factors (4)
- Soc 5401—Social Organizations (4)
- Soc 5411—Formal Organizations (4)

Communication¹

- FScN 3400—Food Demonstration Techniques (3)
- Jour 3301—Photojournalism (4)
- Jour 3155—Publications Editing (4)
- Jour 3173—Magazine Writing (4)
- Jour 3231—Advertising Graphics (4)
- Jour 3241—Advertising Copywriting (4)
- Jour 5143—Interpretation of Science and Technology (4)
- Jour 5261—Advertising: Media Analysis
- Jour 5263—Advertising Campaign Planning and Media Strategy (4)
- Jour 5376—Advanced Photojournalism (5)
- Psy 5751—Psychology of Advertising (4)
- Rhet 3254—Advanced Public Speaking (4)
- Rhet 3572—Grammatical Editing for Technical Writers (2)
- Rhet 5561—Writing for Publication (4)
- Soc 5201—Introduction to Social Psychology (4)
- Soc 5355—Opinion and Communication: Social Factors (4)

Food and Product Development

- FScN 5000—Professional Experience Program (4 cr max)
- FScN 5111—Independent Study in Food Science and Nutrition (1-5)
- FScN 5120—Food Microbiology (5)
- FScN 5122—Sanitation and Control of Microorganisms (2)
- FScN 5135—Food Process Engineering I (4)
- FScN 5136—Food Process Engineering II (4)
- FScN 5310—Advanced Food Chemistry (3)
- FScN 5312—Chemical and Instrumental Analysis of Foods (5)
- FScN 5404—Current Issues in Food and Nutrition (2-4)
- FScN 5406—Current Literature in Foods (2-4)
- FScN 5510—Muscle Chemistry and Physiology (4)
- FScN 5512—Meat and Protein Technology (4)
- FScN 5530—Industrial Processing of Fruits and Vegetables (4)
- FScN 5540—Fats and Oils Chemistry and Technology (4)
- FScN 5555—Freezing and Dehydration of Foods (5)
- FScN 5643—Seminar: World Food Supply Problems (4)
- BioC 5025—Laboratory in Biochemistry (2)
- TexC 5625—Color Metrology (3)

Nutrition

Required Courses:

- Phsl 1002—Human Physiology (4)
- (or) Phsl 3051—Human Physiology for Nursing and Physical Therapy Students (5)
- BioC 5025—Laboratory in Biochemistry (2)
- FScN 5622—Human Nutrition (5)

At least 8 credits in courses selected from nutrition, public health, biochemistry, and medicine in consultation with your adviser.

G. Electives to complete the 185 credits required for graduation with the bachelor of science degree.

Economics of Public Services

Department of Agricultural and Applied Economics
231 Classroom-Office Building (612/373-1755)

Economics of public services is designed to provide technical competencies in applied economic analysis with supporting course work and experience in general fields such as

¹If you choose this collateral area you may, with the approval of your adviser, substitute BioC 1301-1302-1303 for Chem 3301-3302-3305-3306.

Programs

public administration, political science, sociology, geography, and business administration. The curriculum focuses on the economics of financing, providing, and using public goods and services. In it, you will study the efficiency and distributive effects and organizational consequences of public sector activities. You may develop areas of emphasis such as health, education, transportation, housing, municipal services, and regional and community development. As a graduate you will be prepared for positions such as economic policy analyst, planner, and administrator in local, state, regional, and federal government and in private firms. The training also prepares students for continued study at the graduate level.

This program uses an interdisciplinary approach to bring complementary disciplines to bear on planning and administrative training. It relates the traditional specialties of applied resource development and management as well as the social and economic specialties to expanding contemporary needs.

Major Requirements

Students electing the economics of public services major must complete the requirements listed below. Course substitutions in categories A, B, C, and D may be made only with the approval of the college office, and in categories E and F only with the approval of your adviser and the Department of Agricultural and Applied Economics.

A. Communication, Language, Symbolic Systems

- Math 1111—College Algebra and Analytical Geometry (5)
- Rhet 1101—Writing to Inform and Persuade (4)
- Rhet 1104—Library Laboratory (1) S-N
- Rhet 1151—Writing in Your Major (4)
- Rhet 1222—Public Speaking (4)
- Rhet 3254—Advanced Public Speaking (4)
- (or) Rhet 3266—Discussion Methods (4)
- Rhet 3562—Writing in Your Profession (4)
- QA 1050—Elementary Managerial Statistics (4)
- (or) Stat 1051—Introduction to Ideas of Statistics (4)

Recommended courses include:

- AgEc 5020—Applied Linear Programming (4)
- Econ 5231—Introduction to Econometrics (4)
- Math 1142—Short Calculus (5)
- (or) Math 1211—Calculus I (5)
- (and) Math 1221—Calculus II (5)
- Stat 5021—Statistical Analysis I (5)
- Stat 5022—Statistical Analysis II (5)

B. Physical and Biological Sciences

- Biol 1009—General Biology (5)
- Chem 1001—Chemical Principles and Covalent Systems (5)
- Chem 1002—Chemical Principles and Covalent Systems (5)
- EBB 3001—Introduction to Ecology (4)
- (or) EBB 3004—Fundamentals of Ecology (4)

Recommended courses include:

- Biol 1103—General Botany (5)
- (or) Biol 1106—General Zoology (5)
- Geo 1001—Physical Geology (5)
- Geo 1007—Environmental Geology (5)
- Phys 1041, 1045—Introductory Physics and Laboratory (4, 1)
- Phys 1042, 1046—Introductory Physics and Laboratory (4, 1)
- Soil 1122—Introductory Soil Science (4)

C. The individual and Society

See All-College Requirements (end of section II). One course required in the area of Development of Civilization.

- Arch 5137—Planning: Urban Function and Structure (4)
- (or) Geog 5001—Geographical Analysis I (4) (and) Geog 5002—Geographical Analysis II (4)
- (or) Geog 5372—Metropolitan Analysis I (4) (and) Geog 5373—Metropolitan Analysis II (4)
- Psy 1001—General Psychology (5)

- Soc 1001—Introduction to Sociology (4)
(or) Soc 1651—Rural Sociology (4)
Plus four additional courses selected from the following:
Geog 3101—Geography of United States and Canada (4)
Geog 3331—Economic Geography (4)
PA 5151—Energy and Energy Policy (4)
Pol 1001—American Government and Politics (5)
Pol 1027—Urban Politics (4)
Pol 1031—Selected Problems in American Public Policy (4)
Pol 3561—Introduction to Legal Systems (4)
Soc 3401—Principles of Social Organizations (5)

D. Literature, Humanities, and Fine Arts—8 credits minimum

See All-College Requirements (end of section II).

E. Professional Courses in the Major

- AgEc 3610—Community Resource Development (4)
AgEc 3640—Public Finance: Concepts and Practices (4)
AgEc 3900—Special Topics in the Economics of Public Services (3)
AgEc 5099—RCD Interdisciplinary Seminar I (4)
AgEc 5100—RCD Interdisciplinary Seminar II (4)
Plus 16 additional credits selected from the following courses:
AgEc 3290—Agribusiness Management (4)
(or) Mgmt 3001—Fundamentals of Management (4)
AgEc 5560—Economics of Consumer Policies (4)
AgEc 5600—Land Economics (4)
AgEc 5610—Institutional Factors in Land Use (4)
AgEc 5620—Regional Economic Analysis (4)
AgEc 5630—Regional Development Systems (4)
AgEc 5640—Financing State and Local Governments (4)
AgEc 5650—Economics of Natural Resource Policy (4)
AgEc 5660—Economics of Public Services (4)
AgEc 5670—Economics of Agricultural Transportation (4)
PA 3101—Introduction to Public Affairs (4)
RCD 3010—The Minnesota Community: Analysis of Its Organization,
Change, and Development (4)
RCD 5200—Community Development Simulation (4)

F. Supporting Courses

- AgEc 1000—Orientation to Agricultural and Applied Economics (1)
AgEc 1020—Principles of Macroeconomics (5)
AgEc 1030—Principles of Microeconomics (4)
AgEc 1250—Principles of Accounting (5)
(or) Acct 1024—Principles of Financial Accounting I (3) (and)
Acct 1025—Principles of Financial Accounting II (3)
AgEc 3101—Microeconomic Theory (4)
(or) Econ 3101—Microeconomic Theory (4)
AgEc 3102—Macroeconomic Theory (4)
(or) Econ 3102—Macroeconomic Theory (4)

- G. Electives to complete the 192 credits required for graduation with the bachelor of science degree.** During the junior and senior years, students take four or five courses in a specialized area of emphasis such as transportation, health policy and health care delivery, regional and community development, housing, or the economics of education. See your adviser for help in selecting courses.

Entomology

Department of Entomology
219 Hodson Hall (612/373-1700)

Entomology is a scientific discipline that is rooted in biology. It involves the study of insects and other arthropods and their biology, ecology, and control in relation to their environment and to human beings. Two options for specializing in entomology, insect population management and graduate study preparation, are offered.

Programs

Insect Population Management—Although an advanced degree is essential for many positions, entomologists with a bachelor of science degree are employed by federal and state agencies, chemical companies, food processors, mosquito control agencies, and pest control companies, and as biological science teachers. With the rapid development of, the need for, and the interest in insect pest management, there is likely to be a demand for students trained in entomology and allied sciences to monitor pest insect populations, supervise the application of control measures, and participate in environmental impact reviews.

Graduate Study Preparation—This option is designed to provide a broad background in the physical and biological sciences as preparation for graduate study in entomology. Advanced degrees are essential to qualify for positions as professional entomologists. Employment opportunities include college teaching, research (in universities, natural history museums, military services, private industry, and state, federal, and international agencies), extension work, and private practice as a consulting entomologist.

Major Requirements

Students majoring in entomology will select either the insect population management option or the graduate study preparation option. Course substitutions in categories A, B, C, and D may be made only with the approval of the college office, and in categories E and F under the insect population management option and category E under the graduate study preparation option only with the approval of your adviser and the Department of Entomology.

INSECT POPULATION MANAGEMENT OPTION

A. Communication, Language, Symbolic Systems

See Agricultural Science and Industries Curriculum Requirements (end of section II).

B. Physical, Biological, and Analytical Sciences

BioC 1301—Elementary Biochemistry I (5)
BioC 1302, 1303—Elementary Biochemistry II and Laboratory (3, 2)
Biol 1009—General Biology (5)
Biol 1103—General Botany (5)
Biol 1106—General Zoology (5)
Chem 1004—General Principles of Chemistry (5)
Chem 1005—General Principles of Chemistry (5)
Chem 1006—Principles of Solution Chemistry (4)
EBB 3001—Introduction to Ecology (4)
MicB 3103—General Microbiology (5)
Phys 1001, 1005—The Physical World and Laboratory (4, 1)

C. The Individual and Society—14 credits minimum

See All-College Requirements (end of section II). One course required in the area of Development of Civilization.

AgEc 1020—Principles of Macroeconomics (5)

D. Literature, Humanities, and Fine Arts—8 credits minimum

See All-College Requirements (end of section II).

E. Professional Courses in the Major

Ent 3175—Introductory Entomology (5)
Ent 5025—Insect Morphology (5)
Ent 5027—Insect Physiology (5)
Ent 5133—Insect Taxonomy (5)
Ent 5210—Integrated Pest Management (5)
Ent 5250—Principles of Economic Entomology (4)
Ent 5400—Experimental Ecology (3)

F. Supporting Courses

Agrc 1010—Principles of Agronomy (4)
Agrc 1011—Principles of Agronomy—Discussion (1)

- Agro 5030—Weed Control (5)
- PIPa 3001—Introductory Plant Pathology (5)
- (or) PIPa 5050—Forest Pathology (4)
- Soil 1122—Introductory Soil Science (4)
- Stat 5021—Statistical Analysis I (5)
- Stat 5022—Statistical Analysis II (5)

G. Electives to complete the 192 credits required for graduation with the bachelor of science degree.

GRADUATE STUDY PREPARATION OPTION

A. Communication, Language, Symbolic Systems

See Agricultural Science and Industries Curriculum Requirements (end of section II).

B. Physical, Biological, and Analytical Sciences

- BioC 5001, 5025—Biochemistry and Laboratory (4, 2)
- Biol 1009—General Biology (5)
- Biol 3011—Animal Biology (5)
- Biol 3012—Plant Biology (5)
- Chem 1004—General Principles of Chemistry (5)
- Chem 1005—General Principles of Chemistry (5)
- Chem 1006—Principles of Solution Chemistry (4)
- Chem 3301, 3305—Elementary Organic Chemistry I and Laboratory (4, 2)
- Chem 3302, 3306—Elementary Organic Chemistry II and Laboratory (4, 2)
- Math 1142—Short Calculus (5)
- MicB 3103—General Microbiology (5)
- Phys 1041, 1045—Introductory Physics and Laboratory (4, 1)
- Phys 1042, 1046—Introductory Physics and Laboratory (4, 1)
- Stat 5021—Statistical Analysis I (5)
- Stat 5022—Statistical Analysis II (5)

C. The Individual and Society—14 credits minimum

See All-College Requirements (end of section II). One course required in the area of Development of Civilization.

- AgEc 1020—Principles of Macroeconomics (5)

D. Literature, Humanities, and Fine Arts—8 credits minimum

See All-College Requirements (end of section II).

E. Professional Courses in the Major

- Ent 3175—Introductory Entomology (5)
- Ent 5025—Insect Morphology (5)
- Ent 5027—Insect Physiology (5)
- Ent 5133—Insect Taxonomy (5)
- Ent 5210—Integrated Pest Management (5)
- Ent 5250—Principles of Economic Entomology (4)
- Ent 5400—Experimental Ecology (3)

F. Supporting Courses

- EBB 3001—Introduction to Ecology (4)
- EBB 5112—Invertebrate Biology (5)
- GCB 3022—Genetics (4)
- PIPh 3131—Survey of Plant Physiology (4)
- PIPh 3132—Plant Physiology Laboratory (2)
- (or) AnSc 3301—Systemic Physiology (6)
- Soil 1122—Introductory Soil Science (4)

G. Electives to complete the 192 credits required for graduation with the bachelor of science degree.

Fisheries and Wildlife

NOTE: These degree programs were transferred to the College of Forestry as of July 1, 1983.

Department of Fisheries and Wildlife
219 Hodson Hall (612/373-1700)

The fisheries and wildlife curricula are designed to offer basic training in the biological and physical sciences and in related nonscience disciplines to provide the broad

Programs

background necessary in these professional fields. These curricula satisfy only minimum academic requirements for professional employment. The master's degree is the desired, if not required, preparation for many management and administrative and most research positions for fisheries and wildlife biologists. The doctor of philosophy degree is often required for research, administrative, and special appointments, and for teaching at the college level.

Beginning freshmen and new students with advanced standing are admitted with pre-fisheries and wildlife curriculum status. Admission is based on previous academic preparation and other indicators of student potential. Apply before May 15 to begin studies in the fall quarter of the following academic year, or two months prior to the beginning of winter and spring quarters or first and second summer terms.

The pre-fisheries and wildlife status enables students to establish definite curriculum and major goals or to have an early opportunity to seek another curriculum if scholastic performance or interest is lacking. A faculty adviser works closely with these students.

Pre-Fisheries and Wildlife Requirements

At least 90 quarter credits, including all courses in categories A and B below with a minimum grade point average of 2.75, are required in order to declare a fisheries or wildlife major. Credits from categories C and D or electives can be applied toward the 90-credit requirement.

A. Communication, Language, Symbolic Systems—16 credits minimum

- Rhet 1101—Writing to Inform and Persuade (4)
- Rhet 1104—Library Laboratory (1) S-N
- Rhet 1151—Writing in Your Major (4)
- Rhet 1222—Public Speaking (4)
- Math 1142—Short Calculus (5)¹

B. Physical and Biological Sciences—42 credits minimum

- Biol 1009—General Biology (5)
- Biol 1103—General Botany (5)
- Biol 1106—General Zoology (5)
- Chem 1004—General Principles of Chemistry (5)
- Chem 1005—General Principles of Chemistry (5)
- Biol 3041—Ecology (4)
- FW 1001—Orientation in Fisheries and Wildlife (2) S-N
- FW 3052—Introduction to Fisheries and Wildlife Biology and Management (4)
- Phys 1041, 1045—Introductory Physics and Laboratory (4, 1)
- Phys 1042, 1046—Introductory Physics and Laboratory (4, 1)
- VB 1120—Comparative Vertebrate Morphology (5)

C. The Individual and Society—8 credits minimum

- AgEc 1020—Principles of Macroeconomics (5)
- Pol 1001—American Government and Politics (5)
- FR 1201—Conservation of Natural Resources (3) is recommended.

D. Literature, Humanities, and Fine Arts—8 credits minimum

Fisheries Major Requirements

In addition to Pre-Fisheries and Wildlife Requirements listed above, the courses listed in categories E, F, and G below or their equivalents must be completed for a major in fisheries.

E. Fisheries Junior-Senior Required Courses—58-72 credits

- AnSc 3301—Systemic Physiology (6)
- Chem 3100, 3101—Quantitative Analysis and Laboratory (3, 2)

¹See each major for specific mathematics requirements; Math 1211, 1221, and 1231 are recommended.

Chem 3301, 3305—Elementary Organic Chemistry I and Laboratory (4, 2)
CSci 3102—Introduction to Pascal Programing (4)
(or) CSci 3104—Introduction to Programming and Problem Solving (5)
(or) an introductory computer science course
EBB 5601—Limnology (4)
EBB 5136—Ichthyology (4)
FW 5451—Ecology of Fish Populations (5)
FW 5452—Fishery Management in Inland Waters (5)
FW 5454—Fishery Ecology of Polluted Waters (5)
FW 5455—Aquaculture (5)
GCB 3022—Genetics (4)
Geo 1001—Physical Geology (5)
Rhet 3562—Writing in Your Profession (4)
Stat 5021—Statistical Analysis I (5)
Stat 5022—Statistical Analysis II (5)

F. Supporting Courses—Select four of the following—14-21 credits

Bot 5231—Introduction to the Algae (5)
(or) Bot 5811—Freshwater Algae (5)¹
Chem 1006—Principles of Solution Chemistry (4)
Chem 3302, 3306—Elementary Organic Chemistry II and Laboratory (4, 2)
EBB 5112—Invertebrate Biology (5)
EBB 5606—Ecology of Fishes (5)
(or) FW 5456—Field Ecology of Fishes (5)¹
Ent 3175—Introductory Entomology (5)
(or) Ent 5020—Field Entomology (5)¹
MicB 3101—General Microbiology (5)

G. Electives to complete the 192 credits required for graduation with the bachelor of science degree. Selection of electives may be made in consultation with an adviser.

Wildlife Major Requirements

In addition to Pre-Fisheries and Wildlife Requirements listed above, the courses listed in categories E, F, and G below or their equivalents must be completed for a major in wildlife.

E. Wildlife Junior-Senior Required Courses—42-49 credits

AnSc 3301—Systemic Physiology (6)
Bot 3201—Introductory Taxonomy (3)
EBB 5014—Ecology of Plant Communities (5)
(or) EBB 5814—Community Structure and Functioning (5)¹
EBB 5134—Introduction to Ornithology (5)
(or) EBB 5834—Field Ornithology (5)¹
EBB 5817—Vertebrate Ecology (5)¹
(or) one course, intermediate or advanced, in general or animal ecology (4-5)
FW 5129—Mammalogy (5)
FW 5281—Senior Seminar: Wildlife (1)
FW 5561—Wildlife Ecology, Management I: Planning (4)
FW 5562—Wildlife Ecology, Management II: Populations (4)
FW 5563—Wildlife Ecology, Management III: Habitats (3)
FW 5564—Wildlife Ecology, Management IV: Field Problems in Wildlife Resource Management (4)
VPB 5603—Parasites of Wildlife (3)
(or) VPB 5604—Diseases of Wildlife (3)

F. Supporting Courses—24-29 credits

One of the following chemistry sequences:
BioC 1301—Elementary Biochemistry I (5)
BioC 1302, 1303—Elementary Biochemistry II and Laboratory (3, 2)
(or) Chem 3301, 3305—Elementary Organic Chemistry I and Laboratory (4, 2)

¹Offered during the Itasca summer session.

Programs

Chem 3302, 3306—Elementary Organic Chemistry II and Laboratory (4, 2)
CSci 3102—Introduction to Pascal Programming (4)
(or) CSci 3104—Introduction to Programming and Problem Solving (5)
(or) an introductory computer science course
Rhet 3562—Writing in your Profession (4)
Stat 5021—Statistical Analysis I (5)

G. Electives to complete the 192 credits required for graduation with the bachelor of science degree. See your adviser for recommended courses.

Fisheries and Wildlife Minor Requirements

A fisheries and wildlife minor is offered for students who are working toward baccalaureate degrees in other natural-resource management areas or are associated with communications, education, and other fields that enable them to deal with wildlands or water resources in a minor way. The minor provides a basic exposure to the natural history of fish and wildlife species and to the general principles that are applied to managing their populations and habitats. The minor, open to students who have completed the Required Background Courses or their equivalent, can be declared upon completion of the Minor Core Courses plus at least one Optional Course, as follows:

Required Background Courses or their equivalent—18-21 credits in biological sciences:

FW 1001—Orientation in Fisheries and Wildlife (2) S-N
Biol 1103—General Botany (5)
Biol 1106—General Zoology (5)
Biol 3041—Ecology (4)

One vertebrate biology course from the following:

FW 5129—Mammalogy (5)
EBB 5134—Introductory Ornithology (5)
(or) EBB 5834—Field Ornithology (5)¹
EBB 5136—Ichthyology (4)
EBB 5606—Ecology of Fishes (5)
(or) FW 5456—Field Ecology of Fishes (5)¹
VB 1120—Comparative Vertebrate Morphology (5)
(or) EBB 5114—Vertebrate Biology (4)

Minor Core Courses—10-12 credits:

FW 3052—Introduction to Fisheries and Wildlife Biology and Management (4)
FW 5452—Fishery Management in Inland Waters (5)
FW 5563—Wildlife Ecology, Management III: Habitats (3)

Optional Courses—4-5 credits:

FW 5451—Ecology of Fish Populations (5)
FW 5454—Fishery Ecology of Polluted Waters (5)
FW 5455—Aquaculture (4)
FW 5561—Wildlife Ecology, Management I: Planning (4)
FW 5562—Wildlife Ecology, Management II: Populations (4)
FW 5564—Wildlife Ecology Management IV: Field Problems in Wildlife Resource Management (4)

Food Science and Technology

Department of Food Science and Nutrition
225 Food Science and Nutrition (612:373-1071)

Food science and technology applies modern science and engineering to the manufacture and distribution of food. To accomplish this objective, an understanding of the basic principles and techniques of many disciplines, including chemistry, physics, economics, engineering, microbiology, nutrition, management, public health, and agricultural production, must be coupled with the ability to apply this knowledge to food processing and preservation as well as to marketing situations. Food scientists and technologists are

¹Offered during the Itasca Summer Session.

concerned with the theoretical and practical aspects of the food industry that involve the food chain from the production of raw materials to the ultimate utilization of products by consumers. This curriculum balances fundamental principles and useful applications of theory within a flexible program that permits you to tailor your studies to fit personal career goals.

The program emphasizes the attitudes, knowledge, and skills essential to understanding the principles of food science. In it you learn to recognize and analyze problems of the food industry and to arrive at solutions through the application of principles of the biological and physical sciences, engineering, and business. You develop competence in a professional discipline related to the food industry through supplementary studies in an area of emphasis in business administration, chemistry, engineering, microbiology, or public health. Food scientists and technologists should be prepared to meet challenges of work in such areas as cereals, dairy products, fruits and vegetables, meat and poultry products, or fabricated foods of the future.

This program is open to students registered in either the College of Agriculture or the College of Home Economics. Faculty advisers are normally from the Department of Food Science and Nutrition, which is jointly administered by the two colleges.

Many graduates of the program seek employment after earning the bachelor of science degree, while others continue on to graduate study. Among the job areas available for graduates are production management, product and process research and development, public health and regulatory agency service, teaching, merchandising, advertising, technical service and sales, quality control supervision, and international nutrition and food agency work.

Major Requirements

The requirements for the major in food science and technology are listed below. Course substitutions in categories A, B, C, and D may be made only with the approval of the college office, and in categories E and F only with the approval of your adviser and the Department of Food Science and Nutrition.

A. Communication, Language, Symbolic Systems

- Math 1142—Short Calculus (5)
- Rhet 1101—Writing to Inform and Persuade (or equivalent) (4)
- Rhet 1104—Library Laboratory (1) S-N
- Rhet 1151—Writing in your Major (4)
- Rhet 1222—Public Speaking (4)
- Rhet 3562—Writing in your Profession (4)
- 4 credits in statistics

B. Physical and Biological Sciences

- Biol 1009—General Biology (5)
- Biol 5001—Biochemistry (4)
- BioC 5025—Biochemistry Laboratory (2)
- Chem 1004—General Principles of Chemistry (5)
- Chem 1005—General Principles of Chemistry (5)
- Chem 3301, 3305—Elementary Organic Chemistry I and Laboratory (4, 2)
- Chem 3302, 3306—Elementary Organic Chemistry II and Laboratory (4, 2)
- MicB 3103—General Microbiology (5)
- Phys 1041, 1045—Introductory Physics and Laboratory (4, 1)
- Phys 1042, 1046—Introductory Physics and Laboratory (4, 1)

C. The Individual and Society—14 credits minimum

- See All-College Requirements (end of section II). One course required in the area of Development of Civilization.
- AgEc 1020—Principles of Macroeconomics (5)
- (or) Econ 1001—Principles of Macroeconomics (4)
- AgEc 1030—Principles of Microeconomics (4)
- (or) Econ 1002—Principles of Microeconomics (4)

D. Literature, Humanities, and Fine Arts—9 credits minimum

- See All-College Requirements (end of section II).

Programs

E. Professional Courses in the Major

- FScN 1102—Technology of Food Processing (4)
- FScN 3110—Food Chemistry (4)
- FScN 3112—Food Chemistry Laboratory (2)
- FScN 3600—Principles of Nutrition (4)
- FScN 5100—General Seminar (1)
- FScN 5120—Food Microbiology (5)
- FScN 5122—Sanitation and Control of Microorganisms (2)
- FScN 5123—Microbiology of Food Fermentations (2)
- FScN 5135—Food Process Engineering I (4)
- FScN 5136—Food Process Engineering II (4)
- FScN 5312—Chemical and Instrumental Analysis of Foods (5)

Plus a minimum of 20 credits to be chosen from the following courses (with a minimum of 8 of the credits chosen from FScN 5512, 5522, 5523, 5530, 5540, 5555):

- FScN 1500—Meat Science (4)
- FScN 5000—Professional Experience Program (4) A-N only
- FScN 5111—Independent Study in Food Science and Nutrition (1-5)
- FScN 5310—Advanced Food Chemistry (3)
- FScN 5320—Advanced Dairy and Food Microbiology (4)
- FScN 5321—Independent Study in Food Microbiology (1-5)
- FScN 5350—Application of Experimental Design in the Food Industry (4)
- FScN 5360—Sensory Evaluation of Food Quality (4)
- FScN 5380—Food Packaging (3)
- FScN 5390—Introduction to Food Law (4)
- FScN 5412—Physicochemistry of Foods (3)
- FScN 5413—Structural-Functional Relations in Food Systems (3)
- FScN 5510—Muscle Chemistry and Physiology (4)
- FScN 5512—Meat and Protein Technology (4)
- FScN 5522—Technology of Fluid and Concentrated Milk Products (4)
- FScN 5523—Technology of Fermented Dairy Products (4)
- FScN 5524—Sensory Evaluation of Dairy Products (1)
- FScN 5530—Industrial Processing of Fruits and Vegetables (4)
- FScN 5540—Fats and Oils Chemistry and Technology (4)
- FScN 5555—Freezing and Dehydration of Foods (5)

F. Areas of Emphasis

In addition to the above requirements, you must complete one of the following areas of emphasis. The area of emphasis is designed to support and complement your major field. Courses used to complete the area of emphasis cannot be used to meet other major course requirements. It is assumed that a well-conceived area of emphasis will include some 3000- and 5000-level courses.

Cereals

This area of emphasis is designed for the student interested in cereals, including the handling, storage, and marketing of grains as well as the utilization of cereal-based products in food systems. At least 20 credits should be selected from the following courses. Courses must include:

- AgET 3615—Crop Processing and Storage (4)
- FScN 5413—Structural Functional Relations in Food Systems (3)
- AgEc 3420—Grain Marketing Economics (3)

Other courses may include:

- Agro 1100—Morphology and Identification of Crops and Weeds (4)
- Agro 1110—Seed Analysis and Grain Handling (3)
- AgEc 1400—Agricultural Markets and Pricing (4)
- Biol 3012—Plant Biology (5)
- Bot 3109—Plant Anatomy (5)
- Ent 1005—Economic Entomology (4)
- Ent 3175—Introductory Entomology (5)
- Ent 5252—Stored Product Pest Management (4)
- FScN 3403—Experimental Foods (4)
- GCB 3022—Genetics (4)
- GCB 5606—Electron Microscopy (3)
- PIPa 3001—Introductory Plant Pathology (6)
- PIPa 5106 or 5107—Mycology (4)
- PIPh 3131—Survey of Plant Physiology (4)

Chemistry

This area of emphasis is designed for the student seeking a fundamental approach to the chemistry of foods and food processes. FScN 5310 is required of all students selecting this area of emphasis. You must select at least 20 credits of

Food Science and Technology

chemistry, which may include FScN 5310 if not counted in category E. Other credits may include the following:

- BioC 5002—Biochemistry (3)
- Chem 1006—Solution Chemistry (4)
- Chem 3100, 3101—Quantitative Analysis and Laboratory (3, 2)
- Chem 5520—Elementary Physical Chemistry (3)
- Chem 5521—Elementary Physical Chemistry (3)

Dairy Technology

This area of emphasis is designed for the student primarily interested in the technology and processing of dairy products. At least 20 credits must be selected to represent dairy processing, dairy marketing and economics, and other related areas. Courses must include:

- FScN 5522—Technology of Fluid and Concentrated Milk Products (4)
- FScN 5523—Technology of Fermented Dairy Products (4)
- AgEc 3430—Dairy Marketing Economics (3)

Other courses may include:

- AnSc 1520—Milk Production (3)
- AgEc 1400—Agricultural Markets and Prices (4)
- FScN 5524—Sensory Evaluation of Dairy Products (1)
- FScN 5360—Sensory Evaluation of Food Quality (4)

Engineering Technology

This area of emphasis is designed for the student interested primarily in the engineering technology aspects of food process development and production. At least 25 credits in a cohesive program are to be selected in consultation with your adviser. These should include:

- AgET 5021—Mechanics of Agricultural Systems (4)
- AgET 5022—Energy Systems in Agriculture (4)
- AgET 5023—Fluids—Principles and Systems (4)

Students interested in a four-year food engineering degree should consult the listing of the Department of Agricultural Engineering in the *Institute of Technology Bulletin*.

Industrial Engineering

This area of emphasis is designed for the student with competence and interest in the industrial engineering aspects of the food industry. The requirements include the following:

- ME 3900—Introduction to Engineering Statistics (4)
- (or) Stat 3091—Introduction to Probability and Statistics (4)
- At least 20 credits from the industrial engineering courses described in the *Institute of Technology Bulletin*

Management

This area of emphasis is designed for the student interested in the problems of the business and economic phases of food industries. You must select at least 30 credits from course offerings in the Departments of Agricultural and Applied Economics, Economics, and Rhetoric, and in the School of Management.

- BioC 1301—Elementary Biochemistry I (5), BioC 1302—Elementary Biochemistry II (3), and BioC 1303—Elementary Biochemistry Laboratory (2) may be substituted for Chem 3301 (4), 3302 (4), 3305 (2), 3306 (2), Biol 5001 (4) and BioC 5025 (2) in category B.

Meat Science and Technology

This area of emphasis is designed for the student primarily interested in the technology of meat products. At least 20 credits must be selected to represent meat science, technology, marketing, and economics. Courses must include:

- FScN 1500—Meat Science (4)
- FScN 5512—Meat and Protein Technology (4)
- AgEc 3440—Livestock Marketing Economics (3)

Other courses may include:

- AgEc 1400—Agricultural Markets and Prices (4)
- AgEc 5480—Futures, Markets and Prices (4)
- AnSc 1120—Livestock and Meat Evaluation (4)
- AnSc 3143—Meat: Judging and Grading (2)
- LACS 5651—Veterinary Community Medicine (3)

Microbiology

This area of emphasis is designed for the student interested in courses related to the microbiological aspects of the food processing industry. You must select about 20 credits of microbiology-oriented courses in biochemistry, microbiology, plant pathology, public health, and related departments. These usually include:

- MicB 5321—Physiology of Bacteria (3)

Programs

Nutrition

This area of emphasis is designed for the student interested in courses related to the nutritional aspects of the food processing industry. The following courses are required:

Phsl 1002—Human Physiology (4)
(or) Phsl 3051—Human Physiology (5)

About 20 additional credits of nutrition-oriented courses in food science and nutrition, biochemistry, animal science, and related departments, including:

FScN 3622—Nutrition in the Life Cycle (4)
FScN 5622—Human Nutrition (5)

Public Health

This area of emphasis is designed to provide the necessary background for the variety of activities performed by the sanitarian in either government or industrial work related to the regulation and quality control of raw materials and finished products in the food field. At least 20 credits are to be selected from course offerings of the School of Public Health. See the *School of Public Health Bulletin* for course listings.

Other Areas

The above areas of emphasis may not satisfy the needs and interests of every student. With the aid of your adviser, you may plan a course of study in another area of emphasis or in a combination of suggested areas. Examples include advertising, journalism, sales, mechanical engineering, statistics, and experimental design. Some 3000- and 5000-level courses must be included.

G. Electives to complete the 186 credits required for graduation with the bachelor of science degree.

Horticultural Science

Department of Horticultural Science and Landscape Architecture
305 Alderman Hall (612/373-1026)

The horticultural science major offers the following areas of emphasis:

floriculture—production, improvement, and use of floral plants

food production—fruit and vegetable science

general horticulture—studies in a variety of areas of horticulture

landscape management—use and management of horticultural plant materials in park, business, and residential landscapes

nursery management—economic, managerial, and scientific aspects of nursery stock production

turf management—the science and practice of commercial turf production and maintenance

urban horticulture—application and communication of horticultural practices in community settings

Persons holding bachelor's degrees in horticulture work in fruit and vegetable production, floriculture, urban horticulture, turf management, landscape horticulture, and nursery management in state, city, and county agencies as well as in private industry.

Holders of the master's or doctor's degree qualify for challenging research, extension, and teaching positions in industry, government, and education. If you plan to pursue graduate study in horticultural science, you should complete additional work in mathematics and the basic sciences. Consult your adviser about selection of such course work.

Major Requirements

All students in the horticultural science major must complete the requirements listed below. Consult with your adviser to determine a suitable sequence for completing the required courses. Course substitutions in categories A, B, C, and D may be made only with the approval of the college office, and in categories E and F only with the approval of your adviser and the Department of Horticultural Science and Landscape Architecture.

A. Communication, Language, Symbolic Systems

See Agricultural Science and Industries Curriculum Requirements (end of section II).

B. Physical, Biological, and Analytical Sciences

BioC 1301—Elementary Biochemistry I (5)
BioC 1302, 1303—Elementary Biochemistry II and Laboratory (3, 2)
Biol 1009—General Biology (5)
Biol 1103—General Botany (5)
Chem 1004—General Principles of Chemistry (5)
Chem 1005—General Principles of Chemistry (5)
Phys 1001, 1005—The Physical World and Laboratory (4, 1)

C. The Individual and Society—14 credits minimum

See All-College Requirements (end of section II). One course required in the area of Development of Civilization.
AgEc 1020—Principles of Macroeconomics (5)

D. Literature, Humanities, and Fine Arts—8 credits minimum

See All-College Requirements (end of section II).

E. Supporting Courses

Ent 1005—Economic Entomology (4)
(or) Ent 5050—Forest Entomology (4)
PIPa 3001—Introductory Plant Pathology (6)
(or) PIPa 5050—Forest Pathology
PIPh 3131—Survey of Plant Physiology (4)
Soil 1122—Introductory Soil Science (4)

F. Professional Courses in the Major—45 credits (25 of which must be in courses at the 3000 level or above)

Required of all students:
Hort 1016—Greenhouse Management (4)
Hort 1036—Plant Propagation (4)
Hort 1099—Orientation to Horticulture (1)
Hort 1100—Biology of Horticultural Production (4)
Hort 3099—Seminar (1)

Note: You must complete Hort 1016, 1036, 1099, and 1100 plus 50 credits in categories A, B, C, D, and E above before you begin taking horticulture courses at the 3000 level or above.

In addition to the above, you must complete one of the following areas of emphasis.

Floriculture

AgEc 1250—Principles of Accounting (4)
Bot 3109—Plant Anatomy (5)
GCB 3022—Genetics (4)
Hort 1022—Herbaceous Plant Material (5)
Hort 3053—Ornamentals for Interior Design (4)
Hort 3077—Floral Design (3)
Hort 3079—Ornamental Horticultural Business Practices (3)
Hort 3097—Horticulture Practicum (2-4)
(or) Hort 5000—Professional Experience Program (4)
Hort 5040—Plant Growth Regulators (3)
Hort 5052—Commercial Floriculture: Fall Crops (3)
Hort 5053—Commercial Floriculture: Winter Crops (4)
Hort 5054—Commercial Floriculture: Spring Crops (3)
Stat 1051—Introduction to Ideas of Statistics (4)
(or) Stat 3081—Experimental Techniques and Statistical Inference (5)

Food Production

Agro 5020—Introduction to Plant Breeding (3)
Agro 5030—Weed Control (5)
GCB 3022—Genetics (4)
Hort 3031—Fruit Science (4)
Hort 3033—Postharvest Handling and Physiology of Horticultural Crops (3)
Hort 5034—Commercial Vegetable Production: Tuber, Bulb, Root Crops (3)
Hort 5035—Commercial Vegetable Production: Fruit, Seed, and Leafy Types (3)
Hort 5036—Topics: Optimizing Horticultural Food Production (1)
Hort 5040—Plant Growth Regulators (3)
Hort 5041—Environmental Physiology of Horticultural Plants (3)
Hort 3098, 5090, 5091, or 5092 (2 credits minimum)
Stat 3081—Experimental Techniques and Statistical Inference (4)

Programs

One of the following courses:

- Bot 3109—Plant Anatomy (5) (suggested for students considering graduate study)
- EBB 3004—Fundamentals of Ecology (4)
- Geo 1001—Physical Geology (5)
- MicB 3103—General Microbiology (5)

Plus an additional 10 credits of horticulture electives, including a minimum of 3 credits in upper division courses: Hort 5006—Systematics of Temperate and Tropical Horticultural Food Crops is recommended.

General Horticulture

- Bot 3109—Plant Anatomy (5)
- Bot 3201—Introductory Taxonomy (3)
- GCB 3022—Genetics (4)
- Hort 1021, 1022—Woody Plant Materials, Herbaceous Plant Materials (10)
(or) Hort 5021—Ornamental Plant Materials (5)
- Hort 3079—Ornamental Horticulture Business Practices (3)
- Hort 3097—Horticultural Practicum (2-4)
(or) Hort 5000—Professional Experience Program (4)
- Hort 5040—Plant Growth Regulators (3)
- Plus 14 additional credits in horticulture courses at the 3000 level or above

Landscape Management

- Hort 1021—Woody Plant Materials (5)
- Hort 1022—Herbaceous Plant Materials (5)
- Hort 3026—Residential Landscape Design (4)
- Hort 3072—Turf Management (4)
- Hort 3076—Arboriculture (3)
- Soil 3210—Soil Physical Properties (4)
(or) Soil 3416—Soil Fertility (5)
- Hort 3097—Horticultural Practicum (2-4)
(or) Hort 5000—Professional Experience Program (4)
- Hort 5026—Landscape Management (5)
- AgEc 1250—Principles of Accounting (5)
- BLaw 3058—Introduction to Law, and the Law of Contracts and Agency (4)
- LA 3071—Landscape Technology: Ground Form Design (4)
- One course in surveying

One of the following courses:

- Bot 3109—Plant Anatomy (5)
- EBB 3001—Introduction to Ecology (4)
(or) EBB 3004—Fundamentals of Ecology (4)
- GCB 3022—Genetics (4)
- Geo 1001—Physical Geology (5)

One of the following courses:

- Ind 1600—Drafting (3)
- LA 1025—Basic Visualization (4)

Nursery Management

- AgEc 1030—Principles of Microeconomics (4)
- Agro 5030—Weed Control (5)
- GC 1513—Principles: Small Business Operations (5)
- GC 3560—Personnel Administration (4)
(or) IR 3002—Industrial Relations (4)
- Hort 1021—Woody Plant Materials (5)
- Hort 1022—Herbaceous Plant Materials (5)
- Hort 3026—Residential Landscape Design (4)
- Hort 3053—Ornamentals for Interior Design (4)
(or) Hort 3072—Turf Management (4)
- Hort 3076—Arboriculture (3)
- Hort 3079—Ornamental Horticultural Business Practices (3)
- Hort 5026—Landscape Management (5)
- Hort 5040—Plant Growth Regulators (3)
- Hort 5046—Nursery Management and Production I (4)
- Hort 5048—Nursery Management and Production II (4)
- Soil 3416—Soil Fertility (5)
- Ind 1600—Drafting (3)
(or) LA 1025—Basic Visualization I (4)

Plus one of the following:

- AgEc 5020—Applied Linear Programming (4)
- Biol 3041—Ecology (4)
- Bot 3109—Plant Anatomy (5)
- MicB 3103—Microbiology (5)
- GCB 3022—Genetics (4)

Turf Management

- AgEc 1250—Principles of Accounting (4)
- Agro 5030—Weed Control (5)
- BLaw 3058—Introduction to Law, and the Law of Contracts and Agency (4)
- Hort 1021—Woody Plant Materials (5)
- Hort 1022—Herbaceous Plant Materials (5)
- Hort 3031—Fruit Science (4)
- (or) Hort 5034—Commercial Vegetable Production: Tuber, Bulb, Root Crops (3)
- (or) Hort 5035—Commercial Vegetable Production: Fruit, Seed, and Leafy Types (3)
- Hort 3072—Turf Management (4)
- Hort 3076—Arboriculture (3)
- Hort 3097—Horticultural Practicum (2-4)
- (or) Hort 5000—Professional Experience Program (4)
- Hort 5042—Turf Grass Science (5)
- LA 3071—Landscape Technology: Ground Form Design (4)
- Soil 3210—Soil Physical Properties (4)
- (or) Soil 3416—Soil Fertility (5)
- One of the following courses:
 - Bot 3109—Plant Anatomy (5)
 - GCB 3022—Genetics (4)
 - Geo 1001—Physical Geology (5)
 - EBB 3004—Fundamentals of Ecology (4)
 - MicB 3103—General Microbiology (5)
- One course in surveying

Urban Horticulture

- AgEd 5021—Education Through Extension Methods (3)
- AgJo 3530—Publicity (4)
- EBB 3004—Fundamentals of Ecology (4)
- (or) EBB 3001—Introduction to Ecology (4)
- Hort 1021—Woody Plant Materials (5)
- Hort 1022—Herbaceous Plant Materials (5)
- Hort 3026—Residential Landscape Design (4)
- Hort 3031—Fruit Science (4)
- Hort 3053—Ornamentals for Interior Design (4)
- Hort 3072—Turf Management (4)
- Hort 3076—Arboriculture (3)
- Hort 3097—Horticulture Practicum (2-4)
- (or) Hort 5000—Professional Experience Program (4)
- Hort 5034—Commercial Vegetable Production: Tuber, Bulb, Root Crops (3)
- Hort 5035—Commercial Vegetable Production: Fruit, Seed, and Leafy Types (3)
- Ind 1600—Drafting (3)
- (or) LA 1025—Basic Visualization I (4)

G. Electives to complete the 192 credits required for graduation with the bachelor of science degree.

Minor Requirements

This minor enables you to develop your horticultural knowledge, skills, and attitudes to a preprofessional level. The program has the rigor but not the length of a major in horticultural science. It prepares you for a richer personal life, nonprofessional job entry, and subsequent formal or informal studies in horticulture. The program includes a minimum of 25 credits in horticulture plus required supporting courses.

Required Supporting Courses:

- Chem 1001—Chemical Principles and Covalent Systems (5)
- (or) Chem 1004—General Principles of Chemistry (5)
- Soil 1122—Introductory Soil Science (4)
- Biol 1009—General Biology (5)
- Biol 1103—General Botany (5)

Required Courses:

- Hort 1016—Greenhouse Management (4)
- Hort 1036—Plant Propagation (4)
- Hort 1100—Biology of Horticultural Production (4)

Optional Courses:

Hort electives to bring total to 25 credits (one related area course may be used to meet this requirement). You may apply a maximum of 4 credits in special problems, independent study, or Professional Experience Program courses.

International Agriculture

Minor Requirements

The international agriculture minor is an interdisciplinary program combining course work, field experience, and a seminar. A minimum of 30 credits are required, of which 5 must be for either a work/study experience or a major literature review, and 1 for a seminar in international agriculture. Students should develop their course of study in cooperation with an adviser in one of the departments of the College of Agriculture.

Required courses—24 credits minimum

Courses in agriculture outside the major—14 credits

Courses in language, cultural aspects, geography, and history of an area of special interest—10 credits

These courses should form a planned, coherent program that develops competencies in a geographical area of interest to the student.

Research paper: 5 credits minimum

Select one of the following:

1. Field experience including work/study in some area of international agriculture. Students should keep a log book.
2. Extensive literature review in some area of international agriculture. Students should work with a faculty member who has international experience in an area of interest to them.

Seminar in International Agriculture—1 credit

Landscape Architecture

Landscape Architecture Program

205 North Hall, 2005 Buford Avenue, St. Paul, MN 55108 (612/376-7537)

Landscape architecture is concerned with the impact, disposition, and management of natural resources as well as the quality of experience that results from the development of land for specific human use.

The landscape architect is concerned with a wide range of projects: large-scale regional landscape planning; design of exterior environments for working, living, and recreation; commercial, institutional, and industrial development; transportation systems; and multiple-use areas. Projects may vary in scale from single-family residences to regional open space systems. Professional services include land use feasibility studies, site selection studies, site layout proposals, detail grading, construction drawings, and planting plans.

Regional resource planning and design, recreation planning and design, urban landscape design, and detail site planning projects involve landscape architects, architects, planners, engineers, geographers, physical scientists, social scientists, and others. The relationship between regional or single site qualities of terrain, soil, climate, vegetation, orientation, visual quality, and the program for development are studied carefully to assure sound recommendation.

Bachelor of Landscape Architecture (B.L.A.) Program—This five-year program, offered jointly by the College of Agriculture and the Institute of Technology, emphasizes the design process. It is designed to provide the basic professional training for the practice of landscape architecture and to allow for exploration of one or more areas of professional interest. It leads to the professional bachelor of landscape architecture degree.

A total of 230 credits are required for graduation, 130 of them in 3000- and 5000-level courses. This more advanced work includes a design sequence that takes a minimum of three years. Students, through consultation with their advisers, select specialized areas of interest in which to concentrate their studies. These areas include: site planning, focusing on developing small-scale land areas for intensive human use; regional design, focusing on organizing large-scale land areas and analyzing their development potential in terms of

land use; urban design, focusing on the organization of urban environments and systems; and recreational design, focusing on either broad or site aspects of recreational land use. Other areas of interest may be developed.

It is recommended that you complete a minimum of 800 hours of work experience outside of classwork. At least 400 of these hours should be spent in landscape construction or in a landscape nursery and 400 hours in the office of a professional landscape architect.

Bachelor of Environmental Design (B.E.D.) Program—This nonprofessional program is offered only through the Institute of Technology. It is designed to allow you to explore a broad range of environmental courses as well as complete two years of professional courses in landscape architecture. Upon completion of the B.E.D. degree requirements, you may continue on for the professional B.L.A. degree, enter a professional master's degree program, or transfer to another discipline such as city design, city and regional planning, or an area of the social or natural sciences.

A total of 192 credits are required for the B.E.D. degree. It is recommended that you also complete 400 hours of summer work in landscape architecture. Individualized study programs may be arranged with approval of the faculty.

In both degree programs, you must pass required core courses in the curriculum with a minimum grade of C. These courses are LA 1025, 1026, 3071, 3072, 3101, 5117, 5119, 5226, 5261, 5265; Hort 1021, 1022; and all design courses.

Admission procedures and major requirements for the bachelor of landscape architecture program are detailed below. For information about the bachelor of environmental design program, see the *Institute of Technology Bulletin*.

Admission Procedures—To enter the landscape architecture program you must submit an application by May 1 of the year in which you wish to begin. Admission to the program is permitted only in the fall quarter unless advanced standing is granted. The procedures and requirements are as follows:

1. Apply to the University of Minnesota if not already a University of Minnesota student. Forms may be obtained from the Office of Admissions, 240 Williamson Hall, University of Minnesota, 231 Pillsbury Drive S.E., Minneapolis, MN 55455; or the Office of Admissions and Records, 130 Coffey Hall, University of Minnesota, 1420 Eckles Avenue, St. Paul, MN 55108.

Before an application will be considered, you must have completed a minimum of 75 credits of required pre-landscape architecture courses; these credits may include courses for which you are registered at the time of application. This total must include at least 4 credits in basic English or communications, 10 credits in physical and biological sciences, 6 credits in social sciences, 12 credits in studio arts or design, and 8 credits in landscape architectural, environmental, or design theory.

2. Complete the landscape architecture program application form (available from the Department of Horticultural Science and Landscape Architecture, St. Paul; the School of Architecture and Landscape Architecture, Minneapolis; or either admissions office identified above.)
3. Submit a letter of intent stating your reasons for selecting landscape architecture as a profession. You should give an account of your reasons for becoming interested in the field, your experience in landscape architecture or related fields (art, horticulture, architecture, engineering, construction, etc.), your other interests (travel, hobbies, etc.), and your perception of yourself in the role of a landscape architect.
4. Submit an official transcript of all college work completed to date at the University of Minnesota and other colleges. Generally, you must have a 2.50 GPA for admission.

Programs

5. Submit a portfolio of art or design work, environmental or design reports, photographs of sculptural work, slides, or similar examples of creative work. It is suggested that the portfolio be a bound 8½- by-11-inch booklet. A portfolio that is larger than 24 by 36 inches will not be accepted. Material not enclosed in a carry case is also unacceptable. Any slides must be in an 8½- by-11-inch transparent slide carrier. It is recommended that you bring the portfolio to the interview with the faculty member.
6. Interview or correspond with at least two landscape architecture faculty members prior to the May 1 application deadline. Specific times for interviews should be arranged with the individual instructors. The interview or correspondence is used to judge your commitment to finish the landscape architecture design program and to determine your enthusiasm for landscape architecture and sensitivity to people and the environment. It allows you to demonstrate your design, communication, and organizational skills. From the interview the faculty will judge your insight into landscape architecture, professional development, dedication and sincerity, self-confidence, demonstrated design abilities, and self-realization potential.

You are encouraged to visit the design studios and talk to students who are in the program and to find out as much about the profession as you can.

The landscape architecture faculty votes on applicants, who are either admitted to the program, rejected, or assigned pre-landscape architecture status. Approval for admission is based on consideration of the following:

1. The student's academic standing and grade point average.
2. The student's maturity and experience.
3. The student's letter of intent.
4. The estimated design potential of the student.
5. The availability of staff and space.

Applicants will be notified by letter of the admission decision by June 1. Those admitted must notify the landscape architecture program chair of their intention to attend by July 1, or their places will be forfeited. Those not accepting the opportunity must reapply if they wish to enter the program at a later date.

Major Requirements

You must complete 75 credits of the pre-landscape architecture requirements in categories A through E before applying for admission to the landscape architecture program.

A. Communication, Language, Symbolic Systems

- Rhet 1101—Writing to Inform and Persuade (4)
- Rhet 1104—Library Laboratory (1 cr) S-N
- Rhet 1151—Writing in Your Major (4)
- Rhet 1222—Public Speaking (4)
- Rhet 3562—Writing in Your Profession (4)
- Math 1111—College Algebra and Analytical Geometry (5)
- One additional college-level course in mathematics, statistics, or computer science (3)

B. Physical and Biological Sciences—18 credits minimum

These credits are to be selected from courses in such areas as botany, biology, chemistry, geology, natural sciences, and physics. See your adviser if you have questions about selecting course work.

C. The Individual and Society—16 credits minimum

See All-College Requirements (end of section II). One course required in the area of Development of Civilization.

D. Literature, Humanities, and Fine Arts—8 credits minimum

See All-College Requirements (end of section II).

E. Professional and Supporting Courses in the Major

One course in surveying

One of the following courses:

- LA 1021—History of Environmental Development: Architecture (4)
- LA 1022—History of Environmental Development: Landscape Architecture (4)
- LA 1023—History of Environmental Development: Planning (4)
- Arch 5056—Modern Architecture (4)

Two of the following courses:

- LA 1024—Landscape Theory (4)
- LA 1031—Introduction to Landscape Architecture (4)
- LA 3001—Environmental Design: Man and Environment (4)
- LA 3002—Environmental Design: Tools and Processes (4)
- LA 3003—Environmental Design: Implementation and Evaluation (4)

Soil 1122—Introductory Soil Science (4)

12 credits in studio arts

F. Professional Courses in the Major

Hort 1021—Woody Plant Materials (5)

Hort 1022—Herbaceous Plant Materials (5)

LA 1025—Basic Visualization I (4)

LA 1026—Basic Visualization II (4)

LA 3071—Landscape Technology: Ground Form Design (4)

LA 3072—Landscape Technology: Circulation and Utilities Design (4)

LA 3081—Basic Design (6)

LA 3082—Basic Design (6)

LA 3083—Basic Design (6)

LA 3091—Intermediate Design (6)

LA 3092—Intermediate Design (6)

LA 3093—Detail Site Design (6)

LA 3101—Communicating Landscape Quality (4)

LA 5110—Advanced Landscape Planning and Design (6)

LA 5117—Planting Design: Aesthetic and Functional Criteria (4)

LA 5119—Planting Design: Ecological Principles/Land Use Concepts (4)

LA 5224—Contemporary Issues in Landscape Architecture (4)

LA 5226—Professional Practice (4)

LA 5261—History of Landscape Architecture: The European, Oriental, and American Tradition (4)

LA 5265—History of Landscape Architecture: Individual Influences (4)

One of the following courses:

- LA 3073—Landscape Technology: Land Analysis Techniques (4)
- LA 3075—Landscape Technology: Materials and Construction Design (4)
- LA 5225—Landscape Technology: Working Drawings and Specifications (4)

Two of the following courses:

- LA 5101—Site Planning and Design (6)
- LA 5103—Urban Landscape Design (6)
- LA 5105—Recreational Planning and Design (6)
- LA 5107—Regional Landscape Design (6)

G. Electives supporting the professional degree to complete the 230 credits required for graduation with the bachelor of landscape architecture degree.

Nutrition and Dietetics

Department of Food Science and Nutrition

225 Food Science and Nutrition (612/373-1071)

This program is intended for those interested in the field of nutrition and its various applications in dietetics, public health, and nutrition science. The options offered in dietetics and community nutrition meet the requirements of the American Dietetic Association for membership and for internship. Students completing either option and a 6- to 12-month hospital or public health internship may seek employment in hospitals or community agencies.

The nutrition science option is planned for those interested in graduate study in this area. Students in this option should maintain a minimum grade point average of 2.80. Employment possibilities for persons holding graduate degrees in nutrition science include college and university teaching and university and industrial research.

Programs

You must complete the organic chemistry sequence by the end of your sophomore year in order to have the prerequisites to enter courses normally scheduled in the junior year, or you may be delayed in completing the program. Transfer students who have completed organic chemistry or biochemistry courses that are not as extensive as those listed below are required to take additional courses in both fields.

The American Dietetic Association has accredited a coordinated undergraduate program in dietetics at the University. With the cooperation of Twin Cities area hospitals, this program enables qualified students to integrate an internship experience with the final two years of undergraduate study. Upon completing the program students are assured membership in the American Dietetic Association. Enrollment is limited, and interested students should apply to the program director early in their sophomore year.

This program is open to students registered in either the College of Agriculture or the College of Home Economics. Faculty advisers are normally from the Department of Food Science and Nutrition, which is jointly administered by the two colleges.

Major Requirements

Students selecting the nutrition and dietetics major must complete the requirements listed below. Course substitutions in categories A, B, C, and D may be made only with the approval of the college office, and in categories E and F with the recommendation of your adviser and the approval of the Department of Food Science and Nutrition.

A. Communication, Language, Symbolic Systems

- Math 1111—College Algebra and Analytical Geometry (5)
- Rhet 1101—Writing to Inform and Persuade (or equivalent course) (4)
- Rhet 1104—Library Laboratory (1) S-N
- Rhet 1151—Writing in Your Major (4)
- Rhet 1222—Public Speaking (4)
- Rhet 3562—Writing in Your Profession (4)

B. Physical and Biological Sciences

- Anat 1004—Elementary Anatomy (4)
- BioC 5025—Laboratory in Biochemistry (2)
- Biol 1009—General Biology (5)
- Biol 5001—Biochemistry (4)
- Chem 1004—General Principles of Chemistry (5)
- Chem 1005—General Principles of Chemistry (5)
- Chem 3301, 3305—Elementary Organic Chemistry and Laboratory (4, 2)
- Chem 3302, 3306—Elementary Organic Chemistry and Laboratory (4, 2)
- MicB 3103—General Microbiology (5)
- (or) Biol 3013—General Microbiology (5)
- Phcl 1009—Pharmacology for Nursing Students (3)
- Phsl 3051—Human Physiology (5)
- (or) Phsl 1002—Human Physiology (4)

C. The Individual and Society

- See All-College Requirements (end of section II). One course required in the area of Development of Civilization.
- AgEc 1020—Principles of Macroeconomics (5)
- (or) Econ 1001—Principles of Macroeconomics (4)
- AgEc 1030—Principles of Microeconomics (4)
- (or) Econ 1002—Principles of Microeconomics (4)
- Psy 1001—General Psychology (5)
- Soc 1001—Introduction to Sociology (4)

D. Literature, Humanities, and Fine Arts—9 credits minimum

- See All-College Requirements (end of section II).

E. Professional Courses in the Major

- FScN 3110—Food Chemistry (4)
- FScN 3112—Food Chemistry Laboratory (2)
- FScN 3272—Introduction to Food Decision Making (2)
- FScN 3403—Experimental Foods (4)

FScN 3472—Principles of Food Purchasing (4)
FScN 3600—Principles of Nutrition (4)
FScN 3622—Nutrition in the Life Cycle (4)
FScN 3730—Quantity Food Purchasing and Production (5)
FScN 3750—Principles of Foodservice Management (3)
FScN 5100—General Seminar (1)
FScN 5622—Human Nutrition (5)
FScN 5665, 5675—Applied Clinical Nutrition and Laboratory I (2, 1)
FScN 5666, 5676—Applied Clinical Nutrition and Laboratory II (2, 1)
FScN 5667, 5677—Applied Clinical Nutrition and Laboratory III (2, 1)
LaMP 5177—Pathology for Allied Health Students (4)
Mgmt 3001—Fundamentals (4)

4 or 5 additional credits in sociology or anthropology

3 credits in psychology of learning to be selected from:

HSU 5011—Instructional Skills for Health Professionals: The Teaching-Learning Process (3)

PsyF 5182—Psychology of Student Learning (3)

PsyF 5183—Adult Learning, Educational Practice (3)

3-5 credits in statistics or computer usage to be selected from the following or in consultation with your adviser:

PsyF 5110—Introductory Statistical Methods (3)

PubH 5404—Introduction to Biostatistics and Statistical Decision (4)

Soc 3801—Sociological Methods I: Descriptive Statistics (5)

Stat 1051—Introduction to Ideas of Statistics (4)

Stat 3081—Experimental Techniques and Statistical Inference (5)

Stat 5021—Statistical Analysis I (5)

F. Area of Emphasis

In addition to the above requirements, you must complete one of the five following areas of emphasis.

Clinical Dietetics and General Dietetics

The requirements for these options are met by the general program listed in categories A through E above and meet American Dietetic Association requirements for these specializations.

Community Nutrition

If you want to add the community specialization of the American Dietetic Association, you should add the following courses:

PubH 3601—Introduction to Public Health Nutrition (3)

PubH 5380—Applied Human Nutrition (3)

Coordinated Undergraduate Program in Dietetics

The basic curriculum is similar to that specified in categories A through E above. However, it also includes field experience courses in which didactic and clinical phases of instruction are coordinated. A detailed plan of the coordinated program may be obtained from the Department of Food Science and Nutrition.

Nutrition Science

If you want a nutrition science emphasis or are considering graduate study, you may, with the approval of your adviser, substitute up to 28 credits from the courses listed below for an equivalent number of credits from the major requirements. Courses cannot be substituted for FScN 5622. This option is intended primarily to provide preparation for graduate studies and does *not* meet the American Dietetic Association requirements for internship.

BioC 5745—Biochemical Analysis (2)

BioC 5751—General Biochemistry (4)

BioC 5752—General Biochemistry (4)

Chem 1006—Principles of Solution Chemistry (4)

Chem 3100—Quantitative Analysis (3)

Chem 3303—Elementary Organic Chemistry III (4)

Chem 5520—Elementary Physical Chemistry (3)

Chem 5521—Elementary Physical Chemistry (3)

Math 1142—Short Calculus (5)

(or) Math 1201—Pre-Calculus (5)

Math 1211—Calculus I (5)

Math 1221—Calculus II (5)

10-15 credits of college physics

G. Electives to complete the 185 credits required for graduation with the bachelor of science degree.

Plant Health Technology

Department of Plant Pathology
304 Stakman Hall (612/373-0852)

Plant health technologists diagnose and treat plant diseases caused by microorganisms and environmental factors. As a plant health technology major, you will study the

Programs

biological and physical sciences necessary to understand both healthy and diseased plants. Studies provide background and training basic to the diagnosis and treatment of diseases of plants in both urban and rural environments. A required summer internship in the plant disease clinic provides practical experience in disease diagnosis and prescription of treatment.

Graduates of the program may find jobs in the federal, state, industrial, and private sectors where there is a need for personnel knowledgeable in the diagnosis of plant disease, the proper use of pesticides to control disease, and the application of integrated control procedures in the treatment of disease.

If you are preparing for graduate studies in plant pathology, consult your adviser about selection of appropriate course work.

Major Requirements

Students majoring in plant health technology must complete the requirements listed below. Course substitutions in categories A, B, C, and D may be made only with the approval of the college office, and in categories E and F only with the approval of your adviser and the Department of Plant Pathology.

A. Communication, Language, Symbolic Systems

See Agricultural Science and Industries Curriculum Requirements (end of section II).

B. Physical, Biological, and Analytical Sciences

See Agricultural Science and Industries Curriculum Requirements (end of section II).

C. The Individual and Society—14 credits minimum

See All-College Requirements (end of section II). One course required in the area of Development of Civilization.
AgEc 1020—Principles of Macroeconomics (5)

D. Literature, Humanities, and Fine Arts—8 credits minimum

See All-College Requirements (end of section II).

E. Professional Courses in the Major

PIPa 1001—Introductory Plant Pathology (4)
PIPa 5005—Viruses and Bacteria in Plant Disease (4)
PIPa 5006—Fungi, Algae, and Parasitic Seed Plants in Plant Disease (4)
PIPa 5007—Nematodes and Abiotic Agents in Plant Disease (4)
PIPa 5105—Introduction to the Study of Fungi (4)
PIPa 5215—Insects in Relation to Plant Diseases (4)
PIPa 5650—Clinical Plant Pathology (6)
PIPa 5700—Contemporary Chemical Control of Plant Diseases (4)

F. Supporting Courses

Agro 5030—Weed Control (5)
BioC 1302—Elementary Biochemistry II (3)
Ent 1005—Economic Entomology (4)
Ent 5210—Integrated Pest Management (4)
GCB 3022—Genetics (4)
PIPh 3131—Survey of Plant Physiology (4)
Soil 1122—Introductory Soil Science (4)
Soil 5430—Chemistry of Plant Nutrient Elements in Soils (3)
Stat 3081—Experimental Techniques and Statistical Inference (5)

G. Recommended Courses

Agro 3020—Growth, Development, and Culture of Field Crops (5)
EBB 3004—Fundamentals of Ecology (4)
Hort 5021—Ornamental Plant Materials (5)
Mathematics through calculus
Physics (5-10 additional credits)
PIPa 5050—Forest Pathology (4)
Soil 3220—Soil, Water Management, and Conservation (3)

Soil 3419—Fertilizer Technology (2)

Soil 5540—Soil Resources and Environmental Relationships (4)

H. Electives to complete the 192 credits required for graduation with the bachelor of science degree.

Resource and Community Development Curriculum

The resource and community development curriculum prepares students for careers in resource development, community development, public land use, rural and urban zoning, conservation, recreation, resource economics and sociology, environmental design, landscape architecture, and related areas.

Students completing majors in the program can seek positions with federal, state, county, and local planning, administrative, and management agencies as well as with private landscape architecture, planning, banking, recreation, and research organizations. The training offered by the different majors also prepares students for continued study at the graduate level.

Resource and community development is an interdisciplinary curriculum designed to focus the complementary disciplines of agriculture and forestry on planning and administrative training. It relates the traditional specialties of applied resource development and management as well as the social and economic specialties to expanding contemporary needs. In addition to studies in a selected specialty, students acquire a broad background in supporting areas.

The individual majors associated with the resource and community development curriculum include the following (see the appropriate heading earlier in section II, or consult the administering unit listed in parentheses for more information):

- Economics of Public Services (Department of Agricultural and Applied Economics)
- Landscape Architecture (Department of Horticultural Science and Landscape Architecture)
- Recreation Resource Management (College of Forestry)
- Resource Economics (Department of Agricultural and Applied Economics)
- Soil and Water Resource Management (Department of Agricultural Engineering and Department of Soil Science)

Resource Economics

*Department of Agricultural and Applied Economics
231 Classroom-Office Building (612/373-1755)*

The objective of the resource economics curriculum is to provide an interdisciplinary program of basic natural and social sciences combined with studies of useful analytic techniques. In the curriculum you will complete course work in the physical, biological, and social sciences as well as in economics, agricultural economics, planning, resource and community development, and techniques of analysis such as statistics and mathematics.

As a graduate of the program, you will be prepared for employment in extension services, the Soil Conservation Service, planning commissions, and other public and private agencies involved with resource and community development activities. You may also enter graduate programs in agricultural economics, resource economics, resource development, regional economics, or planning.

Major Requirements

Students selecting the resource economics major must complete the requirements listed below. Substitutions in categories A, B, C, and D may be made only with the approval

Programs

of the college office, and in categories E and F only with the approval of your adviser and the Department of Agricultural and Applied Economics.

A. Communication, Language, Symbolic Systems

One of the math sequences listed below. The second sequence is preferred.

Sequence One

Math 1111—College Algebra and Analytical Geometry (5)

Math 1142—Short Calculus (5)

Sequence Two

Math 1201—Pre-Calculus (5)

Math 1211—Calculus I (5)

Math 1221—Calculus II (5)

Rhet 1101—Writing to Inform and Persuade (4)

Rhet 1104—Library Laboratory (1) S-N

Rhet 1151—Writing in Your Major (4)

Rhet 1222—Public Speaking (4)

Rhet 3254—Advanced Public Speaking (4)

(or) Rhet 3266—Discussion Methods (4)

Rhet 3562—Writing in Your Profession (4)

B. Physical and Biological Sciences

Biol 1009—General Biology (5)

Biol 1103—General Botany (5)

(or) Biol 1106—General Zoology (5)

Chem 1004—General Principles of Chemistry (5)

Chem 1005—General Principles of Chemistry (5)

EBB 3001—Introduction to Ecology (4)

(or) EBB 3004—Fundamentals of Ecology (4)

One of the sequences listed below:

Sequence One

Phys 1041, 1045—Introductory Physics and Laboratory (4, 1)

Phys 1042, 1046—Introductory Physics and Laboratory (4, 1)

Sequence Two

Geo 1001—Physical Geology (5)

SoI 1122—Introductory Soil Science (4)

C. The Individual and Society—21 credits minimum

See All-College Requirements (end of section II). One course required in the area of Development of Civilization.

AgEc 1020—Principles of Macroeconomics (5)

AgEc 1030—Principles of Microeconomics (4)

Soc 1001—Introduction to Sociology (4)

(or) Soc 1002—American Community (4)

D. Literature, Humanities, and Fine Arts—8 credits minimum

See All-College Requirements (end of section II).

E. Professional Courses in the Major—40 credits minimum

AgEc 1000—Orientation to Agricultural and Applied Economics (1)

AgEc 3101—Microeconomic Theory (4)

(or) Econ 3101—Microeconomic Theory (4)

AgEc 3102—Macroeconomic Theory (4)

(or) Econ 3102—Macroeconomic Theory (4)

AgEc 3640—Public Finance: Concepts and Practices (4)

(or) AgEc 5640—Financing State and Local Governments (4)

AgEc 3610—Community Resource Development (4)

Recommended courses include:

AgEc 3290—Agribusiness Management (4)

(or) Mgmt 3001—Fundamentals of Management (4)

AgEc 3900—Special Topics in the Economics of Public Services (3)

AgEc 5560—Economics of Consumer Policies (4)

AgEc 5600—Land Economics (4)

AgEc 5620—Regional Economic Analysis (4)

AgEc 5630—Regional Development Systems (4)

AgEc 5650—Economics of Natural Resource Policy (4)

AgEc 5660—Economics of Public Services (4)
 AgEc 5670—Economics of Agricultural Transportation (4)
 See your adviser for additional recommendations.

F. Supporting Courses—35 credits minimum

Arch 5137—Planning: Urban Function and Structure (4)
 AgEc 5099—RCD Interdisciplinary Seminar I (4)
 AgEc 5100—RCD Interdisciplinary Seminar II (4)
 AgET 3410—Hydrology, Water Control (4)
 AgET 5400—Drainage and Irrigation (4)
 CSci 3101—A FORTRAN Introduction to Computer Programming (4)
 (or) CSci 3103—Introduction to Programming Languages and Problem Solving (3)
 (or) CSci 3104—Introduction to Programming and Problem Solving (4)
 EBB 5014—Ecology of Plant Communities (5)
 (or) EBB 5016—Ecological Plant Geography (5)
 FW 3052—Introduction to Fisheries and Wildlife Biology and Management (4)
 Soc 5401—Social Organizations (4)
 (or) Soc 5651—Rural Social Institutions (4)
 (or) RCD 3010—The Minnesota Community: Analysis of Its Organization, Change, and Development (4).
 Stat 5021—Statistical Analysis I (5)
 Stat 5022—Statistical Analysis II (5)
 Additional credits selected from:
 AgEc 1250—Principles of Accounting (5)
 AgEc 1400—Agricultural Markets and Prices (4)
 AgEc 5610—Land Use Institutions of Local Government (4)
 Geog 3511—Introduction to Cartography (4)
 Geog 3531—Quantitative Methods (4)
 Geog 5511—Cartographic Analysis (4)
 Law 5003—Legal Research (cr ar)
 Math 1231—Calculus III (5)
 Math 3211—Multivariable Calculus (5)
 Math 3221—Introduction to Linear Algebra and Linear Differential Equations (5)
 Phil 1001—Logic (5)
 RCD 1010—Issues in the Environment (3)
 RCD 5200—Community Development Simulation (4)
 Soil 3220—Soil, Water Management, and Conservation (3)

G. Electives to complete the 192 credits required for graduation with the bachelor of science degree.

Soil Science

Department of Soil Science
 125 Soils (612/373-1062)

Soil scientists deal with soil and water resource management, conservation, tillage, soil fertility, soil mapping, soil morphology, soil organic matter transformations, environmental quality, microclimatology, soil-plant (crop and natural flora) relationships, and research.

As a graduate in soil science you may be employed as a farmer; soil and water specialist in rural, urban, and recreational planning; county agent; soil surveyor; fertilizer and farm chemical company representative; farm manager; land appraiser; or environmentalist or conservationist.

If you plan to continue your studies for a master's or doctor's degree in preparation for teaching at the college level, research, or consulting work, you should consult with your adviser early in your program. You will usually need to complete additional mathematics and physical and biological sciences course work in preparation for graduate study.

Major Requirements

Students selecting the soil science major must complete the requirements listed below. Course substitutions in categories A, B, C, and D may be made only with the

Programs

approval of the college office, and in categories E and F only with the approval of your adviser and the Department of Soil Science.

A. Communication, Language, Symbolic Systems

See *Agricultural Science and Industries Curriculum Requirements* (end of section II).

AgJo 3111—Journalistic Techniques (5)

Stat 1051—Statistics (4)

(or) Math 1142—Short Calculus (5)

B. Physical, Biological, and Analytical Sciences

See *Agricultural Science and Industries Curriculum Requirements* (end of section II).

C. The Individual and Society—14 credits minimum

See All-College Requirements (end of section II). One course required in the area of Development of Civilization.

AgEc 1020—Principles of Macroeconomics (5)

D. Literature, Humanities, and Fine Arts—8 credits minimum

See All-College Requirements (end of section II).

E. Professional Courses in the Major

Soil Science Courses—24 credits minimum, to include the following courses:

Soil 1001—Orientation to Soil Science (1)

Soil 1122—Introductory Soil Science (4)

Soil 3210—Physical Soil Management and Tillage (4)

Soil 3220—Soil, Water Management, and Conservation (3)

Soil 3416—Soil Fertility (5)

Soil 3520—Soil Morphology, Classification, and Genesis (4)

Soil 3610—Soil Biology (4)

Soil 3918—Senior Seminar (1)

F. Supporting Courses

Water Resource Courses—9 credits minimum, to be selected from the following courses or others with approval of adviser:

AgET 3410—Hydrology, Water Control (4)

AgET 3800—Rural Sanitation, Water Supply (4)

AgET 5400—Drainage, Irrigation (4)

CE 5420—Introduction to Water Resource Management (4)

FR 5114—Forest Hydrology (3)

FR 5110—Water Quality Management (4)

Geo 5601—Limnology (4)

Geo 5611—Groundwater Geology (4)

Plant Sciences Courses—12 credits minimum, 8 to be selected from courses in agronomy or horticulture:

Animal Science Courses—9 credits minimum, to be selected from the following courses or others with approval of adviser:

AnSc 1100—Introductory Animal Science (5)

AnSc 3401—Principles of Animal Nutrition (3)

Biol 1106—General Zoology (5)

Ent 1005—Economic Entomology (4)

FW 3052—Introduction to Fisheries and Wildlife Biology and Management (4)

Earth Science—3 credits minimum, to be selected from the following:

For 5220 (3)—Aerial Photo Interpretation

Geo 1002 (4)—Historical Geology

Geo 3101 (5)—Surficial Geology

Geo 5261 (4)—Glacial Geology

Geog 3311 (4)—Maps

Geog 3551 (5)—Cartography

Computer Science—3 credits minimum, to be selected from the following:

CSci 3101—A FORTRAN Introduction to Computer Programming (4)

CSci 3102—Introduction to Pascal Programming (4)

G. Electives to complete the 192 credits required for graduation with the bachelor of science degree.

Minor Requirements

Two options are available to students who wish to complete a minor in soil science. Both require a minimum of 26 credits.

Option A

Geo 1001—Physical Geology (5)
Soil 1122—Introductory Soil Science (4)
Soil 3210—Physical Soil Management and Tillage (4)
Soil 3220—Soil, Water Management, and Conservation (3)
Soil 3416—Soil Fertility (5)
Soil 3520—Soil Morphology, Classification, and Genesis (4)
Soil 3610—Soil Biology (4)

Option B

Geo 1001—Physical Geology (5)
Soil 1122—Introductory Soil Science (4)
Plus five courses from those listed below:
Soil 3210—Physical Soil Management and Tillage (4)
Soil 3220—Soil, Water Management, and Conservation (3)
Soil 3416—Soil Fertility (5)
Soil 3520—Soil Morphology, Classification, and Genesis (4)
Soil 3610—Soil Biology (4)
Any other 3000-level soils course not including seminars
Any 5000-level soils course not including seminars

Soil and Water Resource Management

Department of Soil Science
125 Soils (612/373-1062)

Department of Agricultural Engineering
213 Agricultural Engineering (612/373-1304)

The objective of the soil and water resource management curriculum is to provide an interdisciplinary program of basic physical, biological, and social sciences studies combined with studies in resource and community development, agricultural engineering, and soil and water science. As a student in the program, you may have an adviser in either the Department of Soil Science or the Department of Agricultural Engineering.

As a graduate of this program you will be prepared for careers in the management and use of soil and water resources. Employment opportunities exist for soil and water specialists in rural, urban, and recreational planning; conservation; land appraisal; and other fields involving the interpretation and use of soil and water information.

Major Requirements

Students majoring in soil and water resource management must complete all requirements listed in categories A, B, C, D, and E. Course substitutions in categories A, B, C, and D may be made only with the approval of the college office. Students may select between a water resources specialization or a soil resources specialization in category F. Course selection and substitutions in categories E and F can be made only with the approval of your adviser. For students electing the water resources specialization in category F, the adviser should be in the Department of Agricultural Engineering. For students electing the soil resources specialization, the adviser should be in the Department of Soil Science.

A. Communication, Language, Symbolic Systems

Math 1111—College Algebra and Analytical Geometry (5)
Math 1142—Short Calculus (5)
Rhet 1101—Writing to Inform and Persuade (4)
Rhet 1104—Library Laboratory (1) S-N
Rhet 1151—Writing in Your Major (4)
Rhet 1222—Public Speaking (4)
Rhet 3562—Writing in Your Profession (4)

Programs

B. Physical and Biological Sciences

- Biol 1009—General Biology (5)
- Biol 1103—General Botany (5)
- Chem 1004—General Principles of Chemistry (5)
- Chem 1005—General Principles of Chemistry (5)
- EBB 3001—Introduction to Ecology (4)
- (or) EBB 3004—Fundamentals of Ecology (4)
- Geo 1001—Physical Geology (5)
- Phys 1041, 1045—Introductory Physics and Laboratory (4, 1)
- Soil 1122—Introductory Soil Science (4)

C. The Individual and Society

See All-College Requirements (end of section II). One course required in the area of Development of Civilization.

- AgEc 1020—Principles of Macroeconomics (5)
- AgEc 1030—Principles of Microeconomics (4)
- Geog 1401—Physical Geography (5)
- Soc 1001—Introduction to Sociology (4)
- (or) Soc 1002—American Community (4)

D. Literature, Humanities, and Fine Arts—8 credits minimum

See All-College Requirements (end of section II).

E. Professional Courses in the Major

- AgEc 3610—Community Resource Development (4)
- AgET 3410—Hydrology, Water Control (4)
- AgET 3800—Rural Sanitation and Water Supply (4)
- AgET 5400—Drainage and Irrigation (4)
- FR 5200—Aerial Photo Interpretation (3)
- (or) FR 5232—Management of Recreational Lands (3)
- RCD 1010—Issues in Environment (3)
- Soc 3201—Principles of Social Psychology (5)
- (or) Soc 3214—Understanding Everyday Life (4)
- (or) Soc 3401—Principles of Social Organization (5)
- Soc 5651—Rural Social Institutions (4)
- (or) Soc 5661—Rural Community Analysis (4)
- Soil 3210—Physical Soil Management and Tillage (4)
- (or) Soil 5232—Soil Physics (4)
- CSci 3101—A FORTRAN Introduction to Computer Programming (4)
- (or) CSci 3102—Introduction to Pascal Programming (4)
- Soil 3220—Soil, Water Management, and Conservation (3)
- Soil 5560—Use and Interpretation of Soil Survey Information (3)

F. Specializations

In addition to the requirements listed in category E above, you must complete the requirements for one of the specializations listed below:

Water Resources Specialization—28-29 credits

- AgET 5099, 5100—Interdisciplinary Seminar (4, 4)
- AgET 5023—Fluids—Principles and Systems (4)
- CE 5405—Hydrology and Hydrologic Design (4)
- Plus a minimum of two courses from the following:
- CE 5401—Water Resources Engineering (4)
- Geol 5601—Limnology (4)
- Geol 5611—Groundwater Geology (4)
- Soil 5340—Organic and Pesticidal Residues (5)

Soil Resources Specialization—27-29 credits

- Soil 1001—Seminar: Orientation (1)
- Soil 3118—Seminar: Soil Pollution and Public Policy (1)
- Soil 3416—Soil Fertility (5)
- Soil 3520—Soil Morphology, Classification, and Genesis (4)
- Soil 3610—Soil Biology (4)
- Soil 3918—Senior Seminar (1)
- Soil 5540—Soil Resource and Environmental Relationships (2)
- Soil 5099, 5100—RCD Interdisciplinary Seminar (4, 4)
- Plus a minimum of one course from the following:

- Agro 3010—Adaptation, Distribution, and Production of Field Crops (4)
- Geol 5601—Limnology (4)
- Geol 5611—Groundwater Geology (4)
- Soil 5340—Organic and Pesticidal Residues (5)
- Soil 5550—Peatlands (3)

G. Electives: to complete the 192 credits required for graduation with the bachelor of science degree.

Technical Communication

Department of Rhetoric
202 Haecker Hall (612/373-0917)

Technical communicators apply modern techniques to the dissemination of technical knowledge in industry, business, education, and government. Technical communicators write for audiences that range from the scientist to management to the consumer of the products and services provided by technology. To accomplish their objectives, technical communicators must first be generalists, well acquainted with the basic principles of science, engineering, the social sciences, and management practices. In addition, they must be familiar with and must be able to apply the basic principles of writing and editing, graphics, communication research and theory, and oral communication. The interdisciplinary technical communication curriculum is designed to provide the necessary fundamental theory for application in these areas within a program flexible enough to allow you to plan a course of study appropriate to your career goals.

As a graduate of the program, you may be employed in government, education, and organizations in such fields as agriculture, communication, computer science, electronics, research and development, and transportation. You may pursue a career as a writer-editor, an extension specialist, or a training or communication specialist.

If you plan to pursue a graduate communication program, you should consult with your adviser about selection of appropriate course work early in your program.

Major Requirements

Students majoring in the undergraduate program in technical communication must complete the requirements listed below. Course substitutions in categories A, B, C, and D may be made only with the approval of the college office, and in categories E and F only with the approval of the Department of Rhetoric.

A. Communication, Language, Symbolic Systems—25 credits minimum

Choose one of the following:

CSci 3101—Introduction to FORTRAN Programming (4)

CSci 3102—Introduction to Pascal Programming (4)

Required Courses:

CSci 3104—Introduction to Programming and Problem Solving (4)

Math 1111—College Algebra and Analytical Geometry (5)

Rhet 1101—Writing to Inform and Persuade (4)

Rhet 1104—Library Laboratory (1) S-N

Rhet 1151—Writing in Your Major (4)

Rhet 1222—Public Speaking (4)

Rhet 3562—Writing in Your Profession (4)

B. Physical and Biological Sciences—18 credits minimum. to be selected from the following courses:

BioC 1301—Elementary Biochemistry I (5)

BioC 1302, 1303—Elementary Biochemistry II and Laboratory (3, 2)

Biol 1009—General Biology (5)

Biol 1103—General Botany (5)

Biol 1106—General Zoology (5)

Bot 1009—Minnesota Plant Life (4)

Bot 1012—Plants Useful to Man (4)

Chem 1004—General Principles of Chemistry (5)

Chem 1005—General Principles of Chemistry (5)

EBB 3004—Fundamentals of Ecology (4)

GCB 3022—Genetics (4)

Geo 1001—Physical Geology (5)

Geo 1002—Historical Geology (4)

Geo 1111—Introductory Physical Geology (5)

MicB 3103—General Microbiology (5)

Phys 1002—Human Physiology (4)

Phys 1001, 1005—The Physical World and Laboratory (4, 1)

Phys 1041, 1045—Introductory Physics and Laboratory (4, 1)

Phys 1042, 1046—Introductory Physics and Laboratory (4, 1)

Programs

C. The Individual and Society—14 credits minimum

See All-College Requirements, category C (end of section II).

D. Literature, Humanities, and Fine Arts—16 credits minimum

See All-College Requirements, category D (end of section II).

E. Professional Courses in the Major—70 credits minimum

Students majoring in technical communication must complete a total of 70 credits in category E with a minimum number in each competency area listed below. Required courses in certain competency areas are identified. Courses identified as recommended may be taken with the approval of your adviser. Courses not listed may be taken only with the approval of the director of the Technical Communication Program or, in his or her absence, the head of the Department of Rhetoric.

Writing and Editing—14 credits minimum

Required Course:

AgJo 3159—Publications Editing (4)

Recommended Courses:

AgJo 3530—Publicity (4)

AgJo 5561—Writing for Publication (4)

Comp 1027—Intermediate Expository Writing (4)

Rhet 3572—Grammatical Editing for Technical Writers (2)

Rhet 5571—Writing for Special Purposes (2)

GC 1425—Business Correspondence (4)

Oral Communication—8 credits minimum

Required Courses:

Rhet 5257—Scientific and Technical Presentations (4)

Rhet 5258—Interviewing: Dynamics of Face-to-Face Communication (4)

Recommended Courses:

Rhet 1221—An Introduction to Interpersonal Communication (3)

Rhet 1251—Effective Listening (3)

Rhet 3254—Advanced Public Speaking (4)

Rhet 3266—Communication, Discussion in Small Group Decision Making (4)

Rhet 3270—Speech: Special Problems (1-5)

Spch 3201—Introduction to Broadcasting Production (4)

Spch 3203—Radio Production (4)

Spch 5411—Small Group Communication (4)

Spch 5431—The Process of Persuasion (4)

Visual Communication—7 credits minimum

No Required Courses

Recommended Courses:

AgJo 5301—Functional Photography (4)

Dsgn 1521—Color and Design (4)

Dsgn 1523—Visual Presentation I (4)

Dsgn 1525—Two-Dimensional Design I (4)

GC 1536—Introduction to Commercial Art (3)

Ind 1600—Drafting (3)

Ind 3120—Graphic Communication: Intermediate (Applied Photography) (3-9)

Rhet 3166—Scientific and Technical Graphics (4)

In addition to these recommended courses, there are many University courses in art, cinematography, television production, and photography that would satisfy this requirement. If you have a special interest in any of these areas, consult with your adviser.

Organizational Communication—7 credits minimum

No Required Courses

Recommended Courses:

Rhet 5150—Direction of Training in Business and Service Organizations (4)

Rhet 5165—Studies in Organizational Communication, Conflict, and Change (4)

Rhet 5170—Managerial Communications (4)

Rhet 5400—Dissemination and Utilization of Information (4)

Rhet 5600—Transfer of Technology (4)

Spch 3111—Leadership Communication (3)

Soch 5412—Group and Organizational Communication (4)

Soch 5414—Authority and Power in Task-Oriented Communication (4)

Communication Theory and Research—7 credits minimum

Required Course:

Rhet 1220—Principles of Human Communication (4)

Recommended Courses:

Clas 3045—Basic Program in Technical Terminology and Word Study (2)

Engl 3851—The English Language (4)

- Engl 5815—History of English Language (4)
- Engl 5831—American English (4)
- Engl 5851—Structure of Modern English (4)
- Ling 3001—Introduction to Linguistics (5)
- Ling 3601—Introduction to Historical Linguistics (4)
- Rhet 3700—Rhetorical Theory (4)
- Rhet 5500—Research in Communication Strategies (4)
- Spch 5403—Theory Construction and Analysis in Communication (4)
- Spch 5421—Quantitative Research in Communication (4)
- Spch 5611—Classical Rhetoric (4)
- Stat 5021—Statistical Analysis I (5)
- Stat 5022—Statistical Analysis II (5)

Philosophy and History of Science and Technology—7 credits minimum

No Required Courses

Recommended Courses:

- HSci 1813—Introduction to History of Science (modern science) (4)
- Phil 5601—Philosophy of Science (4)
- Phil 5615—Minds, Bodies, and Machines (4)

Any course in the history of science and technology (HSci) may be used to fill the recommended portion of this requirement.

Internship—4 credits minimum

- Rhet 5180—Internship in Technical Communication (4-6)

F. Technical Electives—20 credits minimum

Through the selection of your technical electives, you are expected to develop enough competency in a science, social science, or engineering discipline to acquire an understanding of the goals and methods of science and technology. You may also use this portion of the program to prepare for employment in some specific area such as computers or foods. Technical electives will be chosen with the aid of your adviser and can be interdisciplinary as well as intradisciplinary. You may choose from such areas as agriculture, computer science, forestry, the health sciences, home economics, and the natural and physical sciences. At least 8 credits must be at the 3000 level or higher.

G. Electives to complete the 190 credits required for graduation with the bachelor of science degree.

Minor Requirements

Technical Communication—The technical communication minor is intended to augment your major by increasing your capability to communicate in your chosen field. It requires 30-32 credits in addition to the basic communication requirements of the College of Agriculture (Rhetoric 1101, 1104, 1151, 1222, and 3562). Contact a faculty adviser in the Department of Rhetoric for assistance in planning a minor in technical communication.

Required Courses:

- Rhet 1220—Principles of Human Communication (4)
- Rhet 3166—Scientific and Technical Graphics (4)
- Rhet 5257—Scientific and Technical Presentations (4)
- Rhet 5258—Interviewing: Dynamics of Face-to-Face Communication (4)
- AgJo 3159—Publications Editing (4)

Plus two courses from the following list:

- Rhet 1147—Efficient Reading (4)
- Rhet 1221—An Introduction to Interpersonal Communication (3)
- Rhet 1251—Effective Listening (3)
- Rhet 3176—The Use of Scientific and Technical Film (4)
- Rhet 3254—Advanced Public Speaking (4)
- Rhet 3266—Communication, Discussion in Small Group Decision Making (4)
- Rhet 3572—Grammatical Editing for Technical Writers (2)
- Rhet 5170—Managerial Communications (4)
- Rhet 5571—Writing for Special Purposes (2) (Students must register for two quarters and complete 4 credits.)
- AgJo 5561—Writing for Publication (4)

Plus one of the following courses:

- Rhet 1301—Humanities: Modern Thought and the Enlightenment (4)
- Rhet 1302—Humanities: Modern Thought and the Industrial Revolution (4)
- Rhet 1303—Humanities: Modern Thought and the Impact of Evolution (4)

(Note: Courses used to fulfill All-College Requirements cannot be applied to this minor.)

Programs

Agrarian Studies—The agrarian studies minor is a multidisciplinary program based in the humanities. It is designed to complement professional and scientific major degree programs with a broad background stressing the relation of people to agriculture. The program is based on two ideas: (1) an awareness of the social, historical, and cultural heritage of American agriculture is a valuable and satisfying part of the education of all majors in the College of Agriculture, and (2) such a background is essential to many leadership positions in modern agriculture. Students are introduced to the historical development and imaginative expression of agricultural experience and values. A special feature of the program is that students write a senior, integrative paper relating some aspect of their major field to social, cultural, or historical trends in the larger society. For assistance in planning an agrarian studies minor, contact a faculty adviser in the Department of Rhetoric.

Required Courses:

Rhet 1310—Humanities: The Land in American Experience (4)

Rhet 3375—Humanities: Agricultural Heritage (4)

Rhet 3374—Humanities: Special Problems (senior paper) (2)

At least three courses from the following list:

AgEc 3040—Economic Development of American Agriculture (4)

AgEd 1010—History and Philosophy of Vocational and Community Education (3)

AnSc 3113—Animal Welfare (4)

FScN 1010—Man's Food (4)

(or) FScN 1012—Nutrition and Our Food Supply (4)

(or) FScN 5643—Seminar: World Food Supply Problems (4)

RCD 1010—Issues in the Environment (3)

Rhet 1302—Humanities: Modern Thought and the Industrial Revolution (4)

SOC 1651—Rural Sociology (4)

Veterinary Medicine

Students may complete the minimum requirements for admission to the College of Veterinary Medicine within any of the majors in the College of Agriculture. They must meet the requirements for admission to the College of Agriculture and must be accepted into the major of their choice. Pre-veterinary medicine students are guided by faculty advisers in their major departments and are expected to make satisfactory progress toward completion of the degree in those majors.

For information on procedures and requirements for admission to the College of Veterinary Medicine, criteria for selection, degree programs and courses offered by the college, and related subjects, consult the *College of Veterinary Medicine Bulletin*, or write to the Office of Academic Affairs and Research, College of Veterinary Medicine, 460 Veterinary Teaching Hospitals, University of Minnesota, 1365 Gortner Avenue, St. Paul, MN 55108.



A student gets hands-on experience in AnSc 1105—Animal Care.

ALL-COLLEGE REQUIREMENTS

The University of Minnesota believes that all of its students, whatever their area of specialization or professional goals, should hold in common the search for a liberal education. A liberal education frees individuals from the limitations that ignorance places on their power of judgment and choice. More specifically, a liberal education asks individuals to seek control over the intellectual instruments for acquiring and communicating knowledge, primarily the instruments of language and mathematics; to seek understanding of the ways in which scientists contribute to our knowledge of ourselves and our environment; to seek historical and philosophic perspective on the nature of our lives and our world; and to seek appreciation of the creative insights into life and nature provided by literature and the arts.

To help you achieve the goal of a liberal education, the College of Agriculture has set minimum requirements for the four major categories of knowledge listed below. These college requirements meet or exceed the University requirements. The minimum requirements are firmly fixed, and you *should not expect to petition out of even 1 credit in any category*. Transfer students and students who plan to transfer to the college should refer to Transfer Students under Admission in section I.

A. Communication, Language, Symbolic Systems—17 credits (A-N)

To graduate from the College of Agriculture, you must complete 17 credits in communication skills courses in English and rhetoric, foreign language, linguistics, logic, philosophic analysis, or mathematics. For this category you must complete the following courses or their equivalent:

1. Freshman Communication: Rhét 1101 and 1104
2. Writing in Your Major: Rhét 1151
3. Public Speaking: Rhét 1222
4. Writing in Your Profession: Rhét 3562

Suggested courses for additional work in category A include the following:

AgJo 3111, 5561

Cias 1045, 1047, 1048, 3045, 3046, 3047, 3048

CSci 3102, 3104

Foreign Languages—all beginning courses

Ling 1001, 3001

Math—all courses except 0006, 0009, 1001, 1002, 1005, 1006

Phil 1001, 3201, 3231

Rhét 1147, 1220, 1221, 1226, 1251, 1500, 3166, 3254, 3266, 3572, 3700, 5147, 5165, 5170, 5175, 5257, 5400, 5500, 5600

Stat—all courses

Note—You may offer transfer credits in freshman communication and public speaking from other colleges and universities to satisfy these requirements.

You may take Rhét 3562 only in your junior or senior year. Upper division (junior or senior year) courses in professional or technical writing completed at a four-year college may be considered in lieu of Rhét 3562.

If you demonstrate high ability in the proficiency tests in freshman communication, public speaking, or professional writing offered by the Department of Rhetoric, you may be excused from these course requirements. However, you must still meet the minimum requirement of 17 credits by completing other courses in category A.

B. The Physical and Biological Sciences—15 credits (A-N)

To graduate from the College of Agriculture, you must complete a minimum of 15 credits in the physical and biological sciences. All category B requirements listed for the individual curricula meet or exceed the college requirements. Therefore, a suggested list of courses is not included here. For additional work in this category, consult your adviser.

C. The Individual and Society—14 credits (specific requirements must be taken A-N; electives may be taken S-N)

To graduate from the College of Agriculture, you must complete a minimum of 14 credits in this category. *At least one course must be taken in subcategory 2, Development of Civilization: Historical and Philosophical Studies.* A maximum of 10 credits in any one discipline (e.g., history, economics, psychology) may be counted toward the requirements. Technical courses (e.g., accounting, statistics, psychology of learning) may not be applied toward this category.

Suggested courses for category C include the following:

1. Analysis of Human Behavior and Institutions

Afro 1025, 1036, 3061, 3062, 3072, 3091, 3092, 3098, 5401, 5402
 AgEc 1020, 1030, 3070, 5720
 Anth 1102, 1115, 3131, 3211, 3223, 3241, 3251, 3261, 3263, 3281, 3291, 3292, 3501, 3511, 3521, 3531, 3532, 3533, 3591, 5112, 5115, 5116, 5117, 5131, 5141, 5151, 5152, 5153, 5154, 5155, 5161, 5162, 5165, 5173, 5174, 5258
 Chic 1105, 1106, 1107, 3211
 Chn 1032
 Clas 1012, 1015, 1019, 3071, 3072, 3073
 Econ 1001, 1002, 1004, 1005, 3001, 3002
 Fren 3501, 3502
 FSoS 1001, 1002, 1025, 3015
 Geog 1301, 3101, 3131, 3141, 3161, 3181, 3211, 3212, 3213, 3221, 3321, 3331, 3341, 3343, 3351, 3361, 3371, 3378, 3381, 5811
 Ger 3501, 3511, 3512, 3513
 Indc 1504, 1506, 3501, 3502, 3506, 3507, 3511, 3533
 Ital 3501, 3502, 3555
 IntR—all courses except 3091, 5831, 5901, 5902, 5903
 Jour 5601, 5721
 Jpn 1032
 JwSt 1034, 3126, 3142, 3143, 3521
 Ling 1001, 1005, 3111
 MidE 1036, 3001, 3005
 Pol 1001, 1025, 1026, 1027, 1031, 1041, 1051, 3306, 3308, 3309, 3659, 3661, 3765, 3766, 3771, 3773, 3825, 3826
 Psy 1001, 1004, 1005, 3101, 3201
 RelS—all courses except 5890, 5960, 5970, 5980
 Rhet 3280, 5175
 Russ 3106, 3501, 3502, 3503
 Scan 1504, 3501
 Slav 1501, 3501, 3502, 3503
 Soc 1001, 1002, 1651, 3102, 3352, 3401, 3501, 3503, 3551, 3601, 3957
 Span 1501, 1502, 1503, 3501, 3502
 Spch 5611, 5616, 5617, 5618
 SSci 3402
 WoSt 1005, 1006, 1977, 3300, 3301

2. Development of Civilization: Historical and Philosophical Studies (You must complete at least one course from this area.)

Afro 1015, 1441, 1442, 3001, 3002, 3003, 3011, 3012, 3081, 3082, 3340, 3401, 5001
 AgEc 3040
 AgEd 1010
 Amln 1771, 3111, 3112, 3151
 AmSt—all course except 1920, 3920, 3970, 5920
 ANEJ 3117, 3501, 3502, 3505
 Clas 1001, 1002, 1003, 1004, 1005, 1006, 3007, 3008
 Econ 3021
 Hist—all courses listed under the heading "Introductory" in the *CLA Bulletin* plus 3200, 3434, 3435, 3707, 3708, 3821, 3822, 3823, 5171, 5172, 5173, 5281, 5282, 5283
 HSci—all courses except 5970, 5990
 Hum—all courses except 3014, 3044, 3055, 3071, 3201, 3202, 3401, 3403, 3755, 3910, 3970, 3980, 5030, 5063, 5910
 Indc 3411
 Phil 1002, 1003, 1004, 1410, 3001, 3003, 3004, 3005, 3105, 3302, 3303
 Rhet 1301, 1302, 1303, 1310, 1311, 3370, 3375, 3381

D. Literature, Humanities, and Fine Arts—8 credits (may be taken S-N)

To graduate from the College of Agriculture, you must complete a minimum of 8 credits in the humanities, art, literature, music, or theatre arts. You may not apply technical courses or studio courses toward this category. Therefore, you may *not* apply such courses as Mus 1161, Voice: Class Lessons: Mus 1410, Band; LA 1025, Basic Visualization; ArtS 1102, Drawing II; Dsgn 3536, Metalsmithing: Enameling; or Comp 1111, Introduction to Creative Writing.

Suggested courses for category D include the following:

Afro 3101, 3102, 3105, 3108, 3301, 5595, 5597
 Amln 3221, 3242
 AmSt 1101, 1102, 1103
 ArtH—all courses except 5895, 5950, 5960, 5970, 5990
 ArtS 1401
 Chic 3507, 3508, 3510, 3511, 3513
 Clas 1001, 1002, 1003, 1004, 1005, 1006, 1042, 3081, 3082, 3083, 3145, 5102, 5103

Agricultural Science and Industries Curriculum Requirements

CLit—all courses

Dsgn 1501, 5505

Engl—all courses except 1005, 3060, 3851, 3910, 3920, 3931, 3932, 3940, 3950, 3963, 3970, 3980, 5815, 5821, 5831, 5843, 5851, 5860, 5871, 5876, 5910, 5920, 5940, 5950

Foreign Languages—all advanced courses that deal directly with literature and that are not listed under category C may be used

Hum—all courses except 3009, 3044, 3061, 3099, 3204, 3211, 3212, 3401, 3403, 3501, 3502, 3503, 3910, 3970, 3980, 5030, 5910

LA 1022

MidE 3101, 3201, 3202, 3205, 3601, 3602, 5311, 5405, 5406, 5501, 5502, 5503, 5601, 5602

Mus 1603, 1604, 1605, 1606, 1804, 3708, 3709, 3757, 3758, 3791, 3807, 3808, 5601, 5602, 5603, 5604, 5605, 5611, 5631, 5632, 5633, 5634, 5635, 5636, 5637, 5638, 5639, 5641, 5642, 5643, 5661, 5662, 5663, 5664, 5665, 5701, 5702, 5704, 5705, 5707, 5804

Rhet—humanities courses: 1301, 1302, 1303, 1310, 1311, 3370, 3375, 3381

Th 1101, 1102, 1405, 5171, 5172, 5173, 5177, 5178, 5181, 5182, 5186

WoSt 3501, 3502, 5011

Because of the numerous changes that occur in course numbers, titles, and content, a complete list of courses that fulfill each of the above categories is difficult to maintain. Therefore, for approval of courses that do not appear on the above lists, consult the college office.

AGRICULTURAL SCIENCE AND INDUSTRIES CURRICULUM REQUIREMENTS

The curriculum in agricultural science and industries is intended for students with an interest in pursuing a career in the production, processing, marketing, or distribution of agricultural and horticultural commodities. The curriculum also provides an excellent background for farm operation and farm management, or for graduate study in a wide variety of disciplines in the agricultural sciences and in agricultural and applied economics. Specific career opportunities are described in the sections that describe the majors offered by this curriculum.

Courses required for this curriculum have been selected to help you obtain the background in the biological and physical sciences and the skills in oral and written communication that are essential as preparation for studies in scientific and professional agriculture. This background is designed to prepare you to adapt and apply biological, physical, and economic principles to problems encountered in agricultural science, production, and management. Course work requirements in The Individual and Society and in Literature, Humanities, and Fine Arts serve to broaden your educational background in the social sciences, humanities, literature, and the arts, and to better equip you to contribute to society and to develop personal interests and understanding.

The breadth of course work possible in this curriculum (about one-third of the total credits are elective) provides you with an opportunity to develop an individualized program of study. Considerable flexibility is provided in order to accommodate various levels of preparation, aptitudes, and interests.

In addition to the curriculum requirements listed below, you must complete a major in an academic discipline. A minimum of 36 credits are required for a major. Specific course requirements for each major are listed earlier in this section of the bulletin.

A. Communication, Language, Symbolic Systems (A-N)

Math 1111—College Algebra and Analytical Geometry (5)

Rhet 1101—Writing to Inform and Persuade (4)

Rhet 1104—Library Laboratory (1) S-N

Rhet 1151—Writing in Your Major (4)

Rhet 1222—Public Speaking (4)

Rhet 3562—Writing in Your Profession (4)

B. Physical, Biological, and Analytical Sciences (A-N)

Biol 10C9—General Biology (5)

Biol 11C3—General Botany (5)

(or) Biol 1106—General Zoology (5)

Phys 1C01, 1005—The Physical World and Laboratory (4, 1)

(or) Phys 1041, 1045—Introductory Physics and Laboratory (4, 1)

Note: If your curriculum requires one quarter of physics, take Phys 1001, 1005. If your curriculum requires two quarters of physics, take Phys 1041, 1045 and 1042, 1046.

Agricultural Science and Industries Curriculum Requirements

Select one of the five following chemistry sequences:

Sequence One

- Chem 1001—Chemical Principles and Covalent Systems (5)
- BioC 1301—Elementary Biochemistry I (5)
- BioC 1302—Elementary Biochemistry II (3)

Sequence Two

- Chem 1001—Chemical Principles and Covalent Systems (5)
- Chem 1002—Chemical Principles and Covalent Systems (5)
- BioC 1302—Elementary Biochemistry II (3)

Sequence Three

- Chem 1004—General Principles of Chemistry (5)
- Chem 1005—General Principles of Chemistry (5)
- BioC 1301—Elementary Biochemistry I (5)

Sequence Four

- Chem 1004—General Principles of Chemistry (5)
- Chem 1005—General Principles of Chemistry (5)
- Chem 3301—Elementary Organic Chemistry I (4)

Sequence Five¹

- Chem 1004—General Principles of Chemistry (5)
- Chem 1005—General Principles of Chemistry (5)
- Chem 3301, 3305—Elementary Organic Chemistry I and Laboratory (4, 2)
- Chem 3302, 3306—Elementary Organic Chemistry II and Laboratory (4, 2)

In addition, you must complete at least two courses, not including laboratories, in the physical, biological, and analytical sciences. These *must* be selected from the following courses or their equivalent. Courses from this list that are applied to major requirements cannot be used to meet this requirement.

- AgEc 5020—Applied Linear Programming (4)
- BioC 1302, 1303—Elementary Biochemistry II and Laboratory (3, 2)
- Biol 1103—General Botany (5)
- Biol 1106—General Zoology (5)
- Biol 3021—Biochemistry (4)
- Biol 3041—Ecology (4)
- Biol 3033—Genetics (4)
- Bot 3109—Plant Anatomy (5)
- Chem 1006—Principles of Solution Chemistry (4)
- Chem 3100, 3101—Quantitative Analysis and Laboratory (3, 2)
- Chem 3301—Elementary Organic Chemistry I (4)
- Chem 3302—Elementary Organic Chemistry II (4)
- Chem 3303—Elementary Organic Chemistry III (4)
- EBB 3001—Introduction to Ecology (4)
- (or) EBB 3004—Fundamentals of Ecology (4)
- EBB 5014—Ecology of Plant Communities (5)
- GCB 3022—Genetics (4)
- Geo 1001—Physical Geology (5)
- MicB 3103—General Microbiology (5)
- (or) VPB 3103—General Microbiology (5)
- (or) Biol 3013—Microbiology (4)
- Phys 1042, 1046—Introductory Physics and Laboratory (4, 1)
- QA 3053—Quantitative Methods for Administration (4)
- Any mathematics course that requires Math 1111 or 1201 as a prerequisite
- Any statistics course that requires Math 1111 as a prerequisite

C. The Individual and Society—14 credits minimum (specific requirements must be taken A-N; electives may be taken S-N)

See All-College Requirements (end of section II). One course required in the area of Development of Civilization.

AgEc 1020—Principles of Macroeconomics (5) A-N

D. Literature, Humanities, and Fine Arts—8 credits minimum (may be taken S-N)

See All-College Requirements (end of section II).

E. Requirements in the Major

See individual curricula.

F. Electives to complete the 192 credits required for graduation with the bachelor of science degree.

¹This sequence is recommended for students who plan to enter graduate school.



Students participate in meat judging.

III. COURSE DESCRIPTIONS

Symbols—The following symbols are used throughout the course descriptions in lieu of page footnotes:

- * Courses in which graduate students may prepare Plan B projects.
- † All courses preceding the dagger must be completed before credit will be granted for any quarter of the sequence.
- § Credit will not be granted if the equivalent course listed after the section mark has been taken for credit.
- ¶ Concurrent registration is allowed (or required) in the course listed after the paragraph mark.
- # Registration Override Permit, completed and signed by the instructor, is required for registration.
- △ Registration Override Permit, completed and signed by the division, department, or school offering the course, is required for registration.
- H Honors course.
- x Course is offered more than one quarter.

Courses primarily for freshmen and sophomores are numbered 1000 through 1998; for juniors and seniors, 3000 through 3998; for juniors, seniors, and graduate students, 5000 through 5998. Courses numbered 8000 and above are restricted to students registered in the Graduate School.

A hyphen between course numbers (e.g., 3142-3143-3144) indicates a sequence of courses that must be taken in the order listed.

A comma between course numbers (e.g., 1234, 1235, 1236) indicates a series of courses that may be entered any quarter.

When no abbreviated department prefix precedes a course number listed as a prerequisite, that prerequisite is in the same department as the course being described.

Courses in Agriculture

Agricultural and Applied Economics (AgEc)

- 1000. ORIENTATION TO AGRICULTURAL AND APPLIED ECONOMICS.** (1 cr; S-N only)
Introduction to the curricula, areas of specialization, course work, employment opportunities, faculty, and functions of the Department of Agricultural and Applied Economics.
- 1020. PRINCIPLES OF MACROECONOMICS.** (5 cr, §Econ 1001)
Determinants of national income and employment levels; prices and money; the banking system; monetary and fiscal policy; economic growth and development; role of government in the economy.
- 1020H. HONORS COURSE: PRINCIPLES OF MACROECONOMICS.** (5 cr, §Econ 1001; prereq 3rd-qr freshman and B avg or #)
Determinants of national income and employment levels; prices and money; the banking system; monetary and fiscal policy; economic growth and development; the role of government in the economy.
- 1030. PRINCIPLES OF MICROECONOMICS.** (4 cr, §Econ 1002; prereq 1020)
Economics of the firm and household; factor and product price determination; theory of production, consumption, and distribution; supply and demand analysis; equilibrium analysis.
- 1030H. PRINCIPLES OF MICROECONOMICS.** (4 cr, §Econ 1002; prereq 1020 and B avg or #)
Economics of the firm and household; factor and product price determination; theory of production, consumption, and distribution; supply and demand analysis; equilibrium analysis.
- 1250. PRINCIPLES OF ACCOUNTING.** (5 cr)
Fundamentals of business accounting; basic finance concepts; use of accounting data for income tax and managerial decision making.
- 1400. AGRICULTURAL MARKETS AND PRICES.** (4 cr; prereq 1030)
Economics of agricultural marketing; factors determining prices and price trends of agricultural commodities, demand for and supply of agricultural products, and food and fiber market organization.

Course Descriptions

- 3040. ECONOMIC DEVELOPMENT OF AMERICAN AGRICULTURE.** (4 cr; prereq 1030)
Economic, political, social, and technical forces that have shaped the development of American agriculture; the role of agricultural development in national economic development in the United States; implications for presently developing countries.
- 3070. AGRICULTURE AND ECONOMIC GROWTH IN DEVELOPING COUNTRIES.** (4 cr; prereq 1020, 1030)
Agricultural development problems; the contribution of economics to analyzing these problems; the use of economics in agricultural development policy and planning.
- 3080. WORLD FOOD SUPPLY SYSTEMS.** (4 cr; prereq Econ 1001, 1002 or #)
Introduction to the systems by which the world is fed; basic economics of food production and distribution; technical, economic, and institutional factors affecting food supply and demand; international and national policies and issues. Industrialized, centrally planned, and third world countries compared.
- 3101. MICROECONOMIC THEORY.** (4 cr, §Econ 3101; prereq 1030 or Econ 1002, Math 1111 or equiv)
Behavior of households, firms, and industries under competitive and monopolistic conditions; factors influencing production, price, and advertising decisions.
- 3102. MACROECONOMIC THEORY.** (4 cr, §Econ 3102; prereq 1020, 1030 or Econ 1001 and 1002)
Determinants of national income, employment, and price level; aggregate consumption, investment, and government demand; the money market; the labor market.
- 3290. AGRIBUSINESS MANAGEMENT.** (4 cr; prereq 1020, 1030 and Mgmt 3001 for agricultural business majors...3101 or # for others)
Application of economic, other social science, and technical concepts to the decision-making process of firms supplying inputs to agriculture and/or processing and distributing agricultural products.
- 3410. ECONOMIC ORGANIZATION OF THE HOSPITALITY INDUSTRY.** (4 cr; prereq 1020, 1030, Mktg 3000 or #)
Principles of economics applied to markets and firms serving people away from home, including food, lodging, travel, recreation, health care, and related activities.
- 3420. GRAIN MARKETING ECONOMICS.** (3 cr; prereq 1400)
Economic relationships in the marketing of grain and grain products; analysis of supply and demand; grain grades, storage, and transportation; market structure, channels, pricing and competition; government programs and policies.
- 3430. DAIRY MARKETING ECONOMICS.** (3 cr; prereq 1400)
Economic relationships in the marketing of milk and milk products; analysis of supply and demand; market structure, channels, pricing and competition; federal milk market price regulations; dairy programs and policies.
- 3440. LIVESTOCK MARKETING ECONOMICS.** (3 cr; prereq 1400)
Economic relationships in the marketing of livestock and livestock products; analysis of supply and demand; livestock grades, inspection, and transportation; market structure, channels, pricing and competition; government regulations and policies.
- 3500. FARM AND AGRIBUSINESS FINANCE.** (5 cr; prereq 1030, 1250 or Acct 1024 and 1025 or equiv)
Analysis of financing and investment policies for farm and agribusiness firms with reference to effects on liquidity, solvency, and profitability. Introduction to financial intermediaries in agriculture.
- 3610. COMMUNITY RESOURCE DEVELOPMENT.** (4 cr; prereq 1020-1030 or Econ 1001-1002 or #)
Basic concepts of resource use including physical and economic classifications; physical and economic feasibility; benefits and costs; external effects; cost sharing; selected resource use problems. Economic areas and units for planning and development; generation of alternative program elements and development of consequences; problems in choosing elements for an optimum resource development program.
- 3640. PUBLIC FINANCE: CONCEPTS AND PRACTICES.** (4 cr; prereq 1020, 1030 or Econ 1001, 1002)
Survey of government revenue systems, expenditures, taxation, and debt in the United States. Federal, state, and local fiscal institutions; intergovernmental fiscal relations; budget analysis; and policy issues.
- 3710. AGRICULTURAL AND MARKET POLICIES.** (4 cr; prereq 1400 or 3101, 3102 or Econ 3101, 3102 or #)
Analysis of public problems and issues concerning U.S. agriculture and the welfare of rural residents; economic problems of the food and fiber industry and of rural residents and communities; critical appraisal of past and present public programs; economic and social implications of alternative policies and programs; political decision making in policy formulation.
- 3820. FARM MANAGEMENT ECONOMICS.** (4 cr; prereq 1030)
Introduction to the use of farm accounts in planning; application of economic principles and budgeting procedures to the development of enterprise budgets and whole farm plans; development of projected cash flows; and evaluation of investment alternatives.
- 3830. ORGANIZING THE FARM BUSINESS FOR ENTRY, GROWTH, AND TRANSFER.** (4 cr; prereq 3820... 3850 recommended)
Business and personal considerations and analytical procedures for evaluation opportunities and arrangements for gaining entry into farming; analyzing business expansion alternatives; and deciding how best to transfer the farm business between generations. Acquisition of land and machinery and management of labor.

Agricultural and Applied Economics

- 3831. ORGANIZING THE FARM BUSINESS FOR ENTRY, GROWTH, AND TRANSFER LAB.** (1-3 cr; prereq ¶3830)
Development of a detailed production, marketing, and financial plan for either the student's home or another actual farm business.
- 3850. FARM BUSINESS AND ENTERPRISE ANALYSIS.** (4 cr, prereq 1030, 3820, or #)
Principles of selecting, organizing, maintaining, and using a farm accounting system. Financial statements and farm financial management. Tax preparation and planning; analysis and forward planning of crop and livestock enterprises and the overall farm business.
- 3900. SPECIAL TOPICS IN THE ECONOMICS OF PUBLIC SERVICES.** (3 cr; prereq 1020 or #)
Upper division seminar on public service issues; discussion of principles of analysis followed by case studies on topics of current interest such as economics of income maintenance, education, transportation, health services, housing, municipal services.
- 3980. CURRENT ISSUES IN AGRICULTURAL ECONOMICS.** (Cr ar; prereq #)
Discussion and analysis of important and timely problems in agricultural economics. Topics vary from quarter to quarter and are listed in the *Class Schedule*. For full details, inquire at the department office prior to registration.
- 5000. PROFESSIONAL EXPERIENCE PROGRAM.** (4 cr, prereq #: S-N only; free elective for AgEc undergrads; not for grad cr)
Professional experience in agribusiness firms or government agencies obtained through supervised practical experience; evaluative reports and consultations with faculty advisers and employers.
- 5020. APPLIED LINEAR PROGRAMMING.** (4 cr for undergrad, 3 cr for grad; prereq 1030 and Math 1111 or 1131)
Application of linear programming to farm and agribusiness firms. Emphasizes economic concepts using minimal mathematics. Develops skills in computer use for decision making. Profit maximization, cost minimization, and transportation analysis.
- 5099. RCD INTERDISCIPLINARY SEMINAR I.** (4 cr, 5099-5100†, §RCD 5099, §AgET 5099, §LA 5099, §Soil 5099; prereq resource and community development sr or #)
Selected speakers, readings, and discussion topics dealing with resource and community development analysis and implications for resource allocation. Students participate as a team, combining disciplinary skills to analyze complex resource problems.
- 5100. RCD INTERDISCIPLINARY SEMINAR II.** (4 cr, 5099-5100†, §RCD 5100, §AgET 5100, §LA 5100, §Soil 5100; prereq 5099 or #)
(Continuation of 5099) Papers, presentations, and critiques on selected complex resource problems in Seminar I.
- 5104. AGRICULTURAL SYSTEMS ANALYSIS AND MODELING.** (4 cr, §PIPa 5104, §AnSc 5104, §Soil 5104; prereq Math 1142 or #)
Introduction to bioeconomic modeling as preparation for interdisciplinary agricultural systems analysis. Basic concepts; deterministic and stochastic models; delays, feedback, and clockwork; data acquisition; model verification and validation; role of models for agroecosystem management.
- 5120. AGRIBUSINESS MANAGEMENT AND MARKETING.** (3 cr; not open to majors in AgEc Dept; prereq 1020, 1030)
Business management and marketing problems in firms and industries serving agriculture; economic interrelationships among industries supplying agriculture and those processing and distributing farm products.
- 5130. LAND RESOURCE USE.** (3 cr; not open to majors in AgEc Dept; prereq 1020, 1030)
Land as a factor of production; rural and urban utilization; rents and land values; land classification; taxation; exchange; public land management.
- 5140. AGRICULTURAL PRODUCTION.** (3 cr; not open to majors in AgEc Dept; prereq 1020, 1030)
Application of managerial and economic analysis to the planning and evaluation of farm firms. Use of hand procedures and computerized decision aids in obtaining credit, budgeting, and evaluating farm plans.
- 5150. AGRICULTURAL POLICY.** (3 cr; not open to majors in AgEc Dept; prereq 1020, 1030)
Application of economic analysis to agricultural price and income policy issues; development of present-day price and income programs.
- 5180. AGRI-MARKETING COMMUNICATIONS.** (4 cr, §AgJo 5180; prereq basic AgJo course or Δ or #, 1020 and 1030; basic communications and speech courses; not open to agricultural economics grads)
Research and development of a complete marketing plan for an agricultural product from development through the final marketing communications stages.
- 5271. BAYESIAN DECISION MAKING.** (4 cr, §Econ 5271; prereq Stat 5122 or equiv and Econ 1002 or equiv)
Rationale for expected utility representation of decision problems. Amount of a venture problem. Production decisions by firms. Combinations of ventures, portfolio problems.
- 5272. BAYESIAN DECISION MAKING.** (4 cr, §Econ 5272; prereq 5271)
Sequential economic decisions; dynamic programming; multivariate utility.
- 5400. INTERMEDIATE MARKET AND PRICE ANALYSIS.** (4 cr for undergrad, 3 cr for grad; prereq 1400 or 3101 or Econ 3101 or Econ 5151)
Development of analytical models and their application in various market situations. Unique market institutions that have developed in response to marketing problems and policies.

Course Descriptions

- 5440. COOPERATIVES AND AGRIBUSINESS ORGANIZATION.** (4 cr for undergrad, 3 cr for grad; prereq 1400)
Analysis of economic problems and issues facing agricultural cooperatives, including changing market organization, financing, taxation, and antitrust regulations.
- 5480. FUTURES, MARKETS, AND PRICES.** (4 cr for undergrad, 3 cr for grad; prereq 1400 or #)
Economics of cash and futures trading on organized markets; futures trading theory; hedging and speculation.
- 5500. ADVANCED AGRICULTURAL FINANCE.** (4 cr for undergrad, 3 cr for grad; prereq 3500)
Analysis of financial institutions and financial markets. Managerial policy issues confronting managers of financial intermediaries with reference to those operating in an agricultural setting. Current problem issues confronting financial intermediaries.
- 5550. FOOD CONSUMPTION ECONOMICS.** (4 cr for undergrad, 3 cr for grad, §FScN 5474; prereq 3101, Stat 5021, FScN 3472 or equiv or #)
Analytical and empirical treatment of consumer food behavior. Concentrates on data and methods used to study economic and nutritional aspects of food consumption. Students pursue individual projects.
- 5560. ECONOMICS OF CONSUMER POLICIES.** (4 cr for undergrad, 3 cr for grad; prereq 3101 or Econ 3101 or #)
Examination of impact on consumers of legislative, regulatory, and judicial policies for tendency to promote efficiency, equity, consumer sovereignty, and freedom of choice. Evaluation of policies for dealing with information, prices, consumer protection, consumer redress, public goods, and regulatory institutions.
- 5580. ECONOMIC ORGANIZATION OF THE HOUSEHOLD.** (4 cr for undergrad, 3 cr for grad; prereq 1030 or Econ 1002; not open to agricultural economics grads)
Economic concepts applied to the analysis of household production, market and nonmarket work, family formation and size, and household consumption activity.
- 5600. LAND ECONOMICS.** (4 cr for undergrad, 3 cr for grad; prereq 3101, 3102 or Econ 3101, 3102 or #)
Land as a factor of production; land use, classification, and value; sale and rental markets for land; domestic and foreign land policies.
- 5610. LAND USE INSTITUTIONS OF LOCAL GOVERNMENT.** (4 cr for undergrad, 3 cr for grad; prereq 1020, 1030)
Introduction to law as an institution of government as applied to land use. Emphasis on regulatory powers, especially zoning, including types of permits, methods of exercising discretion, constitutional and statutory constraints, administrative procedures, growth control techniques, planned developments, exclusionary zoning, separation of powers, and judicial review. Other regulatory powers include subdivision controls, building, housing and sanitary codes, and official maps.
- 5620. REGIONAL ECONOMIC ANALYSIS.** (4 cr for undergrad, 3 cr for grad; prereq 1030 or Econ 1002)
Analysis of regional industry and community structure; role of resource, transportation, and institutional constraints: trade, migration, and investment in regional growth and change. Use of regional economic information in business investment and location planning.
- 5630. REGIONAL DEVELOPMENT SYSTEMS.** (4 cr for undergrad, 3 cr for grad; prereq 1030 or Econ 1002)
Population, income, and employment disparities in regional growth and development in selected countries. Regional development strategies and institutions for public intervention in regional development process. Regional systems analyses and forecasts for economic policy and development planning.
- 5640. FINANCING STATE AND LOCAL GOVERNMENTS.** (4 cr for undergrad, 3 cr for grad; prereq 3101 or Econ 3101)
Problems and issues in financing state and local public services in the United States. State and local revenue systems, debt, and expenditures. Intergovernmental fiscal relations. Budget analysis.
- 5650. ECONOMICS OF NATURAL RESOURCE POLICY.** (4 cr for undergrad, 3 cr for grad; prereq 3101 or Econ 3101 or Econ 5151 or #)
Application of economic analysis, including project evaluation, to current natural resource issues. Emphasis on conservation and resource scarcity, environmental quality, population growth, and resource use issues and their implications for public policy.
- 5660. ECONOMICS OF PUBLIC SERVICES.** (4 cr for undergrad, 3 cr for grad; prereq 3101 or Econ 3101 or Econ 5151 or #)
Introduction to the issues of finance and supply and demand for public services; pricing, producing, and financing public goods; bureaucratic decision making; implementation of policies.
- 5670. ECONOMICS OF AGRICULTURAL TRANSPORTATION.** (4 cr for undergrad, 3 cr for grad; prereq 3101-3102 or Econ 3101-3102 and Tran 3054 or #)
Application of economic analysis to current issues in agricultural and rural transportation policy. Relationship between transportation infrastructure and economic development and regional and national trade.
- 5720. ECONOMICS OF WORLD AGRICULTURE.** (4 cr for undergrad, 3 cr for grad; prereq 1020, 1030 or #)
Distribution, quality, and utilization of agricultural resources; agricultural organization and structure; location of agricultural activity; national and international agricultural policies.
- 5750. AGRICULTURAL TRADE AND COMMERCIAL POLICIES.** (4 cr for undergrad, 3 cr for grad; prereq 3101, 3102 or Econ 3101, 3102)
Patterns of trade in agricultural products; trade policies and practices of export and import nations; commodity agreements; agricultural trade policies of common market areas; negotiations and potential trade developments.

- 5790. WORLD FOOD SUPPLY PROBLEMS.** (4 cr, §Agro 5200, §PIPa 5220, §Soc 5675, §LACS 5280, §FScN 5643; prereq ag, pre-veterinary medicine, home economics, or social science majors or #...agricultural economics grads with #)
A multidisciplinary approach to the social, economic, and technical problems of feeding the world's growing population. Principles sought from the social and economic sciences, plant sciences, and animal sciences for their application to food problems.
- 5840. MANAGEMENT OF THE FARM BUSINESS.** (4 cr for undergrad, 3 cr for grad; prereq 3820...3830, 3850 recommended)
Decision-making procedures under conditions of uncertainty; development of an information system to monitor and control the ongoing operation; control of crop and livestock enterprises; labor management; and cash flow management.
- 5860. ECONOMICS OF AGRICULTURAL PRODUCTION.** (4 cr for undergrad, 3 cr for grad; primarily for grads; prereq 21 cr in economics or agricultural economics)
Production economics applied to agriculture; profitable combination of production factors; comparative advantage and location of production.
- 5890. INDEPENDENT STUDY: ADVANCED TOPICS IN FARM MANAGEMENT.** (1-6 cr; prereq #)
Special topics or individual work suited to the needs of particular groups of students.
- 5990. SPECIAL TOPICS AND INDEPENDENT STUDY IN AGRICULTURAL AND APPLIED ECONOMICS.** (Cr ar; prereq #)
Special classes, independent study, and supervised reading and research on subjects and problems not covered in regularly offered courses.

FOR GRADUATE STUDENTS ONLY

(For course descriptions, see the *Graduate School Bulletin*)

- 8200. ADVANCED TOPICS IN AGRICULTURE AND APPLIED ECONOMICS**
- 8205. RESEARCH METHODOLOGY IN AGRICULTURAL ECONOMICS**
- 8220. APPLIED MATHEMATICAL PROGRAMMING**
- 8231. AGRICULTURAL PRICES**
- 8245. AGRICULTURAL MARKETING ECONOMICS**
- 8264. RESOURCE ECONOMICS**
- 8266. APPLIED REGIONAL ECONOMICS**
- 8278. AGRICULTURAL AND ECONOMIC DEVELOPMENT**
- 8287. PRODUCTION FUNCTIONS: THEORY AND ESTIMATIONS**
- 8288. DYNAMIC PRODUCTION ECONOMICS**
- 8335. SEMINAR: PRICE ANALYSIS**
- 8344. SEMINAR: COOPERATIVE MARKETING**
- 8345. SEMINAR: AGRICULTURAL MARKETING**
- 8346. SEMINAR: LAW AND AGRICULTURAL ECONOMICS**
- 8356. SEMINAR: CONSUMPTION ECONOMICS**
- 8360. SEMINAR: LAND ECONOMICS AND TENURE**
- 8364. SEMINAR: RESOURCE ECONOMICS AND POLICY**
- 8366. SEMINAR: APPLIED REGIONAL ECONOMICS**
- 8373. SEMINAR: FOOD AND AGRICULTURAL POLICY IN THE UNITED STATES**
- 8378. SEMINAR: AGRICULTURAL DEVELOPMENT**
- 8382. SEMINAR: FARM MANAGEMENT AND PRODUCTION ECONOMICS**
- 8591. CONSUMPTION ECONOMICS**

Agricultural Education (AgEd)

- 1001. INTRODUCTION TO AGRICULTURAL EDUCATION.** (1 cr; prereq #)
Orientation to employment and service in agricultural education; qualifications of teachers, survey of preparatory offerings, the program in Minnesota.

Course Descriptions

- 1010. HISTORY AND PHILOSOPHY OF VOCATIONAL AND COMMUNITY EDUCATION.** (3 cr)
Analysis and interpretation; alternative value positions involving social, economic, and related community variables.
- 3010. ORGANIZATION AND DIRECTION OF FFA ACTIVITIES.** (2 cr)
Development of FFA leadership: vocational agriculture/agribusiness and natural resources education, youth leadership organization; integration of classroom and supervised occupational experience.
- 3021. EDUCATION THROUGH EXTENSION METHODS.** (3 cr; prereq soph)
Role of nonschool agencies in rural and agricultural education; methods and techniques of formal and informal instruction in school and nonschool educational programs.
- 3029. DIRECTED EXPERIENCE IN AGRICULTURAL EDUCATION.** (1-3 cr)
Observation of activities of teachers of agriculture; familiarization with the staff, curriculum, and physical facilities and equipment in a department of vocational agriculture, with opportunity to participate in the functions of a teacher.
- 3031. STUDENT TEACHING IN AGRICULTURE.** (8 cr; prereq jr, 5028, SeEd 3155, #)
Instruction in developing individual farming programs, contacting parents, program analysis of community needs, conducting classes, community activities, Future Farmers of America, and case studies.
- 3041. PRACTICUM: AGRICULTURAL EDUCATION TECHNOLOGY.** (1-3 cr [may be repeated for max 5 cr])
Individualized study packages of 1 credit each of technology in agriculture, horticulture, off-farm agriculture, agricultural mechanics, adult and beginning farmer programs, youth organizations, program evaluation, and visual aids.
- 5000. PROFESSIONAL EXPERIENCE PROGRAM.** (4 cr; prereq #; not for grad cr)
Supervised practical professional experience in agricultural business and industries; evaluative reports and consultations with faculty advisers and employers.
- 5010. HISTORY AND PHILOSOPHY OF VOCATIONAL AND COMMUNITY EDUCATION.** (3 cr)
Analysis and interpretation; alternative value positions involving social, economic, and related community variables.
- 5021. EDUCATION THROUGH EXTENSION METHODS.** (3 cr; prereq grad student or #)
Role of nonschool agencies in rural and agricultural education; methods and techniques of formal and informal instruction in school and nonschool educational programs.
- 5023. EXTENSION METHODS FOR DEVELOPING COUNTRIES.** (3 cr, §HEEd 5023)
Extension methods to promote rapid adoption of improved agricultural practices.
- 5024. HISTORY AND PHILOSOPHY OF EXTENSION SERVICES.** (3 cr; prereq #)
Origin, philosophy, historical development, objectives, and organizational structure of cooperative extension services including agriculture, home economics, 4-H programs, and community development work.
- 5025. EXTENSION PROGRAM DEVELOPMENT.** (3 cr)
Planning, implementing, and evaluating the program development process.
- 5026. EXTENSION ADMINISTRATION.** (3 cr, §HEEd 5026; prereq #)
Administration of the Cooperative Extension Service organization at the county, area, and state levels.
- 5027. PRACTICUM: EXTENSION EXPERIENCES.** (2-6 cr [max 6 cr], §HEEd 3605, §HEEd 5027; prereq #; S-N optional)
Observation of activities of county extension staff; familiarization with staff, program planning and development, county committee, youth activities and office activities, with opportunity to participate in function of an extension educator.
- 5028. TEACHING METHODS IN AGRICULTURAL EDUCATION.** (5 cr; prereq SeEd 3155 or §SeEd 3155)
Methods utilized in teaching agriculture in public schools; use of media, principles of learning, problem solving, test construction, classroom management, and specific practice in problem-solving teaching techniques; use of competency-based individualized instruction as a medium for course presentation and a model for teaching methods.
- 5032. HIGH SCHOOL CURRICULUM IN AGRICULTURE.** (3 cr; prereq 10 cr education)
Philosophy, organization, and administration of instruction in agriculture departments in secondary schools.
- 5034. PROCEDURES IN TEACHING AGRICULTURE.** (3 cr; prereq #)
New developments in methodology; assessment of innovations and procedures; consideration of various levels of instruction.
- 5035. METHODS AND PRACTICES IN TEACHING POST-HIGH SCHOOL AGRICULTURE.** (3 cr)
Problems unique to area vocational-technical school and junior college teaching; improving ability to organize and present subject matter.
- 5041. WORKSHOP: AGRICULTURAL EDUCATION TECHNOLOGY.** (1-6 cr [max 6 cr])
New understandings, techniques, and materials in animal science, plant science, horticulture, soil science, agricultural mechanics, forestry, natural resources, youth organization, visual aids, and occupational exploration.

- 5049. AGRICULTURAL EDUCATION FOR ADULTS.** (5 cr)
Methods, organization, and implementation of systematic education programs for beginning and established farmers; organization of local programs to meet needs of production agriculture in areas of enterprises, agricultural mechanics and management; development of continuing program, observations.
- 5051. ENTERPRISE ANALYSIS.** (3 cr; prereq #)
Analyzing farm business as basis for identifying problems; planning learning experiences to improve farm management at high school, young farmer, and adult levels.
- 5052. FARM BUSINESS MANAGEMENT EDUCATION.** (3 cr; prereq 5049 or #)
Administration, organization, and operation of farm business management education programs for adults; development and utilization of curriculum materials based on farm business record data.
- 5051. PROGRAM PLANNING AND EVALUATION** (3 cr; prereq sr)
Development of program of agricultural education in community school, integration with total school program, administrative relationships, techniques and use of program evaluation in planning.
- 5071. SUPERVISED OCCUPATIONAL EXPERIENCES IN AGRICULTURE.** (3 cr)
Organization and administration of an occupational experience program in agriculture for high schools and area schools.
- 5072. PRACTICUM: AGRICULTURAL BUSINESS AND INDUSTRY.** (1-3 cr per qtr [max 9 cr]; prereq 5071 or #)
Observation, study, and experience in agricultural business and industry; application to educational problems in agriculture.
- 5080. ORGANIZATION AND MANAGEMENT.** (3 cr; prereq #)
Administrative structure and function of subcollegiate programs.
- 5081. CURRENT ISSUES FOR THE BEGINNING AGRICULTURE TEACHER.** (1-3 cr [max 3 cr]; prereq #)
Teaching methods, organization of learning resource materials, management of classroom and laboratory learning activities, curriculum planning and organization, management of discipline situations, school and community relationships for the beginning teacher.
- 5084. CURRICULA FOR CAREER EXPLORATION IN AGRICULTURAL OCCUPATIONS.** (3 cr)
Analysis and evaluation of material; criteria for selection of material; content, organization, resource activities, and teaching techniques.
- 5085. CAREER DEVELOPMENT IN AGRICULTURAL EMPLOYMENT.** (3 cr)
Methods and materials in teaching career development for agricultural industries.
- 5090. INDEPENDENT STUDY.** (1-3 cr; prereq sr or #)
Topics chosen to permit study of areas within education or to supplement areas of inquiry not provided in the regular course structure.
- 5095. INDEPENDENT STUDY.** (3 cr; prereq MEd candidate in agricultural education)
Preparation of a paper dealing with studies in agricultural education applied to professional responsibilities.
- 5128. METHODS OF TEACHING.** (3 cr; prereq non-agricultural education major and/or #)
Methods of teaching agriculture or related subjects; development of competencies in planning, organizing, implementing, and evaluating instruction, with practice in instructional techniques.
- 5129. CURRICULUM PLANNING.** (3 cr; prereq 5128 or 5128...non-agricultural education major and/or #)
Methods and procedures in planning a curriculum to teach within a specific subject matter area; curriculum construction in the subject matter field for use in native country setting.
- 5130. EFFECTIVE TEACHING IN A COLLEGE OF AGRICULTURE.** (3 cr; prereq 1 yr grad study in agriculture or #)
Various approaches to effective teaching in a college of agriculture. Development of a personal philosophy of teaching; practice in employing several types of instructional improvement activities. Intended primarily for the graduate student who plans to teach in a college of agriculture.
- 5200. SEMINAR: WORKING WITH YOUTH THROUGH ADULTS.** (1-3 cr per qtr [max 9 cr incl HEEEd 5200 and YoSt 5200]; prereq Δ ; S-N optional)
Interdisciplinary seminar focusing on definition of the youth work profession; essential skills for youth workers; youth needs, roles, relationships with adults; development and management of a system of support for youth work.

FOR GRADUATE STUDENTS ONLY

(For course descriptions, see the *Graduate School Bulletin*)

- 8001. RESEARCH IN AGRICULTURAL EDUCATION**
- 8010. CURRENT ISSUES IN AGRICULTURAL EDUCATION**
- 8020. SEMINAR: AGRICULTURAL EDUCATION**
- 8091. FIELD PROBLEMS**
- 8303. SEMINAR: GRADUATE STUDIES REVIEW**

Course Descriptions

Agricultural Engineering

COURSES IN AGRICULTURAL ENGINEERING TECHNOLOGY (AgET)

- 1020. AGRICULTURAL SHOP—METALWORK.** (4 cr; prereq Chem 1004 or #; 2 lect and 6 lab hrs per wk)
Arc and oxyacetylene welding, soldering, use and conditioning of metalworking tools, and identification and characteristics of metals used in farm machinery.
- 1090. DIRECTED STUDIES IN AGRICULTURAL ENGINEERING.** (Cr ar; prereq #)
Independent study of topic(s) involving physical principles as applied to agricultural production and land resources.
- 3091. SPECIAL PROBLEMS IN AGRICULTURAL ENGINEERING.** (2-5 cr; prereq #)
Individual study of topics in agricultural engineering. Application of physical principles to agricultural production.
- 3205. POWER AND POWER USE.** (4 cr; prereq Math 1111, Phys 1041; 3 lect and 3 lab hrs per wk)
Internal combustion engine. Principles including elementary thermodynamics of two- and four-cycle engines, ignition, and carburetion. Electric power principles for selection. Power transmission including direct drive, fluid couplers, and hydraulic motors, belts, and chain.
- 3215. MACHINERY AND EQUIPMENT.** (4 cr; prereq Math 1111, Phys 1041; 3 lect and 3 lab hrs per wk)
Mechanics of operation of field machines for tillage, planting, and harvesting and of structural equipment for materials handling. Utilization performance criteria, safety features, and selection processes.
- 3410. HYDROLOGY, WATER CONTROL.** (4 cr; prereq Math 1111, Phys 1041, Soil 1122; 3 lect hrs, 1 hr rec per wk)
The hydrologic cycle—precipitation, infiltration, evaporation, surface runoff. Water table variations, subsurface runoff. Flow in open channels, flow measurement. Watershed runoff, floods. Sediment sources, erosion, and sediment control. Water control on a watershed basis.
- 3606. FARM BUILDING DESIGN, LAYOUT, SYSTEMS.** (4 cr; prereq Math 1111, Phys 1041; 3 lect and 3 lab hrs per wk)
Farm building design based on functional and environmental requirements. Building and farmstead layouts to accommodate improved materials handling systems. Modified environment in warm or cold buildings.
- 3610. ELECTRICITY IN AGRICULTURE.** (4 cr; prereq Math 1111, Phys 1041; 3 lect and 2 lab hrs per wk)
Basic theory and practical application of electricity in agriculture. Electric motors, heating, lighting, and controls. Selection and maintenance of electrical equipment. Electrical safety.
- 3615. CROP PROCESSING AND STORAGE.** (4 cr; prereq Math 1111, Phys 1041; 3 lect and 3 lab hrs per wk)
Grain drying principles and methods. Equipment and systems for on-farm processing, storage, and feeding of grains. Storage and feeding systems for forages. Principles and equipment for storage of fruits and vegetables.
- 3800. RURAL SANITATION AND WATER SUPPLY.** (4 cr; prereq Phys 1041, Chem 1005; 3 lect and 3 lab hrs per wk)
Wells, pumps, water supply, and treatment. Water supply and waste disposal systems for homes, farmsteads, resorts, and recreational use.
- 5000. PROFESSIONAL EXPERIENCE PROGRAM.** (4 cr; prereq #; S-N only; free elective for AgET undergrads; not for grad cr)
Professional experience in agricultural engineering firms or government agencies through supervised practical experience; evaluative reports and consultations with faculty advisers and employers.
- 5020. PROGRAM PLANNING AND INSTRUCTIONAL METHODS IN AGRICULTURAL MECHANICS.** (4 cr; prereq 10 cr agricultural engineering technology, AgEd 3031 or †AgEd 3031)
Planning and designing high school vocational agriculture facilities, organizing equipment, tools, supplies, and storage required by the instructional program. Administering the agricultural mechanics program. Developing teaching techniques and program planning as related to student-supervised study programs in agricultural mechanics.
- 5021. MECHANICS OF AGRICULTURAL SYSTEMS.** (4 cr; prereq Math 1142, Phys 1042; 4 lect hrs per wk)
Analysis of forces in equilibrium as related to agricultural mechanics. Statics, equilibrium condition, loading, and deformation applied to engineering materials used in agriculture.
- 5022. ENERGY SYSTEMS IN AGRICULTURE.** (4 cr; prereq Math 1142, Phys 1042; 4 lect hrs per wk)
Application of principles of thermodynamics, heat utilization, and heat transfer methods to agricultural processes and systems.
- 5023. FLUIDS—PRINCIPLES AND SYSTEMS.** (4 cr; prereq Math 1142, Phys 1042 or #; 3 lect and 2 lab hrs per wk)
Elementary fluid mechanics, flow of liquids and gases, measurement of fluid flow, hydraulic machinery, fluid flow systems.
- 5027. APPROPRIATE TECHNOLOGY FOR INTERNATIONAL DEVELOPMENT.** (4 cr; prereq Math 1111, Chem 1001 or 1004, Phys 1041; 3 lect and 3 lab hrs per wk)
Definitions, history, successes and failures of appropriate technology. Social and technical appropriateness. Water supply, treatment, storage, and conveyance. Water pumps, sanitation. Power; pedal, wind, water, solar, rice-hull furnace, methane, Stirling-cycle engine. Building materials. Agricultural machinery and storage. Transfer and adoption of technology.

- 5030, 5031, 5032, 5033, 5034, 5035. PROBLEMS AND FIELD STUDIES IN ADVANCED AGRICULTURE.** (1-3 cr; prereq 5020 or #)
Principles and practices pertaining to implementation of instructional programs in agricultural mechanics. Selection, application, operation, service, and maintenance of equipment used in agricultural mechanics for the specific instructional program.
- 5030. Agricultural Tractor and Engine Power**
 - 5031. Agricultural Machinery and Mechanization**
 - 5032. Electrical Power and Processing**
 - 5033. Farm Buildings and Environment Control**
 - 5034. Natural Resources Development and Management**
 - 5035. Metal Fabrication Materials and Techniques**
- 5040. ADVANCED METHODS FOR TEACHING AGRICULTURAL MECHANICS.** (3 cr; prereq #; 2 lect and 3 lab hrs per wk; off campus in fall and spring, on campus SSI)
Trends and role of agricultural mechanics in the mechanization of agriculture. Organization of instructional areas, selection of tools, supplies, reference materials, and facilities. Preparation of instructional materials and methods of effective teaching. Development of teaching demonstrations and procedures.
- 5091-5092. SPECIAL PROBLEMS IN AGRICULTURAL ENGINEERING.** (2-5 cr per qtr; prereq #)
Individual study project in agricultural engineering at advanced level. Application of engineering principles to a specific problem.
- 5099. RCD INTERDISCIPLINARY SEMINAR I.** (4 cr, 5099-5100†, §RCD 5099, §AgEc 5099, §LA 5099, §Soil 5099; prereq resource and community development sr or #)
Selected speakers, readings, and discussion topics dealing with resource and community development analysis and implications for resource allocation. Students participate as a team, combining disciplinary skills to analyze complex resource problems.
- 5100. RCD INTERDISCIPLINARY SEMINAR II.** (4 cr, 5099-5100†, §RCD 5100, §AgEc 5100, §LA 5100, §Soil 5100; prereq 5099 or #)
(Continuation of 5099) Papers, presentations, and critiques on selected complex resource problems in Seminar I.
- 5400. DRAINAGE AND IRRIGATION.** (4 cr, prereq Soil 3210; 3 lect and 2 lab hrs per wk)
Soil moisture excesses and deficiencies. Theory and design of tile drainage, surface drainage, and sprinkler irrigation systems. Development of irrigation water supplies. Selection of pumps and power units for drainage and irrigation. Economic feasibility. Legal problems and procedures.

COURSES IN AGRICULTURAL ENGINEERING IN IT (AgEn)

The following courses, offered by the Institute of Technology (IT), are open to students in the four-year engineering curriculum and to those who have completed the prerequisite courses. For descriptions of the courses, see the *Institute of Technology Bulletin*.

- 1031. COMPUTATIONS IN AGRICULTURAL ENGINEERING.** (2 cr)
- 1060. AGRICULTURAL ENGINEERING ORIENTATION.** (1 cr)
- 1071. INTRODUCTION TO AGRICULTURAL ENGINEERING.** (2 cr)
- 3052. PHYSIO-ENGINEERING IN AGRICULTURE.** (4 cr)
- 3060. ANALYSIS IN AGRICULTURAL ENGINEERING.** (4 cr)
- 3970. DIRECTED STUDIES IN AGRICULTURAL ENGINEERING.** (Cr ar)
- 5050. INTERN REPORTS.** (2 cr)
- 5060. PROCESSING.** (4 cr)
- 5070. AUTOMATIC CONTROL AND INSTRUMENTATION.** (4 cr)
- 5072. FINITE ELEMENT METHOD: FUNDAMENTALS AND APPLICATIONS.** (4 cr)
- 5081, 5082, 5083, 5084. DESIGN.** (4 cr)
 - 5081. Power and Machinery**
 - 5082. Soil and Water**
 - 5083. Structures and Environment**
 - 5084. Food Engineering**
- 5130. FOOD ENGINEERING.** (4 cr)
- 5140. THERMAL PROCESSES FOR FOOD.** (4 cr)

Course Descriptions

- 5191-5192. **SPECIAL PROBLEMS IN AGRICULTURAL ENGINEERING.** (2-5 cr)
5330. **AGRICULTURAL MACHINERY.** (4 cr)
5340. **AGRICULTURAL TRACTORS.** (4 cr)
5540. **EROSION CONTROL, WATERSHED ENGINEERING.** (4 cr)
5550. **DRAINAGE AND IRRIGATION ENGINEERING.** (4 cr)
5730. **AGRICULTURAL STRUCTURES DESIGN.** (4 cr)
5740. **ENVIRONMENTAL CONTROL FOR AGRICULTURAL PRODUCTION.** (4 cr)
5910. **AGRICULTURAL WASTE MANAGEMENT ENGINEERING I.** (4 cr)

FOR GRADUATE STUDENTS ONLY

(For course descriptions, see the *Graduate School Bulletin*)

8100. **SEMINAR**
8140. **AGRICULTURAL ENGINEERING SIMILITUDE**
8190, 8191, 8192. **ADVANCED PROBLEMS AND RESEARCH**
8500. **HYDROLOGIC MODELING—SMALL WATERSHEDS**
8700. **MOISTURE AND HEAT TRANSFER**

Agricultural Journalism (AgJo)

3111. **JOURNALISTIC TECHNIQUES.** (5 cr; prereq Rhet 1151 or equiv. C avg, *typing ability*)
Preparation of messages for the mass media, in part in laboratory under deadline pressure. Emphasis on news materials for newspapers with some attention to radio and television and to columns. For students who may need to prepare materials for the media; not open to agricultural journalism or journalism majors.
3122. **AGRICULTURAL AND RURAL AFFAIRS REPORTING.** (4 cr, § Jour 3121; prereq 3111 or Jour 3101 or equiv)
Reporting and editing of news and issues of agricultural and rural affairs including business, farm organizations, government, education, rural communities, courts, regulatory agencies, conservation and other groups, and legislative bodies.
3159. **PUBLICATIONS EDITING.** (4 cr, § Jour 3155; prereq freshman composition plus advanced composition, 3530 or equiv journalism course or #, Δ)
Publication process from copy selection, editing, and preparation to scheduling and supervising production of small publications and periodicals. Business, technical, educational, and general publications. Editing copy, writing headlines and outlines, marking and fitting copy, typesetting, proofreading, and keylining.
3430. **BROADCASTING IN RURAL AMERICA.** (4 cr; prereq 3530 or #)
For students majoring in agricultural journalism, agricultural education, extension education, home economics, education, and forestry. Radio and television and their role in rural life. Activities including news gathering, on-air performance, and broadcast writing. For those expecting to do broadcast work as a part of their profession in rural America rather than for those preparing to be professional broadcasters.
3530. **PUBLICITY.** (4 cr; prereq Rhet 1151 or equiv)
For students planning careers in agriculture, forestry, home economics, veterinary medicine, or some allied industry in which the cooperation of mass media will be needed. Covers mass media relationships, news and direct mail writing, radio and TV broadcasting, and preparation of visuals.
3936. **SPECIAL PROBLEMS.** (Cr ar; prereq 3530 or #)
Communication problems in areas such as specialized analysis of media, specialized writing, publication or periodical planning, preparation of special audio and/or visual production, radio and TV programming, and other mass communication areas.
5000. **PROFESSIONAL EXPERIENCE PROGRAM.** (4 cr; prereq #; S N only; free elective for AgJo undergrads; not for grad cr)
Professional communications experience in firms or government agencies obtained through practical experience; evaluative reports and consultations with faculty advisers and employers.
5100. **SEMINAR IN AGRICULTURAL COMMUNICATION.** (3 cr [max 6 cr]; prereq sr. #)
Study of selected topics through reading, discussion, lectures by resource people, and preparation and presentation of papers.

Agronomy and Plant Genetics

- 5180. AGRI-MARKETING COMMUNICATIONS.** (4 cr, §AgEc 5180; prereq basic AgJo course or Δ or #, AgEc 1020 and AgEc 1030, basic communications and speech courses; not open to agricultural economics grads)
Research and development of a complete marketing plan for an agricultural product from development through the final marketing communications stages.
- 5301. FUNCTIONAL PHOTOGRAPHY.** (4 cr; 35mm camera required)
Use of photography in science and education. Selection and use of equipment and film, close-up techniques, slide set production.
- 5500. RESEARCH IN COMMUNICATION STRATEGIES.** (4 cr; prereq #)
(Same as Rhct 5500) Introduction to basic research design and methodology in communication. Emphasis on application of various research methods to particular communication strategies or settings.
- 5534. RURAL COMMUNICATION MEDIA.** (4 cr; prereq 3530 or equiv in journalism or #)
Behavior and characteristics of mass media reaching rural and agricultural audiences; analysis of research and examples of promotional, informational, and educational programs carried through rural media; theoretical approaches relevant to problems of rural mass media.
- 5535. COMMUNICATIONS IN INTERNATIONAL AGRICULTURAL DEVELOPMENT.** (3 cr; prereq 3530 or equiv in journalism or #)
For American and foreign students. U.S. and foreign rural communications as development tools. Development of ability to plan and execute communication programs in developing nations.
- 5561. WRITING FOR PUBLICATION.** (4 cr, §Jour 3173; prereq 3111 or Jour 3101 or equiv Jour course or #, Δ)
The professional as communicator; analysis of markets; professional, trade, and general publications; information sources and topic selection; adaptation to the specialized and general reader; writing and preparing manuscripts for publication; marketing techniques.
- 5600. TRANSFER OF TECHNOLOGY.** (4 cr; prereq work experience in scientific/technical communication or #)
(Same as Rhct 5600) Methods of transferring scientific and technical knowledge and practice. Review of research in diffusion and transfer methods at different technical levels. Tools, methodologies, and assessment procedures for managing a program. Assessment and design plan required.
- 5936.* SPECIAL PROBLEMS IN AGRICULTURAL COMMUNICATIONS.** (Cr ar; prereq #)
Communications problems related to specific aspects of student's major field of study.

Agronomy and Plant Genetics (Agro)

- 1001. SEMINAR: ORIENTATION TO AGRONOMY.** (1 cr; S-N only)
Introduction to agronomy—its programs and objectives in teaching, research, and extension through informal seminars with staff and students. Visits to research and teaching facilities to acquaint students with personnel and facilities of the department.
- 1010. PRINCIPLES OF AGRONOMY.** (4 cr, §3010, §3020, §3030)
Principles and practices of plant and related sciences as they apply to increasing productivity and improvement of field crops. Emphasis on selection and improvement through breeding of crop varieties, seeds and seeding, crop growth and development, crop production hazards, and harvest and storage of field crops. Lecture and demonstration.
- 1011. PRINCIPLES OF AGRONOMY—DISCUSSION.** (1 cr; S-N only; prereq #1010)
Informal small group discussion of questions and problems identified in lectures in 1010, readings, or other sources and review of examinations and papers.
- 1020. SPECIAL PROBLEMS.** (1-3 cr; prereq 5 cr agronomy, #)
In-depth research or studies in agronomy. Intended for students who wish to pursue aspects of agronomy in greater depth than that offered in formal courses or who wish to investigate areas not presently offered in courses. Tutorial instruction under staff guidance.
- 1100. MORPHOLOGY AND IDENTIFICATION OF CROPS AND WEEDS.** (4 cr)
Developmental morphology of seeds, seedlings, and plants. Morphological features of seeds and plants as keys to help identify crops and weeds of major economic importance in the world. Lecture and laboratory.
- 1110. SEED ANALYSIS AND GRAIN GRADING.** (3 cr; prereq 1100 or #)
Principles and practice in evaluating field crop seeds for purity and quality and in grading grain. Lecture and laboratory.
- 3010. ADAPTATION, DISTRIBUTION, AND PRODUCTION OF FIELD CROPS.** (4 cr; prereq Biol 1009)
Principles of crop adaptation, distribution, and ecology in a context of current and projected world crop needs. Emphasis on the importance of adaptation to crop distribution and production and on the relationships of crops to the environmental factors of light, moisture, and temperature. Crop production practices as a means of managing environmental factors. Lecture and discussion.

Course Descriptions

- 3020. GROWTH, DEVELOPMENT, AND CULTURE OF FIELD CROPS.** (5 cr; prereq Biol 1009, Chem 1005 or equiv)
Principles of growth and development of field crops and their management to achieve maximum crop productivity. Emphasis on seeds and seeding; physiological basis of growth and development; and effects of physical and biological environmental factors on crop growth, development, and culture. Lecture and laboratory.
- 3030. MATURATION, HARVEST, AND STORAGE OF FIELD CROPS.** (4 cr; prereq Biol 1009, Chem 1005 or equiv)
Development and maturation of grains and forage crops, including the synthesis and accumulation of organic constituents and changes in these constituents as a result of the maturation process. Estimation of crop maturity and development of criteria for crop harvest, role of pre- and post-harvest treatments in preparation for storage, and losses associated with crop harvest. Principles of storage and preservation of crops in moist or dry state. Lecture and laboratory.
- 3031. MATURATION, HARVEST, AND STORAGE OF FIELD CROPS—DISCUSSION.** (1 cr; S-N only; prereq 3030)
Informal small group discussion of questions and problems identified in lectures in 3030, readings, or other sources and review of examinations and papers.
- 3060. FIELD PLOT DESIGN IN AGRONOMY.** (3 cr; prereq jr, Δ)
Principles of field plot technique and design as applied to field demonstrations and experiments involving one or two variables. Experiment interpretation procedures including analysis of data, tests of significance, and treatment comparisons. Computers will be utilized for some data processing and statistical procedures.
- 3150. ADVANCED SEED AND GRAIN EVALUATION.** (4 cr; prereq 1100 or #...1110 recommended)
Laboratory practice in identification of crops, weeds, and diseases and in grain grading and seed analysis. Members of the Intercollegiate Crops Team are selected from this class.
- 3200. SEMINAR.** (1 cr; prereq jr or sr, #)
Investigation through literature review and group discussion of selected topics in agronomy. Major emphasis on recent advances in agronomy.
- 5000. PROFESSIONAL EXPERIENCE PROGRAM.** (4 cr; prereq #; not for grad cr; S-N only)
Supervised practical professional experience in agronomic industries and farm enterprise systems, together with studies of various aspects of the industry and related fields.
- 5001. PROBLEMS IN AGRONOMY FOR ADVANCED STUDENTS.** (1-5 cr; prereq 20 cr agronomy, #)
In-depth research or studies in agronomy. Intended for advanced students who wish to pursue aspects of agronomy in greater depth than that offered in formal courses or who wish to investigate areas not presently offered in courses. Independent study and research under staff guidance.
- 5010. FORAGE PRODUCTION AND UTILIZATION.** (4 cr; prereq 1010 or #)
Interrelationships between plants and animals as they relate to the selection, production, and utilization of forage crops. Crop management practices including establishment, maintenance, and harvesting of forages as pasture, hay, or silage. Physiological basis of forage management of various species. Forage quality and utilization as related to livestock feeding with emphasis upon ruminant nutrition. Lecture and laboratory.
- 5020. INTRODUCTION TO PLANT BREEDING.** (4 cr; prereq GCB 3022 or equiv)
Application of genetic principles to improvement of crop plants. Includes self-pollinated, cross-pollinated, and asexually propagated crops.
- 5030. WEED CONTROL.** (5 cr; prereq 1010 or #... Agro 3020 and/or PIPh 3131 recommended)
Survey of the magnitude of the weed problem. Regulatory aspects of weed control and herbicide usage. Principles and methods of weed control. Lecture and discussion.
- 5040. CORN AND SOYBEAN MANAGEMENT.** (3 cr; prereq 3010, 3020, 3030, Soil 1122 or #)
Discussion and case-study approach to corn and soybean management in Minnesota, based on an integration of agronomic principles.
- 5050. HERBICIDES.** (3 cr; prereq 5030, PIPh 3131, BioC 1302)
Lectures and discussions on herbicides; their development, classification, mode of action, persistence, usage, ecological effects, and regulation.
- 5060. SMALL GRAINS, SUNFLOWER, AND SUGAR BEET MANAGEMENT.** (3 cr; prereq 3010, 3020, 3030, 5030, Soil 1122, or #)
Discussion and case study of agronomic principles for production of wheat, oats, barley, sunflowers, and sugar beets, including crop and variety selection and rotation, tillage and seedbed preparation, planting, cultural practices, pest control, harvest, and utilization.
- 5110. ADAPTATION, DISTRIBUTION, AND PRODUCTION OF FIELD CROPS.** (3 cr, §3010; prereq Biol 1009)
Principles of crop adaptation, distribution, and ecology in a context of current and projected world crop needs. Emphasis on the importance of adaptation to crop distribution and production and on the relationships of crops to the environmental factors of light, moisture, and temperature. Crop production practices as a means of managing environmental factors. Lecture and discussion.

- 5120. GROWTH, DEVELOPMENT, AND CULTURE OF FIELD CROPS.** (5 cr, §3020; prereq Biol 1009, Chem 1005 or equiv)
Principles of growth and development of field crops and their management to achieve maximum crop productivity. Emphasis on seeds and seeding; physiological basis of growth and development; and effects of physical and biological environmental factors on crop growth, development, and culture. Lecture, laboratory, and discussion.
- 5130. MATURATION, HARVEST, AND STORAGE OF FIELD CROPS.** (4 cr, §3030; prereq Biol 1009, Chem 1005 or equiv)
Development and maturation of grains and forage crops, including the synthesis and accumulation of organic constituents and changes in these constituents as a result of the maturation process. Estimation of crop maturity and development of criteria for crop harvest, role of pre- and post-harvest treatments in preparation for storage, and preservation of crops in moist or dry state. Lecture, laboratory, and discussion.
- 5200. WORLD FOOD SUPPLY PROBLEMS.** (4 cr, §AgEc 5790, §FScN 5643, §Soc 5675, §LACS 5280; prereq sr or grad student with #)
A multidisciplinary approach to the social, economic, and technical problems of feeding the world's growing population. Principles sought from the social and economic sciences and plant, animal, and food sciences for their application to world food problems.

FOR GRADUATE STUDENTS ONLY

(For course descriptions, see the *Graduate School Bulletin*)

- 8000. SUPERVISED TEACHING EXPERIENCE IN AGRONOMY**
- 8010. RESEARCH IN AGRONOMY**
- 8020. SEMINAR: AGRONOMY**
- 8050. PHYSIOLOGY OF FIELD CROPS**
- 8055. SOURCE-SINK RELATIONS**
- 8080. CURRENT TOPICS IN AGRONOMY**
- 8100. PASTURE AND FORAGE RESEARCH TECHNIQUES**
- 8200. PRINCIPLES OF PLANT BREEDING I**
- 8210. PRINCIPLES OF PLANT BREEDING II**
- 8220. APPLICATION OF QUANTITATIVE GENETICS TO PLANT BREEDING**
- 8230. CYTOGENETICS**
- 8240. PLANT GENETICS IN RELATION TO PLANT IMPROVEMENT**
- 8270. SEMINAR: PLANT BREEDING**
- 8280. CURRENT TOPICS IN PLANT BREEDING**
- 8310.* ORIENTATION TO FIELD CROP BREEDING**
- 8320. ORIENTATION TO AGRONOMY FIELD RESEARCH TECHNIQUES**
- 8330.* RESEARCH IN PLANT GENETICS**

Animal Science (AnSc)

- 1100. INTRODUCTORY ANIMAL SCIENCE.** (5 cr)
Introduction to animal science with emphasis on fundamental concepts of physiology, nutrition, animal breeding, and management as they apply to production of livestock and poultry.
- 1107. SWINE PRACTICUM.** (1 cr; S-N only)
Provides students lacking previous experience with swine an opportunity to work directly with them. Each student will be assigned a gravid female to feed and care for, along with her offspring, during a 5- to 6-week period. Students will be given an opportunity to gain additional experience in breeding and management of swine and in feed preparation.
- 1110. DAIRY CATTLE EVALUATION.** (2 cr)
Evaluation of dairy animals on the basis of anatomy, production performance, and breeding. Visits to one or more herds in the area.
- 1120. LIVESTOCK AND MEAT EVALUATION.** (4 cr)
Evaluation, grading, and pricing of live meat animals, followed by evaluation of the conformation, quality, and finish of carcasses and cuts. Principles of judging and grading of meat.

Course Descriptions

- 1500. MEAT SCIENCE.** (4 cr; prereq Biol 1009)
(Same as FScN 1500) Role of ante- and post-mortem factors in altering the anatomy, function, and biochemical properties of muscle during its conversion to meat; importance of these changes to meat quality, and the manufacture, selection, preparation, and palatability characteristics of meat and meat products.
- 1520. MILK PRODUCTION.** (3 cr; prereq 1100 or #)
Relationships of production and management concepts to dairy farm planning and production and marketing of high-quality milk.
- 1600. HORSE PRODUCTION.** (4 cr, \$5501)
Breeds, selection, diseases, feeding, reproduction, management, and color inheritance of light horses. Demonstrations of equitation, tack, and farriery.
- 1601. HORSE EQUITATION AND MANAGEMENT.** (1 cr)
Equitation, dressage, tack, grooming, and schooling in Western and English styles of riding. Management, nutrition, and record keeping concerning riding horses.
- 1603. BEEF PRACTICUM.** (2 cr; S-N only; prereq soph, #)
For students lacking previous experience with beef cattle. Students will be assigned pregnant females for care and feeding for an 8-week period, including care of the newborn calf. Experience in breeding and management of cattle and in diet preparation.
- 3111. VERTEBRATE BEHAVIOR.** (4 cr; prereq Biol 1009, 3011 or #)
Introduction to the nature and variety, development, motivation, and evolution of animal behavior, emphasizing social interactions and communication.
- 3113. ANIMAL WELFARE.** (4 cr; prereq soph) Phillips
Socioeconomics of the use of other animals by humans. Assessment of animal suffering and welfare. Historical roots of attitudes toward other animals. Management practices and welfare of domestic and wild animals.
- 3130. BEGINNING LIVESTOCK JUDGING.** (2 cr; prereq soph or # ... 1120 recommended)
Visual evaluation of beef cattle, swine, sheep, and quarter horses for type, muscling, degree of finish, structure, and soundness. Short oral presentations. For students with limited livestock judging experience; preparation for collegiate livestock judging team competition.
- 3131. LIVE ANIMAL PERFORMANCE AND SELECTION.** (3 cr)
Meat animal performance and selection through the use of live animal, carcass, and record evaluation. Each class includes a one-hour lecture and a two-hour laboratory. Recommended for students planning vocations in meat animal production, extension, vocational agriculture, and agribusiness.
- 3141. ADVANCED DAIRY JUDGING.** (1 cr; prereq 1110)
Evaluation and selection of dairy cattle. Visits to local dairy herds. Training in presentation of oral and written reasons. Students selected from this course participate in intercollegiate judging contests.
- 3142. ADVANCED LIVESTOCK JUDGING.** (1 cr; prereq 1120, 3130)
Visual evaluation of beef cattle, swine, sheep, and quarter horses for type, muscling, finish, structure, and soundness. Use of production (growth and reproduction) records in evaluation. Oral presentations. For students with previous livestock judging experience; preparation for national collegiate livestock judging team competition.
- 3143. MEATS JUDGING AND GRADING.** (2 cr; prereq 1120 or 11120)
In-depth training in beef, pork, and lamb judging, writing reasons, and carcass grading. Field trips to packing plants. Students selected from this course participate in Intercollegiate Meats Judging Contests.
- 3220. PRINCIPLES OF ANIMAL BREEDING.** (5 cr; GCIS 3022 recommended)
Application of qualitative genetic principles to animal breeding. Introduction to quantitative genetics. Concepts of livestock improvements through breeding and selection systems.
- 3301. SYSTEMIC PHYSIOLOGY.** (6 cr; prereq Biol 1009, BioC 1301)
Introduction to animal physiology, emphasizing the function of the organ systems.
- 3305. REPRODUCTIVE PHYSIOLOGY, ARTIFICIAL INSEMINATION, AND LACTATION.** (5 cr; prereq 3301)
Functions of the reproductive organs, fertilization, the estrous cycle and its endocrine control, reproductive efficiency, and problems and principles of artificial insemination. Anatomy, physiology, and biochemistry of the mammary gland. Mammary growth, initiation and maintenance of lactation, milk synthesis, and factors influencing the lactation curve.
- 3401. PRINCIPLES OF ANIMAL NUTRITION.** (3 cr, \$1401; prereq Chem 1002 or BioC 1301 or Chem 3301)
Classification and function of nutrients; use of nutrients for body maintenance, growth, egg production, gestation, and lactation; comparative study of the digestive systems of farm animal species.
- 3402. APPLIED ANIMAL NUTRITION.** (2 cr, \$1401; prereq 3401)
Sources of nutrients (feedstuffs) for livestock and poultry, nutrient requirements, feeding standards and their uses, formulation using computer technology, practical considerations in livestock feeding.

- 5000. PROFESSIONAL EXPERIENCE PROGRAM.** (4 cr; prereq #: S-N only; free elective for animal science undergrads; not for grad cr)
Professional experience in animal science firms or government agencies through supervised practical experience; evaluative reports and consultations with faculty advisers and employers.
- 5104. AGRICULTURAL SYSTEMS ANALYSIS AND MODELING.** (4 cr. §PIPa 5104, §AgEc 5104, §Soc 5104; prereq Math 1142 or #) Cornelius
Introduction to bioeconomic modeling as preparation for interdisciplinary agricultural systems analysis. Basic concepts; deterministic and stochastic models; delays, feedback, and clockwork; data acquisition; model verification and validation; role of models in agroecosystem management.
- 5221. ANIMAL BREEDING FOR VOCATIONAL AGRICULTURE TEACHERS.** (3 cr; offered summer 1987)
Application of qualitative genetic principles to animal breeding. Introduction to quantitative genetics. Concepts of livestock improvement through breeding and selection systems.
- 5231. DAIRY CATTLE BREEDING.** (4 cr; prereq 3220 or #)
Application of quantitative genetic principles to the breeding of dairy cattle. Primary emphasis on evaluation of males, females, and systems of breeding. Rates of genetic improvement with and without artificial insemination.
- 5232. APPLIED MEAT ANIMAL BREEDING.** (3 cr; prereq 3220 or #)
Application of genetic principles to animal breeding; systems and methods of breeding related to beef cattle, sheep, swine, and poultry; improvement programs, industry-related problems. Genetics of horses also considered.
- 5240. ANIMAL CYTOGENETICS.** (4 cr; prereq GCB 3022 or #)
Application of cytogenetics to problems in animal biology. Emphasis on relationship of cytogenetic principles and practices to other fields such as animal breeding, pathology, cellular biology, and systematics.
- 5315. REPRODUCTIVE PHYSIOLOGY AND LACTATION.** (3 cr; offered summer 1984)
Functions of the reproductive organs, fertilization, the estrous cycle and its endocrine control, reproductive efficiency, and problems and principles of artificial insemination. Anatomy, physiology, and biochemistry of the mammary gland. Mammary growth, initiation and maintenance of lactation, milk synthesis, and factors influencing the lactation curve.
- 5322. PHYSIOLOGY OF REPRODUCTION.** (5 cr; prereq 6 cr systemic physiology)
Principles of reproductive physiology with emphasis on endocrinological aspects.
- 5325. PHYSIOLOGY OF FERTILIZATION AND GESTATION.** (4 cr; prereq 5322 or #; offered winter 1985 and all yrs)
Physiological events occurring during gametogenesis, capacitation, fertilization, the period of embryo, the period of fetus, and parturition.
- 5326. IMMUNOREPRODUCTION.** (4 cr; prereq 5322 or #; offered spring 1985 and all yrs)
Blood groups and polymorphic proteins affecting reproduction, immunoglobulin formation, antigens of semen, ova and genital secretions, immunopathology, maternal-fetal incompatibility, and antibodies to hormones.
- 5327. GENERAL ENDOCRINE PHYSIOLOGY.** (3 cr; prereq 3301 or #)
Biological effects, biochemistry, methods of assay, and regulatory aspects of hormones.
- 5328. GENERAL ENDOCRINE PHYSIOLOGY LABORATORY.** (2 cr; prereq 5327 or #)
Demonstration of concepts in endocrinology using experimental approaches.
- 5330. CURRENT TOPICS IN ENDOCRINOLOGY.** (1 cr; prereq 3301, Biol 5001 or BioC 5001)
Current developments in endocrinology including introductory and review material, methodology, applicability of results to basic and applied research, and impact on existing endocrine principles.
- 5331. FERTILITY AND INCUBATION OF AVIAN EGGS.** (3 cr; prereq 10 cr biology or #; offered winter 1984 and all yrs)
Principles of physiology and management underlying the production of hatching eggs from a variety of avian species, including incubation of eggs and hatchery management.
- 5401. SWINE NUTRITION AND FEEDING.** (4 cr; prereq 1401 or 3401)
Nutrient requirements of swine, all phases of life cycle considered; feed sources, their composition and utilization in formulation of adequate diets. Least cost formulations, nutritional interrelationships, and feeding systems. Use of feed additives.
- 5403. RUMINANT NUTRITION.** (4 cr, §5413; prereq 1401 or 3401)
Nutrient requirements of ruminants (beef and dairy cattle, sheep); nutrient content of feedstuffs, primarily forages; protein and nonprotein nitrogen utilization; energy utilization; nutritional disorders; and formulation of adequate rations.
- 5404. APPLIED ANIMAL NUTRITION.** (3 cr)
Principles and techniques of ration formulation and evaluation for dairy, beef, swine, and equine rations.
- 5405. POULTRY NUTRITION.** (3 cr; prereq 1401 or 3401; offered summer 1985)
Nutrient requirements of chickens and turkeys; feed composition and utilization in formulation of adequate diets. Role of feed additives. Least cost formulations, nutritional interrelationships, and feeding systems.

Course Descriptions

- 5407. LABORATORY ANALYSIS OF FEEDSTUFFS.** (2 cr; prereq sr or #)
The chemistry and theory of feedstuff analyses and interpretation of results. AOAC methods used. Students analyze samples of feedstuffs for dry matter, protein, ether extract, ash, crude fiber, neutral detergent fiber, acid detergent fiber, and lignin. Practical application of feed analyses stressed.
- 5413. RUMINANT NUTRITION.** (3 cr, §5403; prereq 1401; offered summer 1986)
Nutrient requirements of ruminants (beef and dairy cattle, sheep); nutrient content of feedstuffs, primarily forages; protein and nonprotein nitrogen utilization; energy utilization; nutritional disorders; and formulation of adequate rations. Nutrition of horses considered also.
- 5440. INTERMEDIATE ANIMAL NUTRITION.** (4 cr; prereq 1401, BioC 1302...BioC 5001 or Biol 5001 recommended)
Integration of basic information concerning the nature of nutrients and their metabolism, quantitative aspects of nutrition, and influence of growth, pregnancy, and lactation on nutrient needs.
- 5500. MEAT SCIENCE.** (3 cr)
Role of ante- and post-mortem factors in altering the anatomy, function, and biochemical properties of muscle during its conversion to meat; importance of these changes to meat quality and the manufacture, selection, preparation, and palatability characteristics of meat and meat products.
- 5501. HORSE PRODUCTION.** (3 cr, §1600; offered summer 1985)
Breeds, selection, diseases, feeding, reproduction, management, and color inheritance of light horses. Demonstrations of equitation, tack, and farriery.
- 5512. MEAT AND PROTEIN TECHNOLOGY.** (4 cr; prereq BioC 1302 or #)
(Same as FScN 5512) Meat proteins: effects of pH, salt, and temperature on hydration and emulsification; methods of fractionation. Meat preservation: effects of heat, freezing, curing, and problems of product stability during storage. Sausage manufacture: chemistry, technology, least cost analysis (graphical and computer methods), and chemical methods of quality control (rapid and classical methods of proximate analysis).
- 5601. SWINE PRODUCTION.** (4 cr; prereq 1401 or 3401...3220 recommended)
Application of principles of animal breeding, nutrition, physiology, and economics. Swine production systems including swine feeding, breeding programs, selection of breeding animals, management of all classes of swine, housing, diseases, parasites.
- 5602. SHEEP PRODUCTION.** (4 cr; prereq 1401 or 3401...3220, 5403 recommended)
Status and characteristics of the sheep industry; application of principles of animal breeding, nutrition, physiology, and economics to management of sheep breeding flocks. Ration formulation, management, and marketing of feedlot lambs.
- 5603. BEEF CATTLE PRODUCTION.** (4 cr, §5613; prereq 1401 or 3401...3220, 5403 recommended)
Status and characteristics of the beef cattle industry; application of principles of animal breeding, nutrition, physiology, and economics to management of beef cattle breeding herds. Ration formulation, management, and marketing of feedlot cattle.
- 5604. DAIRY FARM MANAGEMENT.** (4 cr, §5614; prereq 1520, 5403 or #...3220 recommended)
Application of principles of animal breeding, nutrition, physiology, and economics to planning and management of the dairy farm: genetic influences, housing requirements, health programs for large herds, feed budgets, and record analysis emphasized.
- 5605. POULTRY PRODUCTION.** (4 cr, §5615; prereq 1401 or 3401...5405 recommended)
The physiology, genetics, diseases, and nutrition of poultry and their relation to current management practices for production of eggs, broilers, and turkeys. Technical and practical phases of production and marketing in relation to their underlying principles. Visits to commercial production units.
- 5609. PRINCIPLES OF FARM ANIMAL ENVIRONMENT.** (3 cr; prereq jr, 3301, or #) El Halawani
Biological processes involved in the adjustment of animals to ambient environments, applications to farm animal management.
- 5611. SWINE PRODUCTION.** (3 cr, §5601; prereq 1401...3220 recommended; offered summer 1987)
Status and characteristics of the swine industry; application of the principles of animal breeding, nutrition, physiology, and economics to swine production; development of a successful swine enterprise.
- 5613. BEEF CATTLE PRODUCTION.** (3 cr, §5603; prereq 1401...3220, 5403 recommended; offered summer 1987)
Status and characteristics of the beef cattle industry; application of the principles of animal breeding, nutrition, physiology, and economics to management of beef cattle breeding herds. Ration formulation, management, and marketing of feedlot cattle.
- 5614. DAIRY FARM MANAGEMENT.** (3 cr, §5604; prereq 5403 or #...3220 recommended; offered summer 1986)
Application of the principles of animal breeding, nutrition, physiology, and economics to the planning and management of the dairy farm: genetic influences, housing requirements, health programs for large herds, feed budgets, and record analysis emphasized.
- 5615. POULTRY PRODUCTION.** (3 cr, §5605; prereq 1401...5405 recommended; offered summer 1984)
The physiology, genetics, diseases, and nutrition of poultry and their relation to current management practices for production of eggs, broilers, and turkeys. Technical and practical phases of production and marketing in relation to their underlying principles. Visits to commercial production units.

- 5703. LITERATURE AND SEMINAR.** (2 or 3 cr [3rd cr for 2nd seminar report]; prereq jr)
Introduction to library resources concerned with animal science. Techniques of searching, abstracting, and constructing reviews for written and oral reports from library materials. Evaluation of seminar reports.
- 5710. SPECIAL PROBLEMS.** (Cr ar; prereq #)
Research in an area of animal science under supervision of a staff member. Written report on the research required.
- 5715. TUTORIAL.** (Cr ar; prereq #)
Informally structured course to encourage study in depth of a specific discipline in animal science. Pertinent readings, centered on fundamental propositions, suggested; preparation of written essays of high quality required. Tutorials available in cryobiology, cytogenetics, genetics, meats, nutrition, and physiology.

FOR GRADUATE STUDENTS ONLY

(For course descriptions, see the *Graduate School Bulletin*)

- 8081. NEUROETHOLOGY**
- 8091. HORMONES AND BEHAVIOR**
- 8220.* ADVANCED ANIMAL BREEDING**
- 8221.* QUANTITATIVE INHERITANCE**
- 8332. PRESERVATION OF SPERMATOOZOA AND EMBRYO**
- 8420.* ENERGY IN ANIMAL NUTRITION**
- 8421.* PROTEIN AND AMINO ACID NUTRITION**
- 8423.* MINERAL NUTRITION**
- 8440.* RUMINANT NUTRITION**
- 8441. RESEARCH TECHNIQUES IN RUMINANT NUTRITION**
- 8603. GRADUATE SEMINAR**
- 8740. CONCEPTS AND DEVELOPMENTS IN RUMINANT NUTRITION**
- 8741. CONCEPTS AND DEVELOPMENTS IN AVIAN NUTRITION**
- 8742. CONCEPTS AND DEVELOPMENTS IN SWINE NUTRITION**
- 8750x. CONCEPTS AND DEVELOPMENTS IN MEAT SCIENCE AND TECHNOLOGY**
- 8810x.* RESEARCH IN ANIMAL SCIENCE**
- 8820x.* RESEARCH IN ANIMAL GENETICS**
- 8830x. RESEARCH IN ANIMAL PHYSIOLOGY**
- 8840x.* RESEARCH IN ANIMAL NUTRITION**
- 8850x.* RESEARCH IN MUSCLE CHEMISTRY AND PHYSIOLOGY**

Entomology (Ent)

- 1005. ECONOMIC ENTOMOLOGY.** (4 cr; prereq Biol 1009 or #)
Brief introduction to structure and classification of insects; management of insect populations; life histories, habits, and recognition of insect pests of livestock, orchards, field crops, vegetables, and ornamentals.
- 3020. PRINCIPLES OF BEEKEEPING.** (4 cr; prereq Biol 1009 or #)
Lecture and laboratory demonstrations. History of beekeeping; life history and behavior of honey bees; colony and apiary management; pollination and hive products; honey bee diseases and their control.
- 3100. ENTOMOLOGICAL TECHNIQUES.** (Cr ar; prereq 3175 or equiv or #)
Practical laboratory instruction in dealing with entomological materials.
- 3175. INTRODUCTORY ENTOMOLOGY.** (5 cr; prereq Biol 1009 or equiv)
General morphology, life histories, habits, and classification of insects.
- 5000. PROFESSIONAL EXPERIENCE PROGRAM.** (4 cr; prereq #; S-N only; free elective for entomology undergrads; not for grad cr)
Professional experience in entomology firms or government agencies through supervised practical experience; evaluative reports and consultations with faculty advisers and employers.

Course Descriptions

- 5001. BASIC ENTOMOLOGY.** (Cr ar; prereq #)
Opportunity to make up certain deficiencies in biological background.
- 5020. FIELD ENTOMOLOGY.** (5 cr; prereq introductory biology; offered SSI at Itasca)
Insect fauna in various natural habitats of the park and surrounding areas. Includes field trips and collection and identification of insects, as well as studies of general morphology, life histories, and habitats of local species.
- 5022. HOUSE AND GARDEN INSECTS.** (3 cr; 3 lect and 6 lab hrs per week)
Identification and life history of commonly encountered Minnesota insects. Lectures by selected faculty and short field trips.
- 5025. INSECT MORPHOLOGY.** (5 cr; prereq 3175 or #)
Comparative studies of external and internal anatomy and histology of insects; phylogeny and function.
- 5027.* INSECT PHYSIOLOGY.** (5 cr; prereq #...BioC 5001 and 5002 or MdBc 5100 recommended)
Essential processes of insects. Includes nerve and muscle mechanisms, energy metabolism, respiration, nutrition and digestion, excretion, regulation and interactions of processes, sensory mechanisms, and behavior. Reproductive behavior, embryology, and postembryonic development of insects.
- 5050.* FOREST ENTOMOLOGY.** (4 cr; prereq any two courses among the forestry, zoological, botanical, biological, and/or agricultural sciences)
Lectures and laboratory concerning ecology and population management of forest insects, with heavy emphasis on tree factors and biological control.
- 5130. AQUATIC ENTOMOLOGY.** (5 cr; prereq 3175 or 5020 or equiv or #; offered at Itasca)
Identification and biology of aquatic and littoral insects in all stages.
- 5133. INSECT TAXONOMY.** (5 cr; prereq 3175 or equiv)
Identification of adults and immatures of taxa within insect orders.
- 5150. LEPIDOPTEROLOGY.** (1 cr, 2 cr with term paper; prereq course in entomology or #...one course each in ecology and genetics recommended)
Overview of Lepidoptera, with emphasis on processes and phenomena such as polymorphism, mimicry, and individual quality that are well demonstrated by this insect order.
- 5200. APICULTURE.** (4 cr; prereq 9 cr entomology or biology)
Characteristics and social behavior of honey bees; colony development and management; diseases and their control; hive products; pollination. Lectures and laboratory demonstrations.
- 5210. INTEGRATED PEST MANAGEMENT.** (5 cr; prereq 1005 or #, 15211, 15212)
Management of insect, mite, and weed populations through integration of various methods and techniques (including biotic agents, host plant resistance, artificial measures, and cultural practices) as harmonious systems that, in the context of the associated environment and population dynamics, maintain subeconomic pest densities.
- 5212. ENTOMOPHAGOUS INSECTS.** (2 cr; prereq 1005 or 3175 or 5050; offered 1983-84 only)
Identification and recognition of entomophagous insects concerned with natural and managed control of insect populations.
- 5213. BIOLOGICAL CONTROL OF INSECTS.** (2 cr; prereq 5210, introductory entomology and course in ecology)
Principles of biological control: history, ecological basis, classical biological control, augmentation, analysis of selected projects.
- 5215.* INSECTS IN RELATION TO PLANT DISEASES.** (4 cr; prereq 5 cr entomology and 5 cr plant pathology or equiv or #)
(Same as PIPa 5215) Insect transmission and dissemination of plant pathogens; development of plant-insect relationships, habits of principal insect vectors, with emphasis on practical methods of control.
- 5250.* PRINCIPLES OF ECONOMIC ENTOMOLOGY.** (4 cr; prereq 15 cr biological sciences and entomology incl 1005 or #; offered 1984-85 and alt yrs)
Methods and principles of insect control. Individual projects.
- 5252. STORED PRODUCT PEST MANAGEMENT.** (4 cr; prereq 1005 or 3175 or #)
Principles of management to protect stored food and fiber: pest identification, damage assessment, and prevention and control procedures based on interrelationships within storage ecosystems.
- 5254. INSECT SAMPLING METHODS.** (3 cr; prereq Stat 5021 and 5022 or equiv or #)
Sampling methods for insect populations, with particular emphases in agroecosystems.
- 5275. MEDICAL ENTOMOLOGY.** (4 cr; prereq 3175 or #)
Principal arthropods noxious to human beings and animals. Emphasis on those that serve as vectors of pathogenic organisms of human beings and animals.
- 5280. LIVESTOCK ENTOMOLOGY.** (3 cr; prereq 3175 or #...AnSc 1100 or equiv and Ent 5275 helpful but not required)
Biology and management of arthropods that are directly and indirectly significant to livestock health and animal production systems, with emphasis on regional and national problems.

- 5300. CHEMICAL AND INSECT BEHAVIOR.** (2 cr; prereq 3175 or EBB 5112 and 12 cr organic chemistry)
Survey of the nature and behavioral role of chemicals affecting insect behavior, with emphasis on mating and host location. Research techniques also discussed.
- 5350. INSECT PATHOLOGY.** (5 cr; prereq 5027)
Survey of the major pathogenic microorganisms that cause diseases in insects; routes of infection of insects; laboratory propagation of disease agents; factors involved in application of disease to control of pest insects with safety considerations.
- 5400.* EXPERIMENTAL ECOLOGY.** (3 cr; prereq 9 cr biology or equiv. 3 cr animal or plant ecology or #)
Experimental approach to study of environmental factors affecting animal populations.
- 5425. SPECIAL LECTURES IN ENTOMOLOGY.** (Cr ar; offered when feasible)
Lectures and/or laboratories in special fields of entomological research given by a visiting scholar or regular staff member.
- 5500. PROBLEMS IN MICROTECHNIQUE.** (Cr ar; prereq #)
Guidance for independent study of material of student's choice with particular reference to insects.
- 5890. RESEARCH PROBLEMS AT ITASCA IN ENTOMOLOGY.** (Cr ar; prereq #)
Undergraduate students may develop a short-term research project during one or both summer terms.
- 5901. SPECIAL PROBLEMS IN ENTOMOLOGY.** (Cr ar; prereq #)
Individual field, laboratory, or library studies in various aspects of entomology.

FOR GRADUATE STUDENTS ONLY

(For course descriptions, see the *Graduate School Bulletin*)

- 8026. TOPICS IN INSECT DEVELOPMENT**
- 8027. ADVANCED INSECT PHYSIOLOGY**
- 8200x. SEMINAR**
- 8210. CURRENT TOPICS IN FOREST ENTOMOLOGY**
- 8250. TOPICS IN APICULTURE**
- 8300.* EXPERIMENTAL ECOLOGY LABORATORY**
- 8305.* INSECT ECOLOGY**
- 8323.* TOPICS IN INSECT PHYSIOLOGY**
- 8400. INSECTICIDES AND THEIR ACTION**
- 8405. INSECTICIDES LABORATORY**
- 8500.* RESEARCH IN ENTOMOLOGY**

Fisheries and Wildlife (FW)

NOTE: These courses were transferred to the College of Forestry as of July 1, 1983.

- 1001. ORIENTATION IN FISHERIES AND WILDLIFE.** (2 cr; S-N only)
Survey of technical requirements and training of fishery and wildlife technicians and scientists; introduction to fields of work, problems, and career outlets.
- 3052. INTRODUCTION TO FISHERIES AND WILDLIFE BIOLOGY AND MANAGEMENT.** (4 cr; prereq Biol 3041; 3 lect, 1 demonstration-discussion session per wk)
Introduction to fishery and wildlife population ecology; environmental relationships of fish and wildlife populations and habitats; management and research methods; fishery and wildlife agency administration.
- 3167. TECHNIQUES OF FOREST WILDLIFE MANAGEMENT.** (1 cr; offered at Cloquet)
Biology and management of important forest wildlife species; methods of evaluating forest wildlife populations and habitats.
- 5000. PROFESSIONAL EXPERIENCE PROGRAM.** (4 cr; prereq #: S-N only; free elective for fisheries and wildlife undergrads; not for grad cr)
Professional experience in fish and wildlife firms or government agencies through supervised practical experience; evaluative reports and consultations with faculty advisers and employers.
- 5103. BASIC FISHERY BIOLOGY.** (Cr ar; prereq #)
Academic opportunity to enhance biological background in fisheries biology.

Course Descriptions

- 5106. BASIC WILDLIFE BIOLOGY.** (Cr ar; prereq #)
Academic opportunity to enhance biological background in wildlife biology.
- 5129. MAMMALOLOGY.** (5 cr; §EBB 5129; prereq Biol 1106 or 3011 or #)
Recent families and orders of mammals of the world and genera and species of mammals of North America, with emphasis on morphology, evolution, and zoogeographic history.
- 5278. SPECIAL LECTURES IN WILDLIFE.** (Cr ar; offered when feasible)
Lectures and/or laboratories in special fields of wildlife biology given by a visiting scholar or regular staff member.
- 5279. SPECIAL LECTURES IN FISHERIES.** (Cr ar; offered when feasible)
Lectures and/or laboratories in special fields of fisheries biology given by a visiting scholar or regular staff member.
- 5281. SENIOR SEMINAR: WILDLIFE.** (1 cr)
Discussion and presentation of papers in wildlife and related subjects.
- 5393. SPECIAL PROBLEMS IN FISHERY BIOLOGY.** (Cr ar; prereq #)
Individual field, library, and laboratory research in various lines of fishery biology.
- 5398. SPECIAL PROBLEMS IN WILDLIFE BIOLOGY.** (Cr ar; prereq #)
Individual field, library, and laboratory research in various areas of wildlife biology.
- 5451. ECOLOGY OF FISH POPULATIONS.** (5 cr; prereq Biol 3041 or equiv, EBB/Geo 5601, EBB 5136, Stat 5022 or equiv or #)
Conceptual models of exploited fish populations; description of population characteristics; computer-assisted estimation of population parameters; influence of exploitation on population structure; yield models; relationships between parental stock, recruitment and yield; influence of abiotic factors on year-class formation.
- 5452. FISHERY MANAGEMENT IN INLAND WATERS.** (5 cr; prereq 5454 or #)
Fundamental concepts and applications of fisheries management; pond and reservoir fisheries; lake and stream investigations, rehabilitation; lake fisheries management; warm-water and trout stream management. Field demonstrations on fish population surveys.
- 5454. FISHERY ECOLOGY OF POLLUTED WATERS.** (5 cr; prereq 5451 or #)
Effects on fish of water quality factors including natural stresses and pollutants. Responses of fish at all levels of biological organization: individuals, populations, communities. Techniques of bioassay, determination of water quality criteria, field investigations, data analysis.
- 5455. AQUACULTURE.** (4 cr; prereq Biol 1009, 1103, 1106 or equiv, Chem 1001-2 or 1004-5 or equiv or #)
Role of aquaculture in resource management and world food production; principles of husbandry of aquatic organisms; interactions between fish metabolism and water quality; nutrition and energetics; pathology; genetics and selective breeding.
- 5456. FIELD ECOLOGY OF FISHES.** (5 cr; prereq introductory course in ecology; offered at Itasca)
Ecological studies, observation, and identification of fishes in their natural habitat including life histories, reproduction, behavior, food habits, interrelationships with other fishes, and general habitat requirements. Collection methods in streams and lakes.
- 5561. WILDLIFE ECOLOGY, MANAGEMENT I: PLANNING POLICY AND ADMINISTRATION.** (4 cr; prereq 3052, sr fisheries or wildlife major or #)
Basic management concepts as related to wildlife resources. Establishment of goals, policies, and procedures. Strategic and operational planning. Development and evaluation of programs to achieve management goals. Application of simulation modeling and management science techniques in wildlife management.
- 5562. WILDLIFE ECOLOGY, MANAGEMENT II: POPULATIONS.** (4 cr; prereq 5561 or #)
Characteristics of wildlife populations relevant to management, including natality, recruitment, and mortality rates, density and behavior.
- 5563. WILDLIFE ECOLOGY, MANAGEMENT III: HABITATS.** (3 cr; prereq sr standing or #)
Habitat relationships of bird and mammal populations and the ecological basis for habitat management. Lectures, readings, library projects, and local field trips.
- 5564. WILDLIFE ECOLOGY, MANAGEMENT IV: FIELD PROBLEMS IN WILDLIFE RESOURCE MANAGEMENT.** (4 cr; prereq sr wildlife major or #)
Problem-solving exercises in the management of wildlife resources. Emphasis on development of management goals; collection, synthesis, and evaluation of data; and development of management recommendations and/or plans. Lectures, readings, laboratory sessions, and local field trips; independent fieldwork usually required.
- 5890. RESEARCH PROBLEMS AT ITASCA IN FISHERIES AND WILDLIFE.** (Cr ar; prereq #)
Undergraduate students may develop a short-term research project during one or both summer terms.

FOR GRADUATE STUDENTS ONLY

(For course descriptions, see the *Graduate School Bulletin*)

8200x. SEMINAR

8364.* RESEARCH IN FISHERY BIOLOGY

- 8377.* RESEARCH IN WILDLIFE BIOLOGY
- 8448.* FISHERY SCIENCE
- 8451.* PRODUCTION BIOLOGY OF FISHERY ENVIRONMENTS
- 8455. FISHERY ECOLOGY OF POLLUTED WATERS LABORATORY
- 8574.* WILDLIFE MANAGEMENT: UPLAND GAME
- 8575.* WILDLIFE MANAGEMENT: WATERFOWL
- 8576.* WILDLIFE MANAGEMENT: LARGE MAMMALS
- 8577. PERSPECTIVES IN WILDLIFE ECOLOGY
- 8578. WILDLIFE RESOURCE PLANNING AND DECISION MAKING

Food Science and Nutrition (FScN)

- 1010. **MAN'S FOOD.** (4 cr, §1012)
Human nutritional needs; food composition, world food supply, consumption patterns, acceptance, quality programs and regulations, food preservation, commercial processes, packaging, marketing, and national and international food programs.
- 1012. **NUTRITION AND OUR FOOD SUPPLY.** (4 cr, §1010)
Human nutritional requirements, basis of a balanced diet, diet and physical fitness in heart disease, obesity, cancer; food and diet fads; effect of processing and storage; additives, food safety, and FDA; future world food production problems and solutions. Individual one-week dietary survey required.
- 1020. **INTRODUCTORY MICROBIOLOGY.** (4 cr; especially for students in home economics; prereq 3rd-qr fr or #)
Fundamental principles of microbiology. Characteristics of bacteria, yeasts, molds, and other microorganisms, their importance in preparation and preservation of foods, relation to health and well-being of the individual and the family.
- 1030. **UNDERSTANDING CHEESE.** (2 cr; intended for nonmajors)
Conversion of milk into cheese; cheese curing; optimum characteristics of many varieties of natural cheeses; fondue, process, and club cheeses; nutritional value and care of cheese in the home.
- 1102. **TECHNOLOGY OF FOOD PROCESSING.** (4 cr; prereq high school chemistry and biology)
Introduction to the technology of processing foods with special reference to the prevention of biological, microbiological, physical, and chemical deterioration. Changes in food composition, microbiological safety, food laws and regulations, technologies of the major food processes such as canning, freezing, and drying.
- 1212. **SCIENTIFIC PRINCIPLES OF FOOD PREPARATION.** (5 cr; prereq Chem 1002 or 1005)
Introduction to composition and chemical and physical properties of foods; interaction and reaction of foods in preparation procedures; evaluation of food products prepared in the laboratory using quality standards.
- 1215. **HOME PRESERVATION OF FOODS.** (2 cr; intended for nonmajors)
Description and demonstration of safe methods of home food preservation. Students prepare various products in the laboratory. Methods covered include canning, freezing, fermenting, and drying.
- 1500. **MEAT SCIENCE.** (4 cr; prereq Biol 1009)
(Same as AnSc 1500) Role of ante- and post-mortem factors in altering the anatomy, function, and biochemical properties of muscle during its conversion to meat; importance of these changes to meat quality; and the manufacture, selection, preparation, and palatability characteristics of meat and meat products.
- 1600. **SOCIOCULTURAL ASPECTS OF NUTRITION.** (3 cr)
Food habits of human beings in terms of historical, social, and cultural perspectives. Influence of different food patterns on nutritional status.
- 1603. **FAMILY NUTRITION.** (2 cr; intended for nonmajors)
Basic concepts in nutrition, emphasizing interrelationships between nutrients and the human requirement for specific nutrients. Current controversial topics in nutrition.
- 3110. **FOOD CHEMISTRY.** (4 cr; prereq BioC 1302 or Biol 5001)
Structures, properties, reactions, and functions of basic chemical components of foods. Chemical properties of food systems, influence of processing, storage, and preparation.
- 3112. **FOOD CHEMISTRY LABORATORY.** (2 cr; prereq 3110 or §3110)
Laboratory experiments to investigate chemical properties and reactions of selected food systems and food components.

Course Descriptions

- 3123. MICROBIOLOGY OF FOODS.** (5 cr, \$MicB 3103, \$VPB 3103; prereq Biol 1009 and 10 cr college chemistry, or 1020 or #: not for majors in food science and technology)
Incidence and sources of microorganisms in foods. Principles involved in control of microorganisms in foods for prevention of spoilage and public health hazards. Enhancement of keeping quality, nutritive value, and flavor attributes of food by the activities of microorganisms, as found in the manufacture of cheese or other fermented food products. Principles in sanitation and in destruction or inhibition of growth of microorganisms through use of physical and chemical agents.
- 3272. INTRODUCTION TO FOOD DECISION MAKING.** (2 cr; prereq 3600)
Factors considered in planning nutritionally adequate and aesthetically pleasing menus for various eating patterns and cost levels. Use of computer to calculate menu nutrient content and to plan menus.
- 3400. FOOD DEMONSTRATION TECHNIQUES.** (3 cr; prereq 1213 or 3403)
Purposes and techniques of food demonstrations for the general public and in business. Production techniques and performance for TV and motion picture demonstrations.
- 3403. EXPERIMENTAL FOODS.** (4 cr; prereq 3110)
Principles and modern concepts of food systems and preparation; laboratory projects to illustrate effects of different procedures and ingredients.
- 3472. PRINCIPLES OF FOOD PURCHASING.** (4 cr; prereq 5 cr in food science and nutrition)
Principles of purchasing the basic groups of foods. Relative cost of key nutrients from different foods within a food group. Food prices and indices of change. Laws and regulations pertinent to the labeling of food. Food standards and grades. Relation of these factors to the purchasing of food.
- 3600. PRINCIPLES OF NUTRITION.** (4 cr; prereq Biol 1009 and Chem 1004 or equiv)
Fundamental principles of nutrition, including the essentiality and metabolism of nutrients and results of nutritional deficiencies or excesses, presented in the context of personal, national, and global aspects of human nutrition.
- 3602. NUTRITION IN PROFESSIONAL HEALTH CARE.** (4 cr, \$3600; prereq chemistry, human physiology, pharmacology, pathophysiology, regis in a professional health discipline)
General principles of nutrition in professional health care. Nutrition as factor in attaining and maintaining health. Role of health practitioner in nutrition education.
- 3622. NUTRITION IN THE LIFE CYCLE.** (4 cr; prereq 3272, 3472, 3600, physiology or human biology or #)
Application of the principles of nutrition to meet the special requirements of growth, development, adult maintenance, and aging. Sociocultural factors affecting food practices.
- 3623. NUTRITION IN THE LIFE CYCLE.** (4 cr; prereq 3272, 3472, 3600, physiology or human biology, regis in coordinated undergraduate program in dietetics)
Application of the principles of nutrition to meet the special requirements of growth, development, adult maintenance, and aging. Sociocultural factors affecting food practices.
- 3642. COMMUNITY NUTRITION.** (3 cr; prereq jr, 3600 or equiv, 6 cr of psychology, sociology, anthropology or economics)
Nutrition and health practices of the family in the community; concepts and methodologies for nutrition education.
- 3643. COMMUNITY NUTRITION.** (3 cr; prereq 3600 or equiv, 6 cr of psychology, sociology, anthropology or economics, regis in coordinated undergraduate program in dietetics)
Nutrition and health practices of the family in the community; concepts and methodologies for nutrition education.
- 3662. INTRODUCTION TO THE CLINICAL PRACTICE OF DIETETICS.** (2 cr; prereq 12 cr in food science and nutrition, regis in coordinated undergraduate program in dietetics)
Introduction to the practice of dietetics in hospitals, outpatient clinics, public service agencies, and food services.
- 3702. PRINCIPLES OF FOODSERVICE ORGANIZATION AND MANAGEMENT.** (4 cr; prereq sr, Mgmt 3001, regis in coordinated undergraduate program in dietetics)
An understanding of systems of foodservice management in the delivery of health care services; ability to select, supervise, and evaluate personnel and to effectively plan and communicate with foodservice management personnel.
- 3703. FIELD EXPERIENCE IN FOODSERVICE MANAGEMENT.** (3 cr; prereq sr, \$3702, Mgmt 3001, regis in coordinated undergraduate program in dietetics)
Supervised foodservice management experience in a health care facility.
- 3730. QUANTITY FOOD PRODUCTION MANAGEMENT.** (5 cr; prereq 1212 or 3403, 3472)
Participation in management procedures used in selection, storage, preparation, pricing, and service of food in quantity. A quantity foodservice used as laboratory.
- 3750. PRINCIPLES OF FOODSERVICE MANAGEMENT.** (3 cr; prereq 3730, Mgmt 3001)
Application of management principles in a foodservice. Business procedures, personnel management, financial management, cost control, and related administrative problems. Field trips may be required.

- 5000. PROFESSIONAL EXPERIENCE PROGRAM.** (4 cr; prereq 15 cr in food science and nutrition and #: not for grad cr; A-N grading only)
Up to 12 weeks of planned experience in a selected position in the food industry; evaluative reports and consultations with faculty advisers and employers.
- 5100. GENERAL SEMINAR.** (1 cr; S-N only; prereq sr or #)
Literature review and presentation of papers in selected areas of food science and nutrition.
- 5111. INDEPENDENT STUDY IN FOOD SCIENCE AND NUTRITION.** (1-5 cr [may be repeated for cr]; prereq Δ ; available to students in any college)
Individual laboratory or library research in some area related to food chemistry, food processing, or nutrition. Open to students in any college who wish to gain experience in food science and nutrition area.
- 5120. FOOD MICROBIOLOGY.** (5 cr; prereq MicB 3103)
Relationship of environment to occurrence, growth, and survival of microorganisms in foods; evaluation of microbiological quality of dairy and food products; characteristics and activities of bacteria, yeasts, and molds related to food spoilage; utilization of microorganisms in manufacture of dairy and food products; recognition and control of food-borne pathogens and food poisoning.
- 5122. SANITATION AND CONTROL OF MICROORGANISMS.** (2 cr; prereq 5120 or #... Δ 5123 advised, especially for food science and technology majors)
Factors that influence control and destruction of microorganisms; chemical, physical, and microbiological principles in cleaning and sanitizing food processing equipment; inactivation of microorganisms and thermal process evaluation; microbiological preservation methods; development of sanitation programs; microbiological criteria; hazard analysis and critical control point concept.
- 5123. MICROBIOLOGY OF FOOD FERMENTATIONS.** (2 cr; prereq 5120 or #... Δ 5122 advised, especially for food science and technology majors)
Characteristics of bacteria, yeasts, and molds involved in dairy and food fermentations; properties of lactic bacteriophages, methods of control in dairy fermentations; composition and factors that influence activity of dairy and food starter cultures; microbiology of natural and controlled fermentations; use of microorganisms in production of single-cell protein and products consumed in food, and in waste utilization.
- 5135. FOOD PROCESS ENGINEERING I.** (4 cr; prereq 1102 or Δ 1102, Math 1142, Phys 1041-1042)
Principles and applications of flow and rheology in Newtonian and non-Newtonian food systems; flow measurement; piping and pump sizing; separation principles (sedimentation, centrifugation, filtration). Principles and applications of forced and natural steady state heat transfer in food processing.
- 5136. FOOD PROCESS ENGINEERING II.** (4 cr; prereq 5135)
Engineering and processing principles and food system applications of single and multistage evaporators and of unsteady heat transfer (heating and cooling). Engineering and application of design and delivery of thermal processing. Freezing heat transfer principles and applications of humidification and leaching in food processes.
- 5310. ADVANCED FOOD CHEMISTRY.** (3 cr; prereq 3110)
Changes in chemical structure and functional properties of foods as modified by processing. Additional topics in areas of flavor, color, safety, nutritive value, sweeteners, and irradiation of food.
- 5312. CHEMICAL AND INSTRUMENTAL ANALYSIS OF FOODS.** (5 cr; prereq 3112, BioC 5025 or #)
Application of quantitative physical, chemical, and instrumental methods of analysis to examination of food products; evaluation of methods and interpretation of results.
- 5320. ADVANCED DAIRY AND FOOD MICROBIOLOGY.** (4 cr; prereq sr, 5122 or #)
Microbiology of food starter cultures; composition of starters, nutrition and metabolism, inhibitors in milk, strain association and compatibility, preservation and mass production, and bacteriophage in cheesemaking. Influence of food environments on spore formation, activation, germination, and resistance. Natural and microbial toxicants in foods, occurrence, techniques (general and specific) for monitoring their presence, and control.
- 5321. INDEPENDENT STUDY IN FOOD MICROBIOLOGY.** (1-5 cr; prereq sr, Δ)
Laboratory or library research on problems related to the microbiology of dairy and food products.
- 5350. EXPERIMENTAL DESIGN IN THE FOOD INDUSTRY.** (4 cr; prereq course in statistics)
Application of concepts and techniques of experimental design to solution of food science problems. Case studies, computer programming, and use emphasized.
- 5360. SENSORY EVALUATION OF FOOD QUALITY.** (4 cr; prereq 3110 and Stat 3081 or 5021 or equiv, consumer food science sr or #)
Fundamentals of sensory perception. Test designs and methods used in studying the sensory qualities of foods.
- 5380. FOOD PACKAGING.** (3 cr; prereq 3110, Phys 1042 or equiv)
Lecture and demonstration of principles of packaging as they apply to foods and the food industry.
- 5390. INTRODUCTION TO FOOD LAW.** (4 cr; prereq 1102 or #)
Analysis of federal and state legal requirements and case law history affecting production, processing, packaging, marketing, and distribution of food and food products.

Course Descriptions

- 5402. MODERN FOOD PREPARATION PRINCIPLES AND PRACTICES.** (2-4 cr; prereq organic chemistry and 15 cr food science and nutrition)
Experimental bases of principles underlying present-day food preparation practices; development of experiences illustrative of such principles in high school teaching, dietetics, and foods in business.
- 5403. EXPERIMENTAL STUDY OF FOODS.** (5 cr; prereq 5360 or #)
Individual laboratory experimentation and comprehensive literature search on a problem in foods. Statistics and computers as a research tool. Data analysis and interpretation for a scientific paper.
- 5404. CURRENT ISSUES IN FOOD AND NUTRITION.** (2-4 cr; prereq 15 cr food science and nutrition or #)
Evaluation of popular and scientific literature dealing with nutrition, food additives, food safety, food fads, health foods, environmental contamination, the consumer movement, naturally occurring food toxicants, processed foods, synthetic foods, and organically grown foods.
- 5406. CURRENT LITERATURE IN FOODS.** (2-4 cr [may be repeated for max 6 cr]; prereq 5413, Δ)
Assigned readings, reports, and discussions of topics in the experimental study of foods.
- 5412. PHYSICO-CHEMISTRY OF FOODS.** (3 cr; prereq 3110)
Characterization of crystalline systems, gels, emulsions, foams, and rheological systems; functionality of food macromolecules in these systems.
- 5413. STRUCTURAL-FUNCTIONAL RELATIONS IN FOOD SYSTEMS.** (3 cr; prereq 3110)
Food as a complex biochemical system. Functionality of various biological entities and chemical constituents of food systems.
- 5462. ADVANCED TOPICS IN SENSORY EVALUATION OF FOOD.** (2-4 cr; prereq 5360)
Review of current literature pertinent to specific topics under active investigation.
- 5472. FOOD PURCHASING.** (4 cr; prereq principles of economics and 15 cr food science and nutrition)
Cost-quality relationships of diverse food products as affected by technological changes. Composition and nutritive value of processed and formulated food products. Functional role of food additives. Recent legislation pertinent to labeling and grading of food products.
- 5473. ADVANCES IN THE MANAGEMENT AND PREPARATION OF FOOD.** (2-4 cr; prereq 3403, 3472, or equiv)
Recent developments in food materials and methods of preparation; their implications in the management of time, money, and energy expenditures.
- 5474. FOOD CONSUMPTION ECONOMICS.** (4 cr, \$AgEc 5550; prereq 3472, AgEc 3101, Stat 5021 or #)
An analytical and empirical treatment of consumer food behavior. Concentrates on data and methods used to study economic and nutritional aspects of food consumption. Students pursue an individual project.
- 5510. MUSCLE CHEMISTRY AND PHYSIOLOGY.** (4 cr; prereq BioC 1302 or #)
(Same as AnSc 5510) Fundamental properties of muscle: ultrastructure, chemistry, and physiology as they relate to muscle proteins, growth, contraction, energy metabolism, adaptive responses, rigor mortis, and conversion of muscle to meat.
- 5512. MEAT AND PROTEIN TECHNOLOGY.** (4 cr, \$5512; prereq 1500 or AnSc 1500 or # and BioC 1302 or Biol 5001)
Meat proteins: pH, salt, and temperature effects on solubility and functionality. Meat preservation: heating, freezing, curing, and problems of product stability during storage. Sausage manufacture: chemistry, technology, use of preblending and least cost analysis, and chemical methods of quality control. Recent developments in processing.
- 5522. TECHNOLOGY OF FLUID AND CONCENTRATED MILK PRODUCTS.** (4 cr; prereq 3110, 5135, 5120 or #)
Application of scientific principles to problems involved in processing fluid and dehydrated milk systems and their control. Demonstration of basic processing operations including heating, cooling, homogenization, evaporation, drying, crystallization, and freezing.
- 5523. TECHNOLOGY OF FERMENTED DAIRY PRODUCTS.** (4 cr; prereq 3112, 5123)
Integration of chemical, microbiological, and physical principles involved in the manufacture and storage of cheeses and fermented milks.
- 5524. SENSORY EVALUATION OF DAIRY PRODUCTS.** (1 cr; prereq 5360 or #)
Laboratory and commercial procedures for evaluating sensory properties and market quality of dairy products. Causes and identification of common defects in flavor, physical properties, and appearance.
- 5530. INDUSTRIAL PROCESSING OF FRUITS AND VEGETABLES.** (4 cr; prereq 3110, 5120, 5135 or #; 3 lect and 3 lab hrs per wk)
Relationship of chemical, physical, and microbiological principles to commercial processing of fruits and vegetables from procurement of raw products through preparation, preservation, packaging, storage, transportation, and merchandising. Emphasis on preservation methods involving heat, sterilization, and freezing.
- 5540. FATS AND OILS CHEMISTRY AND TECHNOLOGY.** (4 cr; prereq 3112 or #)
Nature of fats and oils; their structure, composition, and chemical and physical properties; raw materials for fat and oil products; extraction, refining, hydrogenization, and other industrial manipulations; handling, storage, and analysis and grading of raw materials and finished products.

- 5555. FREEZING AND DEHYDRATION OF FOODS.** (5 cr; prereq 5135, 3110, 5120 or #)
Principles involved in the processing, handling, and storage of frozen, dry, and intermediate moisture foods, with emphasis on physicochemical properties of water in foods.
- 5600. NUTRITION SEMINAR.** (1 cr; prereq #)
Literature review and presentation of papers in selected areas of nutrition. (Extension only.)
- 5622. HUMAN NUTRITION.** (5 cr; prereq 3600, Biol 5001, Phsl 3051 or #)
Physiological function and metabolic role of nutrients and factors influencing the utilization of nutrients in the human body.
- 5642. FIELD EXPERIENCE IN COMMUNITY NUTRITION.** (3-18 cr; prereq course in human nutrition and #)
Application of nutrition information to problems of health and welfare, involving assigned readings, discussions, and experience in a community agency.
- 5643. SEMINAR: WORLD FOOD SUPPLY PROBLEMS.** (4 cr, \$AgEc 5790, \$Agro 5200, \$Soc 5675, \$LACS 5280; prereq sr or grad student with #)
A multidisciplinary approach to social, economic, and technical problems of feeding the world's growing population.
- 5662. CLINICAL NUTRITION.** (3 cr; prereq 5622, Biol 3021 or #)
Application of principles of normal nutrition to clinical problems, with description of altered nutrient requirements under conditions of human disease. Nutritional therapy for common clinical conditions and effect of treatment on nutritional status of patient.
- 5664. FIELD EXPERIENCE IN CLINICAL NUTRITION.** (3-18 cr; prereq course in human nutrition and #)
Application of principles of nutrition to problems in health and disease, involving assigned readings, discussions, and experience in a clinical facility.
- 5665. APPLIED CLINICAL NUTRITION I.** (2 cr; prereq Biol 5001 or f5001, Phsl 3051 or 1002, LaMP 5177, Phcl 1009 or f1009 or demonstrated equiv)
Description of fluid and electrolyte balance; common clinical tests; interrelationships of medications and nutrition. Description of diet therapies for common diseases of the gastrointestinal tract and selected acute medical conditions.
- 5666. APPLIED CLINICAL NUTRITION II.** (2 cr; prereq 5665, 5622 or f5622 or demonstrated equiv)
(Continuation of 5665) Pathology, treatment, and diet therapy for diseases of cardiovascular system and common diseases of the endocrine system, notably diabetes mellitus.
- 5667. APPLIED CLINICAL NUTRITION III.** (2 cr; prereq 5665, 5666)
(Continuation of 5666) Pathology, treatment, and diet therapy in diseases of kidney and urinary tract. Therapeutic management of selected central nervous system disorders, inborn errors of metabolism, and allergies. Special nutritional considerations in care of geriatric patients with common pathological disorders.
- 5668. ADVANCED CLINICAL NUTRITION.** (2 cr; prereq 5662 or #; offered at Rochester and Twin Cities)
An integrated approach to prevention and treatment of illness focusing on the role of nutrition in total medical care.
- 5675. CLINICAL NUTRITION LABORATORY I.** (1 cr; S-N only; prereq 5665 or f5665)
Application of principles of normal and clinical nutrition to diet therapy. Techniques of therapeutic diet writing, patient interviewing, and patient instruction in the dietary management of gastrointestinal, fluid, electrolyte, and other selected acute medical disorders.
- 5676. CLINICAL NUTRITION LABORATORY II.** (1 cr; S-N only; prereq 5666 or f5666)
Application of principles of normal and clinical nutrition to diet therapy. Techniques of therapeutic diet writing, patient interviewing, and patient instruction in the dietary management of endocrine and cardiovascular diseases.
- 5677. CLINICAL NUTRITION LABORATORY III.** (1 cr; S-N only; prereq 5667 or f5667)
Application of principles of normal and clinical nutrition to diet therapy. Techniques of therapeutic diet writing, patient interviewing, and patient instruction in the dietary management of kidney and urinary tract disorders, inborn errors of metabolism, and allergies.
- 5693. SELECTED ASPECTS OF NUTRITION.** (2-4 cr [may be repeated for max 12 cr]; prereq sr, 1212, 3600 or #)
In-depth investigation of a single, preselected aspect of nutrition in any one offering. Teaching procedure and approach determined by nature of topic and student needs. Specific topic announced in advance of course offering.
- 5694. METABOLIC BASIS FOR THERAPEUTIC NUTRITION.** (4 cr; prereq 5664 or #; offered at Rochester and Twin Cities)
Physiological and biochemical bases for dietary treatment and exploration of dietary principles as related to adequate nutrition. Case study presentations and clinical experience included.
- 5702. SELECTED ASPECTS OF FOODSERVICE MANAGEMENT IN HEALTH CARE FACILITIES.** (3 cr; prereq 3 cr elementary statistics, 6 cr economics, #)
Management techniques applied to foodservices for health care facilities. Methods of analyses and control.

Course Descriptions

- 5705. FIELD EXPERIENCE IN FOODSERVICE ADMINISTRATION.** (3 cr; prereq enrollment in dietetic internship)
Supervised experience in foodservice organization and management in a health care facility. (Extension only.)
- 5755. CURRENT TOPICS IN FOODSERVICE MANAGEMENT.** (4 cr [may be repeated for max 8 cr]; prereq #)
In-depth examination of timely issues. Content varies from quarter to quarter.

FOR GRADUATE STUDENTS ONLY

(For course descriptions, see the *Graduate School Bulletin*)

- 8101. RESEARCH SEMINAR**
- 8120. FOOD PROCESS MICROBIOLOGY**
- 8205. GENERAL SEMINAR**
- 8311. FLAVOR CHEMISTRY**
- 8312. REACTION KINETICS OF FOOD DETERIORATION**
- 8313. TOPICS IN LIPID CHEMISTRY**
- 8315. FOOD PROTEINS**
- 8322. MICROBIOLOGY AND ENGINEERING OF FOOD STERILIZATION PROCESSES**
- 8323. MICROBIAL STARTER CULTURES**
- 8324. MICROBIAL TOXINS AND TOXIC MICROORGANISMS IN FOODS**
- 8401. INDEPENDENT STUDY: FOOD SCIENCE**
- 8403. ADVANCED TOPICS IN FOOD SCIENCE**
- 8412. INTERRELATIONSHIPS AND FUNCTIONS OF FOOD COMPONENTS**
- 8621. INDEPENDENT STUDY: NUTRITION**
- 8622. ADVANCED HUMAN NUTRITION I**
- 8623. ADVANCED HUMAN NUTRITION II**
- 8624. ADVANCED HUMAN NUTRITION III**
- 8625. REGULATION OF CARBOHYDRATE AND LIPID METABOLISM**
- 8626. INTESTINAL NUTRIENT METABOLISM**
- Nutr 8745. SEMINAR
- Nutr 8990. GRADUATE RESEARCH

Horticultural Science and Landscape Architecture

Horticultural Science (Hort)

- 1010. HOME HORTICULTURE.** (4 cr; no cr for horticulture majors or minors)
For non-horticulture majors. Applied knowledge of propagation and culture of fruits, vegetables, lawns, flowers, and house plants. Identification and use of trees and shrubs in the home landscape. Lectures and laboratory.
- 1016. GREENHOUSE MANAGEMENT.** (4 cr; prereq Biol 1103)
Fundamentals of greenhouse construction and management; cultural and physiological principles.
- 1021. WOODY PLANT MATERIALS.** (5 cr)
Taxonomy, ecology, and landscape uses of trees, shrubs, and evergreens. Lectures, laboratories, and field trips.
- 1022. HERBACEOUS PLANT MATERIALS.** (5 cr)
Taxonomy, ecology, and landscape uses of perennial and annual flowers, tender and hardy bulbs, ground covers, vines, grasses, and selected plants for interior design. Lectures, laboratory, and garden experience.
- 1036. PLANT PROPAGATION.** (4 cr; prereq 1100 or 1100)
Principles and techniques of propagating plants by seeds, cuttings, grafts, buds, layers, and division. Lectures on principles; laboratories on practice of various propagating techniques; and field trips.
- 1099. ORIENTATION TO HORTICULTURE.** (1 cr; S-N only)
A survey of the field of horticulture including discussion of job potentials for horticulture majors.

Horticultural Science and Landscape Architecture

- 1100. BIOLOGY OF HORTICULTURAL PRODUCTION.** (4 cr; prereq Biol 1103)
Discussion of factors influencing the successful production of horticultural crops. For horticulture majors and other students planning to take advanced horticulture courses. Lectures, experiments, and discussion.
- 3026. RESIDENTIAL LANDSCAPE DESIGN.** (4 cr; prereq 1021, LA 1025 or Ind 1600)
Principles of landscape design with reference to their practical application in planning of residential landscapes. Relationships of landscape design, architectural design, and interior design. Landscape drafting techniques and methods of presentation. Lectures, drawings, and practical problems.
- 3031. FRUIT SCIENCE.** (4 cr; prereq 1100, Soil 1122)
Principles of fruit production. Fruits of the world with emphasis on temperate climate crops. Site selection, cultural and management practices, physiological and environmental control of plant development, dwarfing, growth regulating compounds, insecticides, and herbicides. Lectures and laboratory.
- 3033. POSTHARVEST HANDLING AND PHYSIOLOGY OF HORTICULTURAL CROPS.** (3 cr; prereq 1100)
Fundamental principles in postharvest handling of horticultural crops; precooling, transporting, and storing. Postharvest changes, senescence, respiration, ripening and ethylene physiology. Government laws and regulations. Lectures, discussion, laboratory, field trips.
- 3053. ORNAMENTALS FOR INTERIOR DESIGN.** (4 cr)
Identification, utilization, and culture primarily of foliage plants used in interior decoration. Lectures, reference reading, and field trips.
- 3072. TURF MANAGEMENT.** (4 cr; prereq Soil 1122 and either Hort 1100 or Agro 3020)
General landscape maintenance and turf culture. Work in areas of industrial grounds maintenance, park and recreation area maintenance, and general lawn care.
- 3076. ARBORICULTURE.** (3 cr; prereq 1021, Soil 1122 or FBio 1100)
Survey of environmental and design functions of shade trees. Application of specific cultural principles and techniques pertaining to the installation, maintenance, and preservation of shade and ornamental trees. Equipment selection and adaptability. Fundamental concepts used in organization and administration of community shade tree programs. Lectures, demonstrations, and field trips.
- 3077. FLORAL DESIGN.** (3 cr)
Fundamental principles in floral arrangement. Analysis of basic design principles used in floral design. Decorative use of flowers, foliages, and accessories.
- 3079. ORNAMENTAL HORTICULTURE BUSINESS PRACTICES.** (3 cr)
Business management principles and practices in operation of horticultural retail firms. Scope of the industry and its place in horticulture and the modern business world. Lectures, discussion, and field trips.
- 3097. HORTICULTURE PRACTICUM.** (2-4 cr; prereq upper division horticulture major)
Approved field, laboratory, or greenhouse experiences in application of horticultural information and practices.
- 3098. UNDERGRADUATE RESEARCH PROJECT.** (2-6 cr; prereq 8 cr upper division horticulture courses)
Undergraduate research projects associated with laboratory, field, or greenhouse studies.
- 3099. SEMINAR.** (1 cr [may be repeated for max 2 cr]; prereq jr)
Horticultural problems, research projects, work experience, and employment opportunities.
- 5000. PROFESSIONAL EXPERIENCE PROGRAM.** (4 cr; prereq 15 cr in horticulture and #; not for grad cr)
Up to 12 weeks of experience in a position in the horticulture industry; evaluative reports and consultations with faculty advisers and employers.
- 5006. SYSTEMATICS OF TEMPERATE AND TROPICAL HORTICULTURAL FOOD CROPS.** (4 cr; offered 1983-84 and alt yrs)
Systematic relationships of the world's resources of fruit and vegetable taxa with particular reference to development of improved types and varieties. Lectures, literature review, and laboratory.
- 5020. HORTICULTURAL TECHNIQUES FOR EDUCATION MAJORS.** (3 cr [no cr for horticulture majors]; prereq education major or #; offered 1983-84 and alt yrs)
Horticultural and botanical concepts and their impact on the use of horticultural plants in the classroom. Development of specific single-concept classroom demonstration and pupil-oriented activities relating to horticultural plants.
- 5021. ORNAMENTAL PLANT MATERIALS.** (5 cr, §1021, §1022; offered 1984-85 and alt yrs)
Identification and use of wide range of ornamental plant materials including trees, shrubs, annuals, perennials, and plants for interior design. Application of information and personal observations to individual student's area of study.
- 5026. LANDSCAPE MANAGEMENT.** (5 cr)
Application of basic biological principles to establishment and maintenance of horticultural plantings including commercial, private utility, recreational, highway, and park lands. Techniques and equipment for landscape plantings; adoptive management models for business and institutional organization.

Course Descriptions

- 5031. FRUIT SCIENCE FOR ADVANCED STUDENTS.** (2 cr. §3031; prereq #)
Principles of fruit production. Fruits of the world with emphasis on temperate climate crops. Site selection, cultural and management practices, physiological and environmental control of plant development, dwarfing, growth regulating compounds, insecticides, and herbicides. Lectures and laboratory.
- 5034. COMMERCIAL VEGETABLE PRODUCTION: TUBER, BULB, ROOT CROPS.** (3 cr; prereq 1016, 1036, Soil 1122 or #)
Principles of commercial vegetable crop production with emphasis on tuber, bulb, and root types. Applied physiology of cultural practices and plant responses. Management and cultural techniques. Environmental influence on crop culture.
- 5035. COMMERCIAL VEGETABLE PRODUCTION: FRUIT, SEED, AND LEAFY TYPES.** (3 cr; prereq 1016, 1036, Soil 1122 or #)
Fruit, seed, and leafy types as world food sources; nature and scope of production and distribution systems. Physiological and genetic control of plant and product development, including principles of stand establishment, maturation, and seed production. Impact of nutrition, irrigation, postharvest handling and other variables on crop performance and product quality. Lectures, discussion, and laboratory.
- 5036. TOPICS: OPTIMIZING HORTICULTURAL FOOD PRODUCTION.** (1 cr; prereq 3031 or 5034 or 5035)
Analysis of current and futuristic concepts in fruit and vegetable production. Topics include mechanical harvesting, population density, new cultural concepts, and environmental modifications as they apply to maximizing yield and quality.
- 5038. RESEARCH METHODS IN PLANT PROPAGATION.** (3 cr; prereq 1036 or #)
Basic concepts, theory, and techniques involved in propagating plants studied through literature search and discussion. Students design and conduct experiments with plants or propagation techniques of special interest.
- 5040. PLANT GROWTH REGULATORS.** (3 cr; prereq 15 cr plant sciences incl 3 cr plant physiology)
Physiology and agricultural technology of plant hormones and synthetic growth regulators in horticulture. Emphasis on practical uses of such substances in the control of fruit and leaf abscission, parthenocarp, growth rate, growth habit, plant size, apical dominance, organ initiation, dormancy, germination, flowering and callusing.
- 5041. ENVIRONMENTAL PHYSIOLOGY OF HORTICULTURAL PLANTS.** (3 cr; prereq 15 cr plant sciences, PIPh 3131; offered 1984-85 and all yrs)
Lectures and assigned readings on the relation of water, temperature, and light to the growth and development of horticultural plants.
- 5042. TURF GRASS SCIENCE.** (5 cr; prereq 3072, PIPa 1001, PIPh 3131)
For advanced students in turf with career objectives in professional turf management. All phases of the turf industry considered, with emphasis on the ecology, physiology, and theory of turf population dynamics and on specialized management situations such as golf course, commercial sod production, and fine turf athletic situations.
- 5046. NURSERY MANAGEMENT AND PRODUCTION I.** (4 cr. 5046-5048†; prereq 1021, 1036, 1099)
Introduction, history, organization, and scope of the nursery industry. General nursery business administration, production schedules and cultural management for seed beds and field grown stock.
- 5048. NURSERY MANAGEMENT AND PRODUCTION II.** (4 cr. 5046-5048†; prereq 5046)
Pest management and government regulations concerning the nursery industry. Container growing operations and marketing of all products. Specific topic research and nursery operation development by the student. Laboratory will include field trips and greenhouse and field training in nursery operations. Field trips will be required.
- 5052. COMMERCIAL FLORICULTURE, FALL CROPS.** (3 cr; prereq 1016)
Physiological and cultural aspects of optimized production of principal florist crops of economic importance. Chrysanthemums, carnations, cut flowers, and potted plants especially adapted to Christmas sales. Lectures, reference reading, and field trips to greenhouses, wholesalers, and retail flower stores.
- 5053. COMMERCIAL FLORICULTURE, WINTER CROPS.** (4 cr; prereq PIPh 3131 or #)
Physiological and cultural aspects of bulbous plants (tulips, narcissi, bulbous irises, hyacinths, crocuses, and lilies) and year-round production of azaleas. Emphasis on latest research in growth, developmental, and flowering physiology of these commercially important floricultural crops. Lectures, reference reading, laboratory experience, and field trips.
- 5054. COMMERCIAL FLORICULTURE, SPRING CROPS.** (3 cr; prereq 1016)
Physiological and cultural aspects of optimized production of principal florist crops of economic importance. Roses, snapdragons, gloxinias, and materials adapted to spring sales. Lectures, reference reading, and field trips to greenhouses, wholesalers, and retail stores.
- 5090, 5091, 5092. SPECIAL PROBLEMS.** (1-4 cr per qtr; prereq #)
Written report based on library, laboratory, or field research.

Landscape Architecture (LA)

- 1021. HISTORY OF ENVIRONMENTAL DEVELOPMENT: ARCHITECTURE.** (4 cr, §Arch 1021; 4 lect hrs per wk)
Introduction to the philosophy and principles of architecture and landscape architecture as an art; survey of environmental history from the ancient periods through the medieval age.
- 1022. HISTORY OF ENVIRONMENTAL DEVELOPMENT: LANDSCAPE ARCHITECTURE.** (4 cr, §Arch 1022; prereq 1021; 4 lect hrs per wk)
Continuation of 1021 from the Renaissance through the modern eras; focuses on forces and individuals that shaped the form of architecture and landscape architecture in the 19th and 20th centuries in America and Europe.
- 1023. HISTORY OF ENVIRONMENTAL DEVELOPMENT: PLANNING.** (4 cr, §Arch 1023; prereq 1022; 4 lect hrs per wk)
Introduction to urban planning. Survey of the rise and history of cities as centers of civilization. Collaboration among various disciplines for creating better urban environment and improving the quality of human life in cities.
- 1024. LANDSCAPE THEORY.** (4 cr; 3 lect and 3 lab hrs per wk)
Analysis of design elements and forms involving direction, shape, proportion, and color, with emphasis on their function in design; perception and our relationship to the environment; the social effects and psychological basis for design.
- 1025. BASIC VISUALIZATION I.** (4 cr; 2 lect and 4 lab hrs per wk; prereq LA major or #)
Perspective drawing, landscape sketching, visual analysis of landscape materials, presentation techniques for plans, sections, elevations, and diagrams.
- 1026. BASIC VISUALIZATION II.** (4 cr; prereq 1025; 6 studio hrs per wk)
Continued refinement of the student's ability to execute acceptable line drawings developed in 1025. Emphasis on aiding students to develop their own technique(s). Continued emphasis on perspective sketching, color sense, psychology of graphic interpretation, mixed media, and printing reproduction processes.
- 1031. INTRODUCTION TO LANDSCAPE ARCHITECTURE.** (4 cr; 4 lect hrs per wk)
Design potential of materials of the landscape; exercises in assessment of land developments and detail landscapes; the role of the landscape architect in shaping the natural and cultural environment; brief historical review of site developments.
- 3001. ENVIRONMENTAL DESIGN: PEOPLE AND ENVIRONMENT.** (4 cr, §Arch 3001)
Interaction of people with the environment, using natural and social sciences and the arts as background for readings, lectures, discussions, and workshop sessions.
- 3002. ENVIRONMENTAL DESIGN: TOOLS AND PROCESSES.** (4 cr, §Arch 3002; prereq 3001)
Nature and the effects of various tools and processes of environmental change, ranging from buildings and landscapes to economic policies, climate, and myths. Readings, lectures, discussions, and workshop sessions.
- 3003. ENVIRONMENTAL DESIGN: IMPLEMENTATION AND EVALUATION.** (4 cr, §Arch 3003; prereq 3002)
Design projects, discussions, and readings exploring personal abilities to implement and evaluate environmental change.
- 3071. LANDSCAPE TECHNOLOGY: GROUND FORM DESIGN.** (4 cr; prereq 3082 or #, CE 3100 or AgET 1400; 2 lect, 4 lab hrs per wk)
Lectures, exercises, and projects in ground form manipulation, earthwork computation, and surface drainage techniques.
- 3072. LANDSCAPE TECHNOLOGY: CIRCULATION AND UTILITIES DESIGN.** (4 cr; prereq 3071 and 3083 or #: 2 lect and 4 lab hrs per wk)
Lectures, exercises, and projects in layout of circulation and landscape utilities systems.
- 3073. LANDSCAPE TECHNOLOGY: LAND ANALYSIS TECHNIQUES.** (4 cr; prereq 3072; 2 lect and 4 lab hrs per wk)
Lectures, exercises, and projects in land analysis techniques for use in assessment of land development potential.
- 3075. LANDSCAPE TECHNOLOGY: MATERIALS AND CONSTRUCTION DESIGN.** (4 cr; prereq 3072; 2 lect and 4 lab hrs per wk)
Lectures, exercises, and project in materials and construction techniques and working document preparation.
- 3081-3082-3083. BASIC DESIGN.** (6 cr per qtr; prereq LA student; 2 lect and 10 lab hrs per wk)
Lectures and projects to expand awareness of the design potential of environment, develop processes and graphic techniques for problem solving, and develop methods of presenting ideas verbally and visually. Design of small-scale site systems with simple variables.
- 3091-3092. INTERMEDIATE DESIGN.** (6 cr per qtr; prereq 3083; 2 lect and 10 lab hrs per wk)
Lectures and projects in the design potential of natural land materials, landscape survey and analysis techniques, elements of the environment as they condition design potential, methodologies for solving design problems, methods of expressing landscape form both geographically and through models; design of site systems with simple variations.

Course Descriptions

- 3093. DETAIL SITE DESIGN.** (6 cr; prereq 3092)
Design of small-scale site systems with complex variables.
- 3094. INDEPENDENT STUDY IN GRAPHICS.** (1-4 cr; prereq LA student, #)
Independent study of topics, of student's choice, in graphic communication. Proposal must be submitted for approval by LA faculty member.
- 3095. INDEPENDENT STUDY IN PLANTING DESIGN.** (1-4 cr; prereq LA student, #)
Independent study of topics, of student's choice, related to planting design. Proposal must be submitted for approval by LA faculty member.
- 3096. INDEPENDENT STUDY IN HISTORY OR THEORY.** (1-4 cr; prereq LA student, #)
Independent study of topics, of student's choice, related to history and/or theory of landscape architecture. Proposal must be submitted for approval by LA faculty member.
- 3097. INDEPENDENT STUDY IN COMPUTER-AIDED DESIGN.** (1-4 cr; prereq LA student, #)
Independent study of topics, of student's choice, related to use of computers to aid design and analysis. Proposal must be submitted for approval by LA faculty member.
- 3098. INDEPENDENT STUDY IN DESIGN.** (1-4 cr; prereq LA student, #)
Independent study of topics, of student's choice, related to landscape architecture or design theory or practice. Proposal must be submitted for approval by LA faculty member.
- 3099. INDEPENDENT STUDY IN TECHNOLOGY.** (1-4 cr; prereq LA student, #)
Independent study of topics, of student's choice, related to landscape architecture technology. Proposal must be submitted for approval by LA faculty member.
- 3101. COMMUNICATING LANDSCAPE QUALITY.** (4 cr; 2 lect and 4 lab hrs per wk; prereq 1025 and 3091)
Lectures and exercises in drawing techniques focused on developing graphic skills for designers working predominantly with exterior environments.
- 3200. LANDSCAPE ARCHITECTURE PRACTICUM.** (1-6 cr; prereq LA student, #; S-N only)
Approved design, planning, engineering, contracting, or travel experience in application or development of landscape architecture theory. Proposal must be submitted for approval by LA faculty; final written, graphic, and/or oral presentation must be submitted.
- 5010. PRINCIPLES OF OUTDOOR RECREATION DESIGN AND PLANNING.** (4 cr, §FR 5233; 4 lect hrs per wk)
For advanced students associated with design, management, and planning of recreation facilities. Planning and design principles related to recreational land use and development; parks, campsites, water areas, highways, and summer and winter recreational facilities.
- 5099. RCD INTERDISCIPLINARY SEMINAR I.** (4 cr, 5099-5100†, §RCD 5099, §AgEc 5099, §AgET 5099, §Soil 5099; prereq resource and community development sr or #)
Selected speakers, readings, and discussion topics dealing with resource and community development analysis and implications for resource allocation. Students participate as a team, combining disciplinary skills to analyze complex resource development problems.
- 5100. RCD INTERDISCIPLINARY SEMINAR II.** (4 cr, 5099-5100†, §RCD 5100, §AgEc 5100, §AgET 5100, §Soil 5100; prereq 5099 or #)
(Continuation of 5099) Papers, presentations, and critiques on selected complex resource problems in Seminar I.
- 5101. SITE PLANNING AND DESIGN.** (6 cr; 2 lect and 10 lab hrs per wk; prereq 3093)
Case study analysis and design of site organizational systems.
- 5103. URBAN LANDSCAPE DESIGN.** (6 cr; 2 lect and 10 lab hrs per wk; prereq 3093)
Case study analysis and design of urban environments.
- 5105. RECREATIONAL PLANNING AND DESIGN.** (6 cr; prereq 5010; 2 lect and 10 lab hrs per wk)
Analysis development and presentation of landscape design solutions for diverse recreational land use.
- 5107. REGIONAL LANDSCAPE DESIGN.** (6 cr; prereq 3092; 3 lect and 10 lab hrs per wk)
Emphasis on large-scale land areas. Analyzing development potential and evolving solutions for integration of divergent land use patterns such as agricultural, residential, commercial, industrial, and recreational.
- 5109. SPECIAL PROBLEMS: THESIS PROPOSAL.** (2 cr; hrs ar)
Individual research resulting in a proposal for thesis project to be developed in LA 5110.
- 5110. ADVANCED LANDSCAPE PLANNING AND DESIGN.** (6 cr; prereq terminal qtr of study; 2 lect and 10 lab hrs per wk)
Advanced studies in area of student's option.
- 5117. PLANTING DESIGN: AESTHETIC AND FUNCTIONAL CRITERIA.** (4 cr; prereq 3083 or # and Hort 1021)
Lectures, presentations, field trips, readings, and projects exploring aesthetic and functional design principles related to the use of plants in the landscape. Exploration of both historic and modern principles through design projects of various scales.

Horticultural Science and Landscape Architecture

5119. PLANTING DESIGN: ECOLOGICAL PRINCIPLES/LAND USE CONCEPTS AND IMPLEMENTATION OF PLANTING DESIGN. (4 cr; prereq 5117 or #)

Lectures, presentations, field trips, readings and projects related to the principles and practices of using plants in an ecologically sound and environmentally sensitive manner. Principles derived from prairie, northwoods, riverine, and wetland environments. Integration of naturalized materials within a range of environments of various scales.

5131. DIRECTED STUDIES IN LANDSCAPE ARCHITECTURE HISTORY AND THEORY. (1-6 cr; prereq third yr LA student, Δ)

Advanced independent studies. Student expected to have successfully completed 3000-level independent study courses in previous quarters.

5132. DIRECTED STUDIES IN LANDSCAPE ARCHITECTURE DESIGN. (1-6 cr; prereq third yr LA student, Δ)

Advanced independent studies. Student expected to have successfully completed 3000-level independent study courses in previous quarters.

5133. DIRECTED STUDIES IN LANDSCAPE ARCHITECTURE TECHNOLOGY. (1-6 cr; prereq third yr LA student, Δ)

Advanced independent studies. Student expected to have successfully completed 3000-level independent study courses in previous quarters.

5134. DIRECTED STUDIES IN EMERGING AREAS OF LANDSCAPE ARCHITECTURE. (1-6 cr; prereq third yr LA student, Δ)

Advanced independent studies in areas of student's choice that relate to new or renewed direction in landscape architecture. Student expected to have successfully completed 3000-level independent study courses in previous quarters.

5224. CONTEMPORARY ISSUES IN LANDSCAPE ARCHITECTURE. (4 cr; prereq terminal yr of study; 4 discussion hrs per wk)

Analysis of design principles and design goals in modern society. Review of current site development projects. In-depth investigation into specific areas of land development.

5225. LANDSCAPE TECHNOLOGY: WORKING DRAWINGS AND SPECIFICATIONS. (4 cr; prereq 3072; 3 lect, 3 lab hrs per wk)

Lectures, exercises, and projects in working drawing and specification.

5226. PROFESSIONAL PRACTICE. (4 cr; prereq terminal yr of study)

Professional ethics, responsibility, and relations in business. Office management, preparation of professional communications, estimates, specifications, and contracts. Lectures, written exercises, and office visits.

5227. IMPACT ASSESSMENT AND ENVIRONMENTAL MEDIATION. (5 cr; prereq sr, grad, or #; offered at Itasca only)

Lectures in history, laws, and analysis of impact assessment and environmental mediation. Integrated with interdisciplinary emphasis on fieldwork related to a selected issue, actual document preparation, presentation, and individual responsibility.

5228. SEMINAR: TOPICS IN CAMPUS PLANNING. (4 cr; prereq 3093 or #)

Lectures and discussion, presentations, field trips, readings, and paper exploring aspects of contemporary and historic issues in campus planning, the use of energy-efficient buildings, and related issues dealing with efficient land use and site planning.

5261. HISTORY OF LANDSCAPE ARCHITECTURE: THE EUROPEAN, ORIENTAL, AND AMERICAN TRADITION. (4 cr; prereq first yr LA student; 4 hrs lect and discussion per wk)

Influences and forms that have established a basis for the landscape architecture tradition in Europe, the Orient, and the United States. Emphasis on principles and techniques and on the continuity of design imagination inherent in specific examples of the altered environment.

5265. HISTORY OF LANDSCAPE ARCHITECTURE: INDIVIDUAL INFLUENCES. (4 cr; prereq second yr LA student; 4 hrs lect and discussion per wk)

Personal influences of noteworthy designers (current and historic), and how such influence precipitated design structures by these creative people within the affective domain of personal expression.

FOR GRADUATE STUDENTS ONLY

(For course descriptions, see the *Graduate School Bulletin*)

Agro 8270.* SEMINAR: PLANT BREEDING

GCB 8900. SEMINAR: GENETICS

Hort 8022. BREEDING ASEXUALLY PROPAGATED CROPS

Hort 8023. EVOLUTION OF CROP PLANTS

Hort 8041. DISCUSSIONS IN ADMINISTRATIVE ORGANIZATION

Hort 8042. HORTICULTURAL SEMINAR

Hort 8045.* PLANT HARDINESS

Course Descriptions

- Hort 8051x.* **ADVANCED PROBLEMS IN HORTICULTURAL CROP BREEDING**
- Hort 8052x.* **ADVANCED PROBLEMS IN PHYSIOLOGY OF HORTICULTURAL CROPS**
- Hort 8060. **DISCUSSIONS IN POTATO RESEARCH**
- Hort 8061.* **DISCUSSIONS IN INCOMPATIBILITY**
- Hort 8062.* **DISCUSSIONS IN PLANT HARDINESS**
- Hort 8063.* **DISCUSSIONS IN HORTICULTURAL PLANT BREEDING**
- Hort 8064.* **DISCUSSIONS IN FLORICULTURAL SCIENCE**
- Hort 8065.* **DISCUSSIONS IN POSTHARVEST PHYSIOLOGY**
- Hort 8066. **DISCUSSIONS IN HORTICULTURAL RESEARCH**

Plant Pathology (PiPa)

- 1001. INTRODUCTORY PLANT PATHOLOGY: LECTURE AND INTRODUCTION TO DIAGNOSTIC PROCEDURES AND LABORATORY.** (4 cr; prereq soph, 9 cr plant science)
Biotic and abiotic causes of plant disease. Representative plant diseases of significance in Upper Midwest that illustrate principles of plant pathology. Theory of laboratory and diagnostic techniques.
- 3001. INTRODUCTORY PLANT PATHOLOGY: LECTURE, LABORATORY, AND INTRODUCTION TO DIAGNOSIS.** (6 cr, §5002; prereq soph, 9 cr plant science)
Biotic and abiotic causes of plant disease. Representative plant diseases of significance in Upper Midwest that illustrate principles of plant pathology. Laboratory and diagnostic techniques. "Plant Disease Situation" problem solving.
- 3090. RESEARCH IN PLANT PATHOLOGY.** (Cr ar; prereq 1001 or equiv or #)
Assignment of special problems to undergraduate students who desire opportunity for independent research in plant pathology.
- 5000. PROFESSIONAL EXPERIENCE PROGRAM.** (4 cr; prereq 15 cr in plant pathology and #; not for grad cr)
Open to advanced students in plant health technology program. Up to 12 weeks of experience in a selected agricultural industry; evaluative reports and consultations with faculty advisers and employers.
- 5002. INTRODUCTORY PLANT PATHOLOGY FOR ADVANCED STUDENTS.** (5 cr, §3001; prereq 14 cr plant science or #)
- 5005. VIRUSES AND BACTERIA IN PLANT DISEASE.** (4 cr; prereq 20 cr biology including botany, biochemistry, and plant physiology; offered fall quarter yearly)
Plant diseases caused by bacteria and viruses with emphasis on effects, symptoms, pathogen identification, and control.
- 5006. FUNGI, ALGAE, AND PARASITIC SEED PLANTS IN PLANT DISEASE.** (4 cr; prereq 20 cr biology including botany, biochemistry, plant physiology, and mycology, PiPa 5105; offered winter quarter yearly)
Fungi, algae, and parasitic seed plants as plant pathogens, representative types with particular reference to the techniques used in their identification and control.
- 5007. NEMATODES AND ABIOTIC AGENTS IN PLANT DISEASE.** (4 cr; prereq 20 cr biology including biochemistry and plant physiology; offered spring quarter yearly)
Nematodes and abiotic agents as plant pathogens with emphasis on diagnosis, identification, and control.
- 5050. FOREST PATHOLOGY.** (4 cr; prereq Biol 1103 or equiv)
Diseases of forest and shade trees; wood decay. Symptoms, etiology, and control. Lectures, laboratory, and fieldwork.
- 5102. FIELD MYCOLOGY.** (5 cr; prereq 9 cr botany or #; offered at Itasca)
General characteristics of fungi, especially those used in identification; cultural and taxonomic procedures and practices.
- 5104. AGRICULTURAL SYSTEMS ANALYSIS AND MODELING.** (4 cr, §AgEc 5104, §AnSc 5104, §Soil 5104; prereq Math 1142 or #)
Introduction to bioeconomic modeling as preparation for interdisciplinary agricultural systems analysis. Basic concepts; deterministic and stochastic models; delays, feedback, and clockwork; data acquisition; model verification and validation; role of models in agroecosystem management.
- 5105. INTRODUCTION TO THE STUDY OF FUNGI.** (4 cr; prereq 9 cr botany or Biol 1011 or #)
Structures, habits, classification, and identification of fungi.

- 5106. MYCOLOGY: ASCOMYCETES—FUNGI IMPERFECTI.** (4 cr; prereq 3001 or 5050 or MicB 3103; offered 1984 and alt yrs)
Lectures and laboratory exercises on taxonomy, identification, life histories, genetics, and ecology of fungi.
- 5107. MYCOLOGY: BASIDIOMYCETES.** (4 cr; prereq 1001, 3001 or 5050 or MicB 3103; offered 1984 and alt yrs)
Lectures and laboratory exercises on the taxonomy, identification, life histories, genetics, and ecology of fungi.
- 5109.* BIOCHEMISTRY AND PHYSIOLOGY OF FUNGI.** (3 cr; prereq 8 cr biochemistry or #: offered 1985 and alt yrs)
Lectures, assigned readings, and discussions of the chemical structure and activities of the fungus cell, including growth, nutrition, regulation of intermediary metabolism and protein and nucleic acid syntheses, sporulation and spore germination, mitochondrial biogenesis, photobiology, mycoviruses, and natural products.
- 5200. POISONOUS PLANTS.** (2 cr; prereq Biol 1011, 3 cr botany)
Plants poisonous to animals and people; plant families and species, symptoms of poisoning, and toxic principles. Lectures and field trips.
- 5215.* INSECTS IN RELATION TO PLANT DISEASES.** (4 cr; prereq 5 cr entomology, 5 cr plant pathology or equiv or #)
(Same as Ent 5215) Insect transmission and dissemination of plant pathogens; development of plant-insect relationships; habits of principal insect vectors with emphasis on methods of control.
- 5650. CLINICAL PLANT PATHOLOGY.** (6 cr; prereq 3001 and 8 cr plant pathology; offered summer session yearly)
Field trips, clinical and laboratory experience in diagnosis, prevention, and control of plant diseases affecting field, fruit, and vegetable crops, ornamentals and trees. Field plot experiences.
- 5700. CONTEMPORARY CHEMICAL CONTROL OF PLANT DISEASES.** (4 cr; prereq 1001, 5005, 5006, BioC 1301)
Control of plant diseases utilizing biological and cultural practices, disease resistance, and chemicals in an integrated manner. Emphasis on use and action of fungicides.

FOR GRADUATE STUDENTS ONLY

(For course descriptions, see the *Graduate School Bulletin*)

- 8001. PLANT DISEASE THEORY I: MOLECULAR TO CELLULAR**
- 8002. PLANT DISEASE THEORY II: TISSUES TO WHOLE PLANTS**
- 8003. PLANT DISEASE THEORY III: POPULATIONS**
- 8090. RESEARCH IN PLANT PATHOLOGY**
- 8095. ADVANCED PROCEDURES AND RESEARCH IN MYCOLOGY**
- 8111. GENETICS OF PLANT PATHOGENS**
- 8200. PLANT PATHOLOGY COLLOQUIUM**
- 8201. SEMINAR**
- 8202. SEMINAR**

Rhetoric (Rhet)

- 1101. WRITING TO INFORM AND PERSUADE.** (4 cr; §Comp 1011; prereq 1Rhet 1104)
Relationship of fact finding and clear thinking to informative and persuasive writing. Importance of thesis sentence, evidence, coherence, clarity, and correctness. Relatively short (500-750 words) assignments designed to complement instruction in the Library Laboratory.
- 1104. LIBRARY LABORATORY.** (1 cr; S-N only; taught by St. Paul campus library staff)
On-site instruction in information retrieval techniques. Lectures, audiovisual presentations, and problem-solving assignments designed to strengthen skills in using the library.
- 1147. EFFICIENT READING.** (4 cr)
Exploration of the adult reading process with emphasis on comprehension, speed, and vocabulary development. For persons of average or above-average reading ability who wish to develop and refine college-level reading skills. Not a basic course. (Meets with 5147)
- 1151. WRITING IN YOUR MAJOR.** (4 cr; prereq 1101, 1104, and soph status)
Students investigate and write on subjects related to their majors. The criterion of appropriateness: good writing meets the expectation of readers and the conventions of a particular form. Assignments such as literature review, abstract, fact sheet, instructions, and feature article.
- 1220. PRINCIPLES OF HUMAN COMMUNICATION.** (4 cr)
Introduction to the nature of human communication with emphasis on the development, structure, history, and use of language as a primary means of contact between people. Elements of nonverbal communication, listening, and intercultural communication.

Course Descriptions

- 1221. AN INTRODUCTION TO INTERPERSONAL COMMUNICATION.** (3 cr; prereq completion of freshman communication requirement)
Dimensions of interpersonal communication. Theories, problems, and practical exercises. Designed to enable students to become better communicators. Principles and experiences including factors related to interpersonal perception, orientation, contents, models, choice, attraction, barriers, and breakdowns.
- 1222. PUBLIC SPEAKING.** (4 cr; prereq 1101 and 1104)
Practical course in fundamentals of speechmaking. Emphasis on organizing the speech and projecting it to the audience.
- 1226. PARLIAMENTARY PROCEDURE, LEADERSHIP, AND PARTICIPATION.** (3 cr; prereq completion of freshman communication requirement)
Individual participation in the creation and development of a functioning organization using rules of parliamentary procedure as its basis for doing business. History, theories, and processes of democratically oriented organizations.
- 1251. EFFECTIVE LISTENING.** (3 cr)
Designed to increase listening comprehension by developing four central abilities. Readings, research, theory, and practice.
- 1301. HUMANITIES: MODERN THOUGHT AND THE ENLIGHTENMENT.** (4 cr)
Introduction to humanities tracing the impact of the scientific revolution on human thought. Scientific and religious movements and countermovements as they influence modern thinking.
- 1302. HUMANITIES: MODERN THOUGHT AND THE INDUSTRIAL REVOLUTION.** (4 cr)
The industrial transformation of Europe; laissez-faire capitalism and liberalism; the romantic response; socialism.
- 1303. HUMANITIES: MODERN THOUGHT AND THE IMPACT OF EVOLUTION.** (4 cr)
The impact of evolutionary thought; philosophy, religion, and morality in a changing society.
- 1310. HUMANITIES: THE LAND IN AMERICAN EXPERIENCE.** (4 cr)
American attitudes toward the land from colonial times to the present as expressed in social history, literature, and the fine arts. Social thought and the relationship between farm and city, wilderness and countryside. The changing appearance of America.
- 1311. HUMANITIES: THE FAMILY IN AMERICAN EXPERIENCE.** (4 cr)
American attitudes toward family life from colonial times to the present as expressed in literature, the fine arts, and social history. The impact of Protestantism, democracy, capitalism, and reform movements, including women's rights, on the family ideal.
- 1376. HUMANITIES: TOPICS IN HUMANITIES AND LITERATURE.** (4 cr)
Topics vary from quarter to quarter and are listed in the *Class Schedule*. For full details, inquire at the department office prior to registration.
- 1401. LITERATURE FOR THE GENERAL READER.** (4 cr)
Analysis of literary structural forms and stylistic devices: poetry, drama, and prose fiction.
- 1442. NOVEL AND SHORT STORY.** (4 cr)
Analysis of selected European and American fiction. Emphasis on literary style in relation to themes of prose fiction.
- 1500. INTRODUCTION TO WORD PROCESSING.** (2 cr; prereq #: 5 weeks long; S-N only)
Individualized programmed instruction in the use of the Xerox 820 Word Processing System. Students work independently through five two-hour lessons, learning how to log onto the system, create and edit files, type and edit a text, use seven menus to perform basic text editing processes, and print a text. Three hours of lab time each week for practicing and conferring with instructor or lab assistant.
- 1506. ORIGINAL WRITING.** (3 cr)
Systematic analysis of short story techniques. Through reading and writing short stories, the student is acquainted with basic constants of the art. Emphasis is on writing, but the course also provides a different way of reading and appreciating short stories.
- 3166. SCIENTIFIC AND TECHNICAL GRAPHICS.** (4 cr; prereq #)
A survey of graphic methods of transferring scientific and technical knowledge. Designed to acquaint students with types and methods of using graphics in technical communication. Contemporary and historical overview of the use of graphics in scientific and technical disciplines. As many types of graphics as possible will be used in class: illustrated lecture, videotape, 35mm slides, and others.
- 3176. THE USE OF SCIENTIFIC AND TECHNICAL FILM.** (4 cr)
The uses of motion pictures as a communication tool by science and industry. Students learn to apply film concepts and aesthetics in evaluation of films. The emphasis is on theory rather than production.
- 3192. COMMUNICATION FOR INTERNATIONAL EXCHANGE GROUPS.** (3 cr; prereq intermediate knowledge of oral and written English)
Communication and culture among members of international exchange groups of similar national origins. Communication processes and skill areas; factors such as animal, interpersonal, nonverbal, and intercultural communication. Facets of American literature, painting, and architecture.

- 3254. ADVANCED PUBLIC SPEAKING.** (4 cr; prereq 1222)
Training for specific speech situations most likely to be encountered professionally. Emphasis on analysis, design, preparation, and delivery of presentations to provide greater flexibility within a variety of speech environments.
- 3266. COMMUNICATION, DISCUSSION IN SMALL GROUP DECISION MAKING.** (4 cr; prereq completion of freshman communication requirement)
Role of communication techniques in the small group decision-making process. Emphasis on discussion within a variety of decision-making modes such as voluntary groups, business meetings, and conflict groups.
- 3270. SPEECH: SPECIAL PROBLEMS.** (1-5 cr; prereq #)
Supervised reading and research on advanced speech-communication topics not covered in regularly scheduled speech offerings.
- 3280. AMERICAN WOMEN COMMUNICATORS.** (3-5 cr; prereq completion of freshman communication requirement)
Effective communication by American women traced historically; original texts of speeches by women (both in print and on tape) analyzed. Students examine the rhetoric used in available speeches and, where possible, evaluate the vocal delivery used. In a few cases, influential written communications will be considered where speech texts are unavailable. Individual research into special areas of American culture to discover influential women speakers or analyze the most important speeches of individual women.
- 3370. AMERICAN HUMANITIES.** (4 cr)
Examination of the American character and changes it has undergone in the 19th and 20th century as exemplified by the social, artistic, literary, and architectural record.
- 3374. HUMANITIES: SPECIAL PROBLEMS.** (1-2 cr; prereq #)
Primarily for supervised reading and research on topics not covered in regularly scheduled humanities offerings.
- 3375. HUMANITIES: AGRICULTURAL HERITAGE.** (4 cr)
Examination and analysis of significant events or periods affecting rural agricultural peoples as expressed in historical, cultural, and literary documents. Understanding of major values, attitudes, and philosophies related to agricultural change and development.
- 3381. HUMANITIES: 20TH-CENTURY CULTURE.** (4 cr)
The changing structure of 20th-century culture from World War I to the present. Communism, fascism, and democracy. Modern movements in literature, the visual arts, and architecture.
- 3473. CONTEMPORARY LIFE IN CONTEMPORARY LITERATURE.** (4 cr)
Reading and analysis of significant modern literary works.
- 3562. WRITING IN YOUR PROFESSION.** (4 cr; prereq 1101, 1104, 1151, and jr status)
Projects in professional writing. Relationship between structuring information to meet the needs of particular readers and writing effectively. Assignments such as the feasibility report, proposal, memorandum, letter of application, and résumé.
- 3572. GRAMMATICAL EDITING FOR TECHNICAL WRITERS.** (2 cr; prereq #; 5 weeks long; S-N only)
Students work independently through exercises in grammar and punctuation, learning proofreading marks and correcting manuscripts. Completing the exercises and passing a final exam required to receive credit. Not a remedial grammar course.
- 3700. RHETORICAL THEORY: PERSUASION AND THE LITERATURE OF SCIENCE.** (4 cr; prereq completion of freshman communication requirement)
Introduction to principles of rhetorical analysis. Emphasis on Aristotelian theory. Practice in rhetorical criticism of contemporary communication.
- 5000. PROFESSIONAL EXPERIENCE PROGRAM.** (4 cr; prereq #: S-N only; free elective for rhetoric undergrads; not for grad cr)
Professional experience in firms or government agencies through supervised practical experience; evaluative reports and consultations with faculty advisers and employers.
- 5100. TECHNICAL COMMUNICATION: SPECIAL PROBLEMS.** (Cr ar; prereq #)
Designed for supervised reading, research, and work on advanced technical communication projects not covered in regularly scheduled courses.
- 5147. EFFICIENT READING.** (4 cr)
Exploration of the adult reading process with emphasis on comprehension, speed, and vocabulary development. For persons of average or above-average reading ability who wish to develop and refine college-level reading skills and to understand linguistic, psychological, and physiological aspects of the complex human skill of reading. An evaluative paper and some seminar meetings are required. (Meets with 1147)
- 5150. DIRECTION OF TRAINING IN BUSINESS AND SERVICE ORGANIZATIONS.** (4 cr; prereq freshman communication or equiv)
Business, industrial, and service organizations and their in-post and out-post training programs. Scope and sequence of specialized training and development programs, job of typical director of training and development, and skills required for entry into field. Students visit a training and development office in a selected business or service organization and conduct descriptive research on effectiveness of program involved.

Course Descriptions

- 5165. STUDIES IN ORGANIZATIONAL COMMUNICATION, CONFLICT, AND CHANGE.** (4 cr; prereq freshman communication or equiv)
The roles of internal and external organizational communication, conflict-problem identification, and change processes. Contemporary theory and research in organizational development. Methods of problem identification and diagnosis. Change processes and applications to actual organizational settings.
- 5170. MANAGERIAL COMMUNICATIONS.** (4 cr; prereq freshman communication or equiv)
Systematic analysis of communication techniques and procedures for the manager. Emphasis on manager's ability to achieve vertical and horizontal understanding and acceptance. Readings, guest speakers, and a term project.
- 5175. PRINCIPLES OF LANGUAGE DEVELOPMENT.** (4 cr)
Analysis through history and semantics of principles of the English language. The course is based on the premise that an understanding of how English has evolved will generate a more enlightened attitude in its use.
- 5180. INTERNSHIP IN TECHNICAL COMMUNICATION.** (4-6 cr; prereq #)
Designed to give technical communication majors on-the-job experience at the University or in industry or government.
- 5257. SCIENTIFIC AND TECHNICAL PRESENTATIONS.** (4 cr; prereq 1222, 3562 or #)
Presentations for specific situations related to technical or scientific topics. Audience analysis and adaptation, techniques of support and visualization, organization for clarity and accuracy, and techniques of interpreting and answering questions. Students will make and evaluate technical and scientific presentations. Emphasis on seminar reports and professional conference papers.
- 5258. INTERVIEWING: DYNAMICS OF FACE-TO-FACE COMMUNICATION.** (4 cr)
Designed to improve intrapersonal and interpersonal skills in interviewing situations. Students learn to understand and use appraisal, reprimand, complaint, persuasion, problem solving, and counseling interview techniques, and participate in a research interview project. Equal emphasis on the interviewer and interviewee roles.
- 5375. HUMANITIES: SEMINAR IN AMERICAN AGRARIANISM.** (3 cr; prereq #)
Interdisciplinary seminar in humanities. The roots of the agrarian ideal in European thought and in early America. Individual research into and evaluations of the agrarian tradition in American social and political philosophy, and in history of imaginative literature, fine arts, and popular culture.
- 5400. DISSEMINATION AND UTILIZATION OF INFORMATION.** (4 cr; prereq jr, sr, or grad standing)
Methods and processes of using specialized information. Study of cases and development of materials for application in professional fields. Emphasis on channels for dissemination and utilization.
- 5500. RESEARCH IN COMMUNICATION STRATEGIES.** (4 cr; prereq #)
(Same as AgJo 5500) Introduction to basic research design and methodology in communication. Emphasis on application of various research methods to particular communication strategies or settings.
- 5551. REPORT AND THESIS WRITING.** (3 cr; prereq 3562 or #)
For graduate students and seniors actually working on reports or theses. Organization of reports and theses; library investigation; presentation of data; methods of documentation. Emphasis on revision of manuscripts and improvement in style of writing.
- 5571. WRITING FOR SPECIAL PURPOSES.** (2 cr; 5 weeks long; prereq technical communication major or minor, freshman communication, 3562 or #)
Analysis of and writing practice in a specific genre of practical writing (grant proposal, procedures and policies manual, operations manual, newsletter). Content varies from quarter to quarter.
- 5600. TRANSFER OF TECHNOLOGY.** (4 cr; prereq work experience in scientific communication or #)
(Same as AgJo 5600) Methods of transferring scientific and technical knowledge and practice. Review of research in diffusion and transfer methods at different technical levels. Tools, methodologies, and assessment procedures for managing a program. Assessment and design plan.
- 5700. COMMUNICATION IN TECHNOLOGICAL AND ENVIRONMENTAL IMPACT ASSESSMENT.** (4 cr; prereq sr or grad standing, one course in statistics, #)
Theories and processes involved in technological assessment and environmental impact statement preparation. Case studies of technology assessments, forecasts, and environmental impact statements. Term project on planning of process and project management in an actual impact assessment.

Soil Science (Soil)

- 1001. ORIENTATION TO SOIL SCIENCE.** (1 cr; S-N only)
Information discussions with teaching, research, and extension staff in the various disciplines of soil science. Visits to research and teaching facilities to acquaint students with department and faculty.

- 1122. INTRODUCTORY SOIL SCIENCE.** (4 cr; prereq Chem 1001 or 1004)
Basic physical, chemical, and microbiological properties of soil. Soil genesis, classification, and principles of soil fertility. Lectures and laboratory.
- 1262. INTRODUCTION TO METEOROLOGY.** (4 cr)
(Same as Geog 1425) Pre-calculus introduction to nature of atmosphere and its behavior. Atmospheric composition, structure, stability, and motion; precipitation processes, air masses, fronts, cyclones and anticyclones; general weather patterns; meteorological instruments and observations; plotting and analysis of maps; forecasting.
- 1428. SEMINAR: ORGANIC AGRICULTURE.** (1 cr; S-N only)
Round table discussions and assigned readings concerning organic farming methods.
- 3049. SOIL PHYSICS SURVEY.** (1 cr; prereq AEM 3016 or TAEM 3016, †AgET 3050)
Soil physical concepts and calculations most essential for agricultural engineering students in the IT curriculum. Lectures and laboratory.
- 3118. SEMINAR: SOIL POLLUTION AND PUBLIC POLICY.** (1 cr; S-N only; offered fall 1984 and alt yrs)
Round table discussions of assigned readings in the subject matter.
- 3210. PHYSICAL SOIL MANAGEMENT AND TILLAGE.** (4 cr; prereq 1122, Math 1111, Phys 1041 or #)
Physical characteristics of soil related to plant growth and development. Seedbed preparation, tillage, water storage and availability, soil heat, aeration and their modification for greater crop yields where feasible. Lecture and laboratory.
- 3218. SEMINAR: SOIL WATER, IRRIGATION, AND TILLAGE.** (1 cr; S-N only; offered winter 1984 and alt yrs)
Round table discussions of assigned readings in the subject matter.
- 3220. SOIL, WATER MANAGEMENT, AND CONSERVATION.** (3 cr; prereq 3210 or #)
Factors affecting soil and water losses. Effect of soil tillage methods and cropping systems on structure maintenance, erosion control, water storage, and infiltration. Techniques and organizations in soil and water conservation.
- 3416. SOIL FERTILITY.** (5 cr; prereq 1122)
Fundamental concepts in soil fertility evaluation. Emphasis on the dynamics of mineral elements in the soil and evaluation and interpretation of plant and soil relationships. Introduction to diagnostic techniques through measurement of specific soil fertility parameters. Lectures and laboratory.
- 3418. SEMINAR: REMOVAL OF PLANT NUTRIENTS FROM SOILS BY PERCOLATION, RUNOFF, AND EROSION.**
(1 cr; S-N only; offered winter 1985 and alt yrs)
Round table discussions of assigned readings in the subject matter.
- 3419. FERTILIZER TECHNOLOGY.** (2 cr; prereq 3416 or #)
Introduction to the theory and principles of fertilizer manufacture, fertilizer mixing, and fertilizer application procedures used in agronomic and horticultural operations.
- 3428. SEMINAR: SOIL FERTILITY AND SOIL AMENDMENTS.** (1 cr; S-N only; offered winter 1985 and alt yrs)
Round table discussions and assigned readings.
- 3518. SEMINAR: FFA LAND JUDGING.** (1 cr; S-N only)
Discussions of and use of the high school FFA soil judging scorecard.
- 3520. SOIL MORPHOLOGY, CLASSIFICATION, AND GENESIS.** (4 cr; prereq 1122)
Field observation and identification of the morphological characteristics of soils. Interpretation of soil profiles for water-related characteristics. Identification of soil landscapes and the influence of soil-forming factors on soil morphology. Lecture and field laboratory.
- 3528. SEMINAR: USE AND INTERPRETATION OF SOIL SURVEYS.** (1 cr; S-N only; offered fall 1983 and alt yrs)
Round table discussions of assigned readings in the subject matter.
- 3548. SEMINAR: USE AND MANAGEMENT OF ORGANIC SOILS.** (1 cr; S-N only; offered fall 1983 and alt yrs)
Round table discussions and assigned readings.
- 3610. SOIL BIOLOGY.** (4 cr; prereq 1122 and PIPa 1001 or #)
The soil environment and its biological population. Role of living organisms in the soil-plant environment and cyclic transformations of agronomic interest (carbon, nitrogen, and mineral substances). Effect of soil microflora on soil fertility and plant nutrition. Lectures and laboratory.
- 3618. SEMINAR: BIOLOGICAL NITROGEN FIXATION.** (1 cr; S-N only; offered winter 1984 and alt yrs)
Round table discussions and assigned readings.
- 3918. SENIOR SEMINAR.** (1 cr; prereq jr or sr)
Techniques in seminar preparation and presentation for soil scientists. Presentation of selected research topics.
- 5000. PROFESSIONAL EXPERIENCE PROGRAM.** (4 cr; prereq 12 cr in soils and #; not for grad cr)
Up to 12 weeks of experience in a position related to soil science. Evaluation of work experience by employer and faculty adviser in consultation with student and employer.

Course Descriptions

- 5099. RCD INTERDISCIPLINARY SEMINAR I.** (4 cr, 5099-5100†. \$AgEc 5099, \$AgET 5099, \$LA 5099, \$RCD 5099; prereq sr or #)
Selected speakers, readings, and discussion topics dealing with resource and community development analysis and implications for resource allocation. Discussions reflect diverse disciplinary contributions.
- 5100. RCD INTERDISCIPLINARY SEMINAR II.** (4 cr, 5099-5100†. \$AgEc 5100, \$AgET 5100, \$RCD 5100; prereq 5099)
Designed to help students develop the ability to identify and analyze resource development problems. Discussions reflect diverse disciplinary contributions. Students participate as members of a team, combining disciplinary skills. Guest speakers and student assignments.
- 5104. AGRICULTURAL SYSTEMS ANALYSIS AND MODELING.** (4 cr, \$PIPa 5104, \$AgEc 5104, \$AnSc 5104; prereq Math 1142 or #)
Introduction to bioeconomic modeling as preparation for interdisciplinary agricultural systems analysis. Basic concepts; deterministic and stochastic models; delays, feedback, and clockwork; data acquisition; model verification and validation; role of models for agroecosystem management.
- 5114. SPECIAL PROBLEMS IN SOILS.** (1-5 cr [may be repeated for max 10 cr]; prereq 1122 or #)
Research, readings, and instruction.
- 5228. SEMINAR: CLIMATOLOGY, METEOROLOGY, AND AGRICULTURE.** (1 cr per qtr [max 3 cr]; prereq #: offered fall, winter, and spring)
Round table discussions and assigned readings.
- 5230. SOIL-PLANT-WATER RELATIONS.** (3 cr; prereq 1122, general botany course)
Principles of plant interaction with soil and water; evapotranspiration; nutrient availability. Emphasis on processes at the root-soil interface such as water and nutrient transport and uptake.
- 5232. SOIL PHYSICS.** (5 cr; prereq Math 1142, 2 qtrs physics or # or #)
Basic physical laws governing processes occurring in soils and their quantification. Physical basis for water, air, and heat transport processes. Lectures, laboratory demonstrations, and problem-solving help sessions.
- 5240. MICROCLIMATOLOGY (SOILS).** (5 cr; prereq Math 1111, 10 cr physics or #)
Meteorology and climatology in relation to the soil-atmosphere interface, with emphasis on the microclimate, physical processes taking place within the microclimate, modification of the microclimate by human activities including agricultural practices, description of meteorological instruments, and use of weather data.
- 5310. SOIL CHEMISTRY.** (4 cr; prereq 1122, analytical chemistry or #: offered 1984-85 and all yrs)
Composition of soil mineral and organic matter. Solubility models applied to mineral stability. Oxidation reduction, acidity and pH, ion exchange. Acid, alkaline, calcareous, and alkali soils.
- 5340. ORGANIC AND PESTICIDAL RESIDUES.** (5 cr; prereq 1122, sr or #)
The fate of crop residues, animal wastes, sewage materials, petroleum hydrocarbons, detergents, and pesticides in soils with emphasis on the chemical, physical, and biological factors of the soil that influence decomposition or persistence.
- 5360. SOIL CLAY MINERALOGY.** (4 cr; prereq sr or grad)
Origin, extent, importance, and identification of soil clay minerals. Crystalline and non-crystalline. Pedologic implications.
- 5416. SOIL FERTILITY.** (4 cr, \$3416; prereq 1122)
Fundamental concepts in soil fertility evaluation. Emphasis on dynamics of mineral elements in the soil and evaluation and interpretation of plant and soil relationships. Introduction to diagnostic techniques through measurement of specific soil fertility parameters. Lectures, laboratory, and discussion.
- 5424. APPLIED CLIMATOLOGY.** (3 cr; prereq 5140 or Geog 3421 or #)
Intended for advanced undergraduates and beginning graduate students who have a background in the principles of climatology or microclimatology. Sources of climatic data, methods of analysis, and selected set of specific applications that focus on agricultural and environmental management problems.
- 5510. MORPHOLOGY, CLASSIFICATION, AND GENESIS OF SOILS.** (4 cr, \$3520; not open to soil science and soil and water science majors; prereq 1122)
Field observation and identification of the morphological characteristics of soils. Interpretation of soil profiles for water-related characteristics. Identification of soil landscapes and the influence of soil-forming factors on soil morphology. Lecture and field laboratory.
- 5515. SOIL DEVELOPMENT, CLASSIFICATION, AND GEOGRAPHY.** (4 cr; prereq 3520 or #)
Soil profile characteristics; influence of parent material, climate, topography, vegetation, and time on soil development; system of soil classification, and geographical distribution of soil orders.
- 5532. SOILS AND THE ECOSYSTEM.** (5 cr; may be taken in place of EBB 5819; prereq course in ecology; offered at Itasca in summer)
Functional and structural aspects of soils as a component of the ecosystem. Interrelationships of soil and vegetation on the landscape.

- 5540. SOIL RESOURCES AND ENVIRONMENTAL RELATIONSHIPS.** (2 cr; prereq 1122 or #)
Current types of soil resource concepts, land use as related to soils, and interactions of technology on the soil environment. Possible short- and long-term effects of fertilizers, soil amendments, and other substances on the soil-water ecosystem.
- 5550. PEATLANDS: FORMATION, CLASSIFICATION, AND UTILIZATION.** (3 cr; prereq 1122 or #)
Formation, properties, and management of peatlands important to crop, forestry, and energy production in this state and worldwide. Lecture.
- 5560. USES AND INTERPRETATION OF SOIL SURVEY INFORMATION.** (3 cr; prereq 3520 or #)
Techniques used in preparing soil maps of varying scales. Information available from soil maps and accompanying reports evaluated for use in agriculture, engineering, waste treatment, forestry, and land planning. How soil survey information can be used to the fullest extent by both laypersons and the scientific community.
- 5570. FIELD TOUR OF MINNESOTA SOILS.** (3 cr; prereq 3520 or #)
Two-week field tour of both northern and southern Minnesota's soils. Soil formation, soil profiles, land use and management practices discussed while visiting representative soils. Travel expenses are student's responsibility.
- 5632.* SOIL MICROBIOLOGY AND PLANT GROWTH.** (4 cr, §5612; prereq 1122 and course in microbiology or #)
The soil environment. Microbiological population of the soil. Role of microorganisms in the soil-plant environment and cyclic transformations of agronomic interest (carbon, nitrogen, and mineral substances). Effect of soil microflora on soil fertility and plant nutrition. Lectures and laboratory.
- 5710. ADVANCED FOREST SOILS.** (3 cr [4 cr with paper]; prereq 1122, FR 5114)
Factors affecting tree growth; estimation, modification, and management effects on site productivity; regeneration.

FOR GRADUATE STUDENTS ONLY

(For course descriptions, see the *Graduate School Bulletin*)

8111. COLLOQUIA IN SOIL SCIENCE
8122. ADVANCED SOIL SCIENCE
8124. RESEARCH PROBLEMS IN SOILS
8128. SEMINAR
8250. FLUID FLOW IN SOILS
8330. ADVANCED SOIL CHEMISTRY AND MINERALOGY

Courses in Programs Serving All Departments in the College of Agriculture

Agriculture (Agri)

- 1000. ACADEMIC ENRICHMENT AND HONORS PROGRAM: SPECIAL PROJECTS.** (1-15 cr; S-N only; prereq acceptance for Special Projects Grant, agriculture major only)
Pursuit of a special interest in depth as an alternative to regular classroom activities. Requires submission of a proposal describing the project, including estimation of its duration and a tentative expense budget (funds of up to \$400 are available for approved projects). For further information, check with the college office.
- 1001. LEADERSHIP DEVELOPMENT: INDEPENDENT STUDY.** (2 cr [may be repeated for max 6 cr]; S-N only; prereq agriculture major, #)
Leadership development seminar for undergraduates. Theories of leadership, leadership styles, leadership skills. Students work with mentors from business, education, and government.

Plant Physiology (PIPH)

Students in the College of Agriculture may be interested in the following courses in plant physiology. With the approval of your adviser, you may use the introductory courses in plant physiology in partial fulfillment of the science requirement. You may take 3000- and 5000-level courses in plant physiology after you have completed the necessary prerequisites. These courses introduce the field of plant physiology and illustrate how knowledge in this special area of plant science may be utilized in private and government research and in

Course Descriptions

college and university teaching and research. If you are interested in plant physiology as a professional career, contact one of the faculty members listed in this area in the *Graduate School Bulletin*.

- 3131. SURVEY OF PLANT PHYSIOLOGY.** (4 cr, §5131, §Bot 3131, §5131; prereq Biol 1103 or 3012, BioC 1302 or *BioC 1302 or Biol 5001)
Physiological principles underlying processes that occur in living plants with emphasis on higher plants. Growth and development, mineral nutrition, transport, water relations, and metabolism with emphasis on photosynthesis and nitrogen assimilation. For laboratory see PIPh 5132.
- 5131. SURVEY OF PLANT PHYSIOLOGY.** (4 cr, §3131, §Bot 3131, §Bot 5131; prereq Biol 1103 or 3012, BioC 1302 or *BioC 1302 or Biol 5001)
Same as PIPh 3131 with the addition of a weekly discussion and advanced reading session.
- 5132. PLANT PHYSIOLOGY LABORATORY.** (2 cr, §Bot 5132; prereq 5131 or *5131)
Laboratory course to accompany PIPh 3131 and 5131.
- 5167.* PHYSIOLOGY OF THE PLANT CELL.** (3 cr; prereq plant anatomy, inorganic and organic chemistry or biochemistry; offered 1984-85 and all yrs)
Characteristics of the living state, general aspects of cell metabolism, development of the cell, polarity, differentiation, and irritability of the cell and cellular movements.
- 5168.* EXPERIMENTAL PROTOPLASMATOLOGY.** (3 cr; prereq #; offered 1983-84 and all yrs)
Physical and physicochemical properties of living protoplasm in plant cells including viscosity, wall attachment, permeability, primary and secondary fluorescence, and vital staining.
- 5182.* PLANT METABOLISM.** (3 cr, §Bot 5182; prereq 5131, a course in biochemistry)
Plant metabolism including photosynthesis, respiration, and synthesis of macromolecules by plants. Structure-function relations at the plant, cell, and subcellular level. Energy flow in the plant system and regulation of plant metabolism.
- 5183.* WATER, MINERALS, AND TRANSLOCATION.** (4 cr, §Bot 5183; prereq 5131)
Membrane phenomena and osmotic properties of cells. Uptake, movement, and loss of water in plants including effects of external factors. Translocation of organic substances. Absorption, distribution, and function of inorganic elements.
- 5184.* PLANT GROWTH AND DEVELOPMENT.** (3 cr, §Bot 5184; prereq 5131)
Control of seed germination, mobilization of macromolecular breakdown products during germination and seedling growth, photomorphogenesis, chloroplast development, flowering and photoperiodism, fruit development and ripening, seed formation, senescence, mechanism of action of plant growth substances.
- 5185.* PHYSIOLOGY OF PHOTOSYNTHETIC MICROORGANISMS.** (3-5 cr; prereq #; offered 1984-85 and all yrs)
Primarily a lecture course. Applications of spectrophotometry, manometry, and other techniques toward elucidation of physiological behavior, chemical makeup, and intermediary metabolism of algae and photosynthetic bacteria.
- 5188.* RESEARCH PERSPECTIVES IN PLANT PHYSIOLOGY.** (Cr ar; prereq Chem 3100, 3101, 8 cr biochemistry, #)
A laboratory course in which the student undertakes a well-defined research problem of limited scope.
- 5703. INTERNAL WATER BALANCE.** (3 cr; prereq #; offered 1983-84 and all yrs)
Laboratory course in which components of water balance in plants (turgor, osmotic, water potentials) are measured using various techniques. Matching method to experimental goals.
- 5721, 5723, 5725, 5726. METHODS OF PLANT ANALYSIS.** (Cr ar; prereq Chem 3100, 3101, 8 cr biochemistry, #)
In-depth experimental laboratory approach to microscopic analysis, sample preparation, fractionation, isolation, and measurement of plant compounds employing modern methods of plant physiology. Independent units in:
- 5721. **The Primary Plant Metabolites.** (Cr ar; offered 1984-85 and all yrs)
 - 5723. **Plant Hormones and Tissue Culture.** (Cr ar; offered every yr)
 - 5725. **Plant Nucleic Acids.** (Cr ar; offered 1983-84 and all yrs)
 - 5726. **Analysis of Cell Structure.** (Cr ar; offered 1984-85 and all yrs)
- 5970.* SPECIAL PROBLEMS IN PLANT PHYSIOLOGY.** (Cr ar)
Research, readings, instruction.

FOR GRADUATE STUDENTS ONLY

(For course descriptions, see the *Graduate School Bulletin*)

8055. SOURCE-SINK RELATIONS

8251. SEMINAR: PLANT PHYSIOLOGY

- 8281.* GROWTH AND DIFFERENTIATION OF PLANTS
- 8282.* ADVANCED TOPICS IN PLANT METABOLISM
- 8285. PHOTOSYNTHESIS
- 8310. METHODS IN PLANT PHYSIOLOGY

Additional courses dealing with topics related to plant physiology are offered by several other University departments. Interested students should consult listings in agronomy, horticultural science, plant pathology, and soil science (College of Agriculture); biochemistry, botany, and ecology (College of Biological Sciences); and forest resources (College of Forestry).

Resource and Community Development (RCD)

- 1010. ISSUES IN THE ENVIRONMENT. (3 cr)
Interdisciplinary offerings exploring five areas of environmental concern: aspects of environmental design that provide maximum compatibility of human beings with their environment, sources of water pollution and their control, disposal and control of solid wastes from agriculture, minimization of pesticide pollution of the environment, and managed use of forest resources to maintain environmental quality. A televised course involving 20 taped lectures and 10 discussion periods.
- 3010. THE MINNESOTA COMMUNITY: ANALYSIS OF ITS ORGANIZATION, CHANGE, AND DEVELOPMENT. (4 cr; prereq one social science course and #)
Community problem solving and decision making. How local problems are defined, what communities can do in dealing with their problems, and how information (primarily scientific knowledge) may be applied to local problems. Conceptual analysis of communities and their problems. Secondary data analysis as a research technique for use in analysis of community problems in Minnesota.
- 3118. SEMINAR: SOIL AND WATER POLLUTION AND PUBLIC POLICY. (1 cr, §Soil 3118; S-N only; offered fall 1984 and alt yrs)
Public policies as they influence land use and soil and water resources.
- 5099. INTERDISCIPLINARY SEMINAR I. (4 cr, 5099-5100†, §AgEc 5099, §AgET 5099, §LA 5099, §Soil 5099; prereq resource and community development sr or #)
Selected speakers, readings, and discussion topics dealing with resource and community development analysis and implications for resource allocation. Students participate as a team, combining skills to analyze complex resource problems.
- 5100. INTERDISCIPLINARY SEMINAR II. (4 cr, 5099-5100†, §AgEc 5100, §AgET 5100, §LA 5100, §Soil 5100; prereq 5099 or #)
(Continuation of 5099) Papers, presentations, and critiques on selected complex resource problems in Seminar I.
- 5110. SPECIAL PROBLEMS. (1-4 cr [may be repeated for max 12 cr]; prereq resource and community development sr, #)
Projects, plans, and written reports related to 5100, 5101; resource and environmental inventory and analysis.
- 5120. ENVIRONMENTAL PROBLEMS. (3 cr, §1010)
Interdisciplinary offering exploring five areas of environmental concern: aspects of environmental design that provide maximum compatibility of human beings with their environment, sources of water pollution and their control, disposal and control of solid wastes from agriculture, minimization of pesticide pollution of the environment, and managed use of forest resources to maintain environmental quality. A televised course involving 22 taped lectures and 10 discussion periods. Report on a specific environmental problem also required. Offered in Extension only.
- 5200. COMMUNITY DEVELOPMENT SIMULATION. (4 cr for undergrad, 3 cr for grad; prereq #)
Participation in a water and land resource use and a fiscal management simulation of a community development process. Use of gaming simulation techniques in devising, testing, and negotiating alternative strategies of environmental and economic regulation and in assessing their private and social costs.

Rural Sociology (Soc)

- 1651. RURAL SOCIOLOGY. (4 cr)
Factual data necessary to understand problems of rural social life.

Course Descriptions

- 5315. LATIN AMERICAN SOCIETIES IN TRANSITION.** (4 cr; prereq 12 cr in sociology, economics, anthropology or political science or #)
Relationship of population, technology, and organization structure to levels of modernization among Latin American nations. Differentiation, diffusion, innovation, and social conflict as precipitants of social change.
- 5651. RURAL SOCIAL INSTITUTIONS.** (4 cr; prereq any 3xxx sociology course or equiv or #)
Factors in the rural environment that condition the functioning of rural social institutions—family, school, church, local government, health, welfare.
- 5661. RURAL COMMUNITY ANALYSIS.** (4 cr; intended for persons in rural community organization, rural teaching, extension work, and related fields; prereq any 3xxx sociology course or equiv or #)
Tools, techniques, and methods of making community field studies.
- 5671. COMPARATIVE RURAL SOCIETIES: LATIN AMERICAN.** (4 cr; prereq 12 cr in sociology, anthropology, economics or political science or #)
Social and cultural change in Latin America. Demographic and ecological characteristics, institutional structure and its accompanying associations; linkages with outside and world views.
- 5675. WORLD FOOD SUPPLY PROBLEMS.** (4 cr, \$AgEc 5790, \$FScN 5643, \$PIPa 5220, \$LACS 5280; prereq major in agriculture, veterinary medicine, nutritional sciences, social science field or #...grad students by Δ only)
Multidisciplinary approach to social, economic, and technical problems of feeding the world's growing population. Principles from social, plant, animal, and nutritional sciences and their application to food problems analyzed.

FOR GRADUATE STUDENTS ONLY

(For course descriptions, see the *Graduate School Bulletin*)

- 8651, 8652, 8653. SEMINAR: RURAL SOCIOLOGY.** (3 cr per qtr; offered when feasible)
- 8661. SEMINAR: RESEARCH METHODS IN RURAL SOCIOLOGY.** (3 cr; offered when feasible)

Statistics (Stat)

- 1051. INTRODUCTION TO IDEAS OF STATISTICS.** (4 cr; prereq high school higher algebra)
Presentation and analysis of data. Probabilistic models for inference. Inference and decision procedures. Emphasis on concepts rather than computation.
- 3081. EXPERIMENTAL TECHNIQUES AND STATISTICAL INFERENCE.** (5 cr; prereq college algebra; open only to agriculture students)
Sampling, variability, description and analysis of data, tests and confidence intervals, multiple comparisons; choosing experimental design, material, and size. Introduction to correlation and regression.
- 3091. INTRODUCTION TO PROBABILITY AND STATISTICS.** (4 cr, §5121, §5131; prereq differential and integral calculus)
Elementary probability and probability distributions, sampling and elements of statistical inference. Treatment more mathematical than that in 1051.
- 5021. STATISTICAL ANALYSIS I.** (5 cr; prereq college algebra or #)
Frequency distributions; descriptive statistics; elementary probability; binomial, Poisson, and normal distribution; estimation and testing; analysis of variance; multiple comparisons; linear regression.
- 5022. STATISTICAL ANALYSIS II.** (5 cr; prereq 5021 or #)
(Continuation of 5021) Multiple regression and correlation; multiway analysis of variance, variance components, covariance; elementary principles of design; basic nonparametric methods.
- 5101. INTRODUCTION TO DECISION THEORY.** (4 cr, §5132; prereq Econ 5111 or Math 1142 or 1211 or #)
Elements of probability; basic concepts in statistical decision theory; relationship to game theory and other types of decision problems; prediction and inference.
- 5121-5122. THEORY OF STATISTICS.** (4 cr per qtr, §5131-5132-5133; prereq Math 1231 or 1331 or 1621)
Univariate and multivariate distributions, law of large numbers, sampling, likelihood methods, estimation and hypothesis testing, regression and analysis of variance and covariance, confidence intervals, and distribution-free methods.
- 5131-5132-5133. THEORY OF STATISTICS.** (4 cr per qtr, §5121-5122; prereq Math 3211 or 3411)
5131: Probability models, univariate and bivariate distributions, independence, and basic limit theorems. 5132-5133: Statistical decision theory, sampling, estimation, testing hypotheses, parametric and nonparametric procedures for one-sample and two-sample problems, regression, and analysis of variance. Treatment more mathematical than that of 5121-5122.

Large Animal Clinical Sciences

- 5201. SAMPLING METHODOLOGY IN FINITE POPULATIONS.** (4 cr; prereq 5021 or 5121 or 3091 or #)
Simple random, systematic, stratified, and unequal probability sampling. Ratio and regression estimation. Multistage and cluster sampling.
- 5211. THEORY OF SAMPLE SURVEYS.** (4 cr; prereq 5122 or 5133)
Mathematical treatment of survey sampling, including stratified and multistage sampling, models for nonsampling errors.
- 5271-5272. BAYESIAN DECISION MAKING.** (4 cr. §Econ 5271-5272; prereq *5122 or *5132 for 5271...5122 or 5132. Econ 1002 for 5272...5271 recommended for 5272)
5271: Axioms for personal probability and utility. Elements of statistical decision theory. Bayesian analysis of linear models. 5272: Expected utility models for economic decisions made under conditions of uncertainty. Application to portfolio selection, forward and futures trading, betting, contingency markets, and business planning.
- 5301. DESIGNING EXPERIMENTS.** (4 cr; prereq 5022 or 5122 or 5133 or #)
Control of variation, construction, and analysis of complete and incomplete block, split plot, factorial, and groups of similar experiments. Confounding, crossover, and optimum seeking designs.
- 5302. APPLIED REGRESSION ANALYSIS.** (4 cr; prereq 5022 or 5122 or 5133 or #)
Simple, multiple, and polynomial regression. Estimation, testing, and prediction. Stepwise and other numerical methods: examination of residuals; weighted least squares; nonlinear models; response surface. Experimental research and economic applications.
- 5401. INTRODUCTION TO MULTIVARIATE METHODS.** (4 cr; prereq 5022 or 5122 or #)
Bivariate and multivariate distributions. Inference on multivariate normal distributions. Discrimination and classification. Multivariate analysis of variance. Partial, canonical correlation and independence. Principal component analysis, factor analysis, analysis of repeated measurements, cluster analysis, and profile analysis.
- 5421. ANALYSIS OF CATEGORICAL DATA.** (4 cr; prereq 5022 or 5122 or 5133 or #)
Varieties of categorical data, cross-classifications and contingency tables, tests for independence. Multidimensional tables and log-linear models, maximum-likelihood estimation, and tests of goodness-of-fit. Analysis of Markov chain data. Smoothing counts.
- 5601. NONPARAMETRIC METHODS.** (4 cr; prereq 5022 or 5122 or #)
Necessary discrete and continuous probability distributions. Goodness-of-fit, sign tests, order statistics, rank tests for location and for scale, two-sample and k-sample comparisons, association. Methods and applications.
- 5900. TUTORIAL COURSE.** (Cr ar; prereq #)
Study in areas not covered by regular offerings. Directed study.
- 5911-5912-5913. TOPICS IN STATISTICS.** (3 cr per qtr [may be repeated for cr with Δ]; prereq 5122 or 5133 and #)
Topics vary.

Courses in the College of Veterinary Medicine Available to College of Agriculture Students

Large Animal Clinical Sciences (LACS)

- 3502. ANIMAL HEALTH AND DISEASE.** (5 cr)
Designed for non-veterinary medicine student to give a broad understanding of veterinary science as it applies to health and disease of domestic animals. Emphasis on basic concepts of disease and common animal diseases. How stress and management practices aggravate and create new disease conditions.
- 5280. SEMINAR: WORLD FOOD SUPPLY PROBLEMS.** (4 cr. §AgEc 5790, §Agro 5200, §FScN 5643, §Soc 5675; prereq major in agriculture, veterinary medicine, nutritional sciences, social science field or #...grad students by Δ only)
A multidisciplinary approach to the social, economic, and technical problems of feeding the world's growing population. Principles sought from the social, economic, plant, animal, and nutritional sciences for their application to food problems.
- 5650. VETERINARY EPIDEMIOLOGY.** (3 cr; prereq 10 cr biology, 12 cr chemistry or #)
Principles of epidemiology, ecology, and veterinary public health. Biostatistics applied to the measurement of health and disease in populations.

Course Descriptions

Veterinary Biology (VB)

- 1120. COMPARATIVE VERTEBRATE MORPHOLOGY.** (5 cr; recommended for pre-veterinary medicine students; prereq Biol 1106 or #)
Interpretation of vertebrate morphology, morphogenesis, and function with emphasis on phylogeny and adaptive significance.
- 5120. COMPARATIVE VERTEBRATE MORPHOLOGY**
Same as VB 1120.
- 5140. VERTEBRATE MICROANATOMY.** (1-6 cr; prereq 5120 or #)
The microscopic structure and cytochemical and functional aspects of cells, tissues, and organs of representative examples of vertebrates. Four units: basic tissues (2 cr); gastrointestinal tract (1 cr); respiratory and integumentary systems (1 cr); excretory, reproductive, and endocrine systems (2 cr). Depending on background and interest, students may elect to register for any or all units.
- 5320. AVIAN PHYSIOLOGY.** (5 cr; prereq 6 cr systemic physiology or equiv, #; offered winter 1984 and alt yrs)
Physiology of wild and domestic birds.
- 5330. WILD BIRD MEDICINE.** (2 cr; prereq third or fourth yr or grad student or #)
Brief summary of important aspects of avian anatomy and physiology. Survey of diseases common to wild birds and surgical repair of common injuries and fractures.

Veterinary Medicine, College of (CVM)

- 1100. ORIENTATION TO VETERINARY MEDICINE.** (1 cr)
History of the veterinary profession, careers within the profession, and employment trends. Resources available to those interested in a career in the profession, including the College of Veterinary Medicine and the Animal Health Technology courses offered in Minnesota.

Veterinary Pathobiology (VPB)

- 3103. GENERAL MICROBIOLOGY.** (5 cr; not open to veterinary medicine students; prereq 10 cr chemistry, 4 cr biological sciences)
Lectures and laboratory exercises concerning the morphology, taxonomy, genetics, physiology, and ecology of microorganisms. Practical application of fundamental principles of microbiology to other phases of science and industry.
- 5603. PARASITES OF WILDLIFE.** (3 cr; prereq #; offered 1985 and alt yrs)
Biologic relationships of animal parasites and disease to regional wildlife.
- 5604. DISEASES OF WILDLIFE.** (3 cr; offered 1984 and alt yrs)
Economic and biologic relationships of infectious and noninfectious diseases of wildlife.
- 5707. POULTRY DISEASE CONTROL.** (3 cr; not open to veterinary medicine students; prereq Biol 1102, AnSc 1100, MicB 3103 or equiv)
General anatomy; physiology of digestion and reproduction; prevention and control of the more important diseases affecting poultry.

IV. FACULTY

Agricultural and Applied Economics

Professor Emeritus

O. Uel Blank, Ph.D.
Willard W. Cochrane, Ph.D.
Selmer A. Engene, Ph.D.
John S. Hoyt, Ph.D.
Harald R. Jensen, Ph.D.
Lee R. Martin, Ph.D.
Frank J. Smith, Ph.D.

Professor

G. Edward Schuh, Ph.D., *head*
Fred J. Benson, Ph.D.
Boyd M. Buxton, Ph.D.
Dale C. Dahl, Ph.D.
Reynold P. Dahl, Ph.D.
K. William Easter, Ph.D.
Kenneth E. Egertson, M.S.
Vernon R. Eidman, Ph.D.
Earl I. Fuller, Ph.D.
Jerome W. Hammond, Ph.D.
Paul R. Hasbargen, Ph.D.
Richard O. Hawkins, M.S.
John D. Helmberger, Ph.D.
Clifford G. Hildreth, Ph.D.
James P. Houck, Ph.D.
Wilbur R. Maki, Ph.D.
Glenn L. Nelson, Ph.D.

Willis L. Peterson, Ph.D.
Malcolm J. Purvis, Ph.D.
Philip M. Raup, Ph.D.
Terry L. Roe, Ph.D.
Gordon D. Rose, Ph.D.
Vernon W. Ruttan, Ph.D.
Wesley B. Sundquist, Ph.D.
Kenneth H. Thomas, Ph.D.
John J. Waelli, Ph.D.
Arlie D. Waldo, Ph.D.
Delane E. Welsch, Ph.D.

Associate Professor

Jeremiah E. Fruin, Ph.D.
Robert P. King, Ph.D.
Jean L. Kinsey, Ph.D.
Benjamin H. Senauer, Ph.D.
Robert W. Snyder, Ph.D.
Thomas F. Stinson, Ph.D.
Carole B. Yoho, M.S.

Assistant Professor

Jeffrey D. Aplan, Ph.D.
Karen M. Brooks, Ph.D.
Theodore Graham-Tomasi, Ph.D.
C. Ford Rung, Ph.D.
Jerry Lee Thompson, Ph.D.

Agricultural Education

Professor

R. Paul Marvin, Ph.D., *head*
W. Forrest Bear, Ph.D.
George H. Copa, Ph.D.
Curtis D. Norenberg, Ph.D.

Edgar A. Persons, Ph.D.
Gordon I. Swanson, Ph.D.

Associate Professor

Gary W. Leske, Ph.D.
Roland L. Peterson, Ed.D.

Agricultural Engineering

Professor

Frederick G. Bergsrud, M.S., *head*
Evan R. Allred, M.S.
Donald W. Bates, M.S.
W. Forrest Bear, Ph.D.
Harold A. Cloud, Ph.D.
Arnold M. Flikke, Ph.D.
Kenneth A. Jordan, Ph.D.
Curtis L. Larson, Ph.D.
Roger E. Machmeier, Ph.D.
R. Vance Morey, Ph.D.
Cletus E. Schertz, Ph.D.
John Strait, M.S.
David R. Thompson, Ph.D.
John A. True, M.S.

Associate Professor

Phillip R. Goodrich, Ph.D.
Robert J. Gustafson, Ph.D.
Donald C. Slack, Ph.D.

Assistant Professor

Larry D. Jacobson, Ph.D.
Kevin A. Janni, Ph.D.
Charles A. Onstad, Ph.D.
Jerry A. Wright, M.S.
Robert A. Young, Ph.D.

Instructor

Charles J. Clanton, M.S.
Hal D. Werner, M.S.

Information and Agricultural Journalism

Professor

Donald E. Wells, Ph.D., *head*
Harold B. Swanson, Ph.D.

Wesley Grabow, Ph.D.
John M. Sperbeck, M.S.

Assistant Professor

Mary Kay O'Hearn, B.A.

Associate Professor

Donald Breneman, M.A.

Agronomy and Plant Genetics

Professor Emeritus

Charles R. Burnham, Ph.D.
Jean W. Lambert, Ph.D.

Professor

Herbert W. Johnson, Ph.D., *head*
Robert N. Andersen, Ph.D.
Donald K. Barnes, Ph.D.
Richard Behrens, Ph.D.
William A. Brun, Ph.D.
Robert H. Busch, Ph.D.
Vernon B. Cardwell, Ph.D.
Verne E. Comstock, Ph.D.
R. Kent Crookston, Ph.D.
Laddie J. Elling, Ph.D.
Jon L. Geadelmann, Ph.D.
Burlie G. Gengenbach, Ph.D.
John A. Goodding, Ph.D.
Gary H. Heichel, Ph.D.
Dale R. Hicks, Ph.D.
Gordon C. Marten, Ph.D.
Neal P. Martin, Ph.D.
Gerald R. Miller, Ph.D.

Ervin A. Oelke, Ph.D.
Ronald L. Phillips, Ph.D.
Donald C. Rasmusson, Ph.D.
Robert G. Robinson, Ph.D.
Lawrence H. Smith, Ph.D.
Oliver E. Strand, Ph.D.
Robert E. Stucker, Ph.D.
Deon D. Stuthman, Ph.D.
Carroll P. Vance, Ph.D.

Associate Professor

Leland L. Hardman, Ph.D.
Robert J. Jones, Ph.D.
Howard W. Rines, Ph.D.
Craig C. Sheaffer, Ph.D.
Steve R. Simmons, Ph.D.
Donald L. Wyse, Ph.D.

Assistant Professor

Lynn W. Gallagher, Ph.D.
John W. Gronwald, Ph.D.
Robert D. McGraw, Ph.D.
James H. Orf, Ph.D.

Animal Science

Professor

Richard D. Goodrich, Ph.D., *head*
Paul B. Addis, Ph.D.
C. Eugene Allen, Ph.D.
Robert D. Appleman, Ph.D.
Raymond L. Arthaud, Ph.D.
Robert W. Berg, Ph.D.
William J. Boylan, Ph.D.
Charles J. Christians, Ph.D.
Bo G. Crabo, Ph.D.
John D. Donker, Ph.D.
Richard J. Epley, Ph.D.
Edmund F. Graham, Ph.D.
Melvin L. Hamre, Ph.D.
Jerry D. Hawton, Ph.D.
Alan G. Hunter, Ph.D.
Robert M. Jordan, Ph.D.
Jay C. Meiske, Ph.D.
J. William Mudge, Ph.D.
Donald E. Otterby, Ph.D.
Richard E. Phillips, Ph.D.

William E. Rempel, Ph.D.
Robert N. Shoffner, Ph.D.
Paul E. Waibel, Ph.D.
Jesse B. Williams, Ph.D.
Charles W. Young, Ph.D.

Associate Professor

William R. Dayton, Ph.D.
Mohamed E. El. Halawani, Ph.D.
James G. Linn, Ph.D.
James E. Pettigrew, Ph.D.
Jonathan E. Wheaton, Ph.D.

Assistant Professor

Steven G. Cornelius, Ph.D.
Fred R. Ehle, Ph.D.
Leslie B. Hansen, Ph.D.
Ronny L. Moser, Ph.D.
Steven D. Plegge, Ph.D.
Jeffrey Reneau, D.V.M.
Marshall D. Stern, Ph.D.
Gerald R. Steuernagel, Ph.D.

Entomology

Professor Emeritus

Alexander C. Hodson, Ph.D.
A. Glenn Richards, Ph.D.

Professor

Marion Brooks-Wallace, Ph.D.
Huai-chang Chiang, Ph.D.
Edwin F. Cook, Ph.D.
Laurence K. Cutkomp, Ph.D.
Basil Furgala, Ph.D.
Herbert M. Kulman, Ph.D.
Roger D. Price, Ph.D.
Edward B. Radcliffe, Ph.D.

Professor and

Extension Entomologist

Phillip K. Harein, Ph.D.

Associate Professor

Richard L. Jones, Ph.D., *acting head*

Associate Professor

and Extension Specialist

Mark E. Ascerno, Ph.D.
David M. Noetzel, M.S.

Assistant Professor

Roger D. Moon, Ph.D.
David W. Ragsdale, Ph.D.

Fisheries and Wildlife

Professor Emeritus

William H. Marshall, Ph.D.
Allan G. Peterson, Ph.D.

Professor

L. Daniel Frenzel, Ph.D.
Gordon W. Gullion, M.A.
Thomas F. Waters, Ph.D.

Associate Professor

Ira A. Adelman, Ph.D., *acting head*

James A. Cooper, Ph.D.
Peter A. Jordan, Ph.D.
George R. Spangler, Ph.D.

*Associate Professor
and Extension Specialist*
James R. Kitts, Ph.D.

Assistant Professor
Yosef Cohen, Ph.D.

Food Science and Nutrition

Professor Emeritus

Samuel T. Coulter, Ph.D.
Margaret D. Doyle, Ph.D.
Harold Macy, Ph.D.
Lura M. Morse, Ph.D.
Elmer L. Thomas, Ph.D.

Professor

Elwood F. Caldwell, Ph.D., *head*
Howard A. Morris, Ph.D., *assistant head*
Paul B. Addis, Ph.D.
William M. Breene, Ph.D.
Francis F. Busta, Ph.D.
A. Saari Csallany, D.Sc.
Joan Gordon, Ph.D.
Theodore P. Labuza, Ph.D.
Larry L. McKay, Ph.D.
Vernal S. Packard, Jr., Ph.D.
Irving J. Pflug, Ph.D.
Gary A. Reineccius, Ph.D.
Patricia B. Swan, Ph.D.
Sita R. Tatini, Ph.D.
Shirley W. Thenen, Ph.D.
Edmund A. Zottola, Ph.D.

Associate Professor Emeritus

Esther Y. Trammell, M.S.
Dorothy G. Verstraete, M.S.

Associate Professor

Eugenia A. Davis, Ph.D.
Annette T. Gormican, Ph.D.

Allen S. Levine, Ph.D.
Zata M. Vickers, Ph.D.
Joseph J. Warthesen, Ph.D.
Isabel D. Wolf, M.S.

Assistant Professor Emeritus
Margarita Billings, B.S.

Assistant Professor

Elaine H. Asp, Ph.D.
Amar S. Bakshi, Ph.D.
Steven D. Clarke, Ph.D.
Mary E. Darling, M.P.H.
Louise M. Mullan, Jr., M.S.
Stephen D. Phinney, Ph.D.
Dennis A. Savaiano, Ph.D.
Joanne L. Slavin, Ph.D.
David E. Smith, Ph.D.
Carolyn P. Thomas, Ph.D.

instructor

Madge Hanson, M.S.
Margaret L. Olson, M.A.

Lecturer

Lorrayne F. Anderson, M.S.
Wayne H. Clifford, Ph.D.
Mary A. Jones, Ph.D.
Alfred T. May, B.Ph.
Karen E. Moxness, M.S.
Sr. M. Moira Tighe, M.S.

Horticultural Science and Landscape Architecture

Professor Emeritus

William H. Alderman, Ph.D.
Arvo Kallio, Ph.D.
Robert E. Nylund, Ph.D.
Leon C. Snyder, Ph.D.
Orin C. Turnquist, Ph.D.

Professor

James F. Bartz, Ph.D., *head*
Peter D. Ascher, Ph.D.
Mark L. Brenner, Ph.D.
David W. Davis, Ph.D.

Sharon Desborough, Ph.D.
Francis de Vos, Ph.D.
C. Gustav Hard, Ph.D.
Leonard B. Hertz, Ph.D.
Aly Lasheen, Ph.D.
Floran I. Lauer, Ph.D.
Pen H. Li, Ph.D.
Jane P. McKinnon, M.S.
Robert Mullin, Ph.D.
Harold M. Pellett, Ph.D.
Paul E. Read, Ph.D.
Joseph R. Sowokinos, Ph.D.

Faculty

Eduard J. Stadelmann, Ph.D.
Donald B. White, Ph.D.
Richard E. Widmer, Ph.D.
Harold F. Wilkins, Ph.D.

Associate Professor

John V. Carter, Ph.D.
Shirley T. Munson, M.S.
Peter J. Olin, M.L.A.
Bert T. Swanson, Ph.D.
Luther Waters, Jr., Ph.D.

Plant Pathology

Professor Emeritus

Carl J. Eide, Ph.D.
Matthew B. Moore, M.S.

Professor

David W. French, Ph.D., *head*
Neil A. Anderson, Ph.D.
Ernest E. Banttari, Ph.D.
Howard L. Bissonnette, Ph.D.
Robert M. Brambl, Ph.D.
William R. Bushnell, Ph.D.
Fred I. Frosheiser, Ph.D.
Bill W. Kennedy, Ph.D.
Thor Kommedahl, Ph.D.
David H. MacDonald, Ph.D.
Chester J. Mirocha, Ph.D.
John B. Rowell, Ph.D.
John F. Schafer, Ph.D.
Darroll D. Skilling, Ph.D.
Ward C. Stenstra, Ph.D.
Roy D. Wilcoxson, Ph.D.

Assistant Professor

Deborah L. Brown, M.S.
Van W. Cline, M.L.A.
Mervin Eisel, M.S.
James J. Luby, Ph.D.
Albert H. Markhart III, Ph.D.
Joan I. Nassauer, M.L.A.

Lecturer

Emily E. Hoover, Ph.D.

Associate Professor

James V. Groth, Ph.D.
Sagar V. Krupa, Ph.D.
Benham E. L. Lockhart, Ph.D.
Donald V. McVey, Ph.D.
Richard J. Meronuck, Ph.D.
Thomas H. Nicholls, Ph.D.
James A. Percich, Ph.D.
Francis L. Pfleger, Ph.D.
Alan P. Roelfs, Ph.D.
Paul G. Rothman, Ph.D.
Elwin L. Stewart, Ph.D.
P.S. Teng, Ph.D.
Richard J. Zeyen, Ph.D.

Assistant Professor

James S. Baumer, Ph.D.
Robert A. Blanchette, Ph.D.

Resource and Community Development

Note: In addition to the following faculty members from various departments of the College of Agriculture, others participate from outside the college.

Professor

Russell S. Adams, Ph.D.
Evan R. Allred, M.S.
George A. Donohue, Ph.D.
K. William Easter, Ph.D.
Rouse S. Farnham, Ph.D.
Curtis L. Larson, Ph.D.
Wilbur R. Maki, Ph.D.
Gordon D. Rose, Ph.D.
John J. Waelli, Ph.D.

Associate Professor

Philip R. Goodrich, Ph.D.
Peter J. Olin, M.L.A.
Donald C. Slack, Ph.D.

Assistant Professor

Randolph L. Cantrell, Ph.D.
Van W. Cline, M.L.A.
Lois Mann, M.A.

Instructor

Charles J. Clanton, M.S.

Rhetoric

Professor Emeritus

James I. Brown, Ph.D.
James R. Holloway, D.D.
Ralph G. Nichols, Ph.D.
Marjorie H. Thurston, Ph.D.

Professor

Thomas E. Pearsall, Ph.D., *head*
James E. Connolly, Ph.D.
William M. Marchand, Ph.D.
Edward B. Savage, Ph.D.
L. David Schuelke, Ph.D.
Eugene S. Wright, Ph.D.

Associate Professor

J. Michael Bennett, Ed.D.
Richard W. Ferguson, Ph.D.
Richard O. Horberg, Ph.D.
Sarah E. McBride, Ph.D.
Earl E. McDowell, Ph.D.
Thomas M. Scanlan, Ph.D.
Arthur E. Walzer, Ph.D.
Victoria M. Winkler, Ph.D.

Assistant Professor

Warren Y. Gore, M.A.
Laurie J. Hayes, Ph.D.
Margaret L. Somers, Ph.D.

Soil Science

Professor Emeritus

Harold F. Arneman, Ph.D.
Alfred C. Caldwell, Ph.D.
William P. Martin, Ph.D.
Curtis J. Overdahl, Ph.D.

Professor

William E. Larson, Ph.D., *head*
Russell S. Adams, Jr., Ph.D.
Donald G. Baker, Ph.D.
George R. Blake, Ph.D.
Rouse S. Farnham, Ph.D.
William E. Fenster, Ph.D.
Janis Grava, Ph.D.
David F. Grigal, Ph.D.
Lowell D. Hanson, Ph.D.
Jean A. E. Molina, Ph.D.

Richard H. Rust, Ph.D.
Edwin L. Schmidt, Ph.D.
James B. Swan, Ph.D.

Associate Professor

Paul R. Bloom, Ph.D.
Terence H. Cooper, Ph.D.
Peter H. Graham, Ph.D.
Clifton F. Halsey, M.S.
Gary L. Malzer, Ph.D.
Mark W. Seeley, Ph.D.

Assistant Professor

Martha Gaudreau, Ph.D.
John F. Moncreif, Ph.D.
Robert C. Munter, M.S.
George W. Rehm, Ph.D.

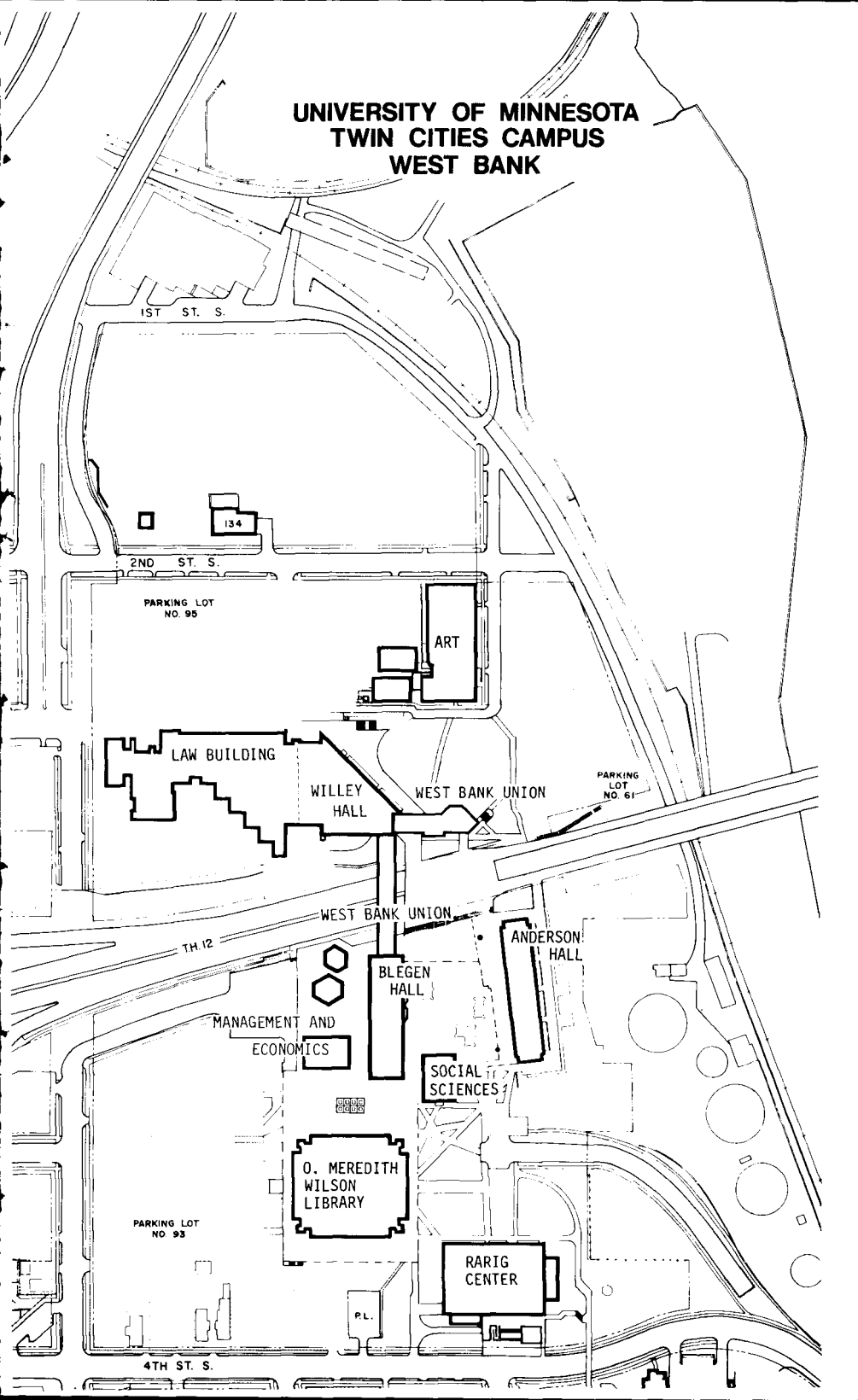


A student works on a horticultural research project.

INDEX

Academic Enrichment and Honors Program	12	General Information	1, 6
Administration	3	Grading	13
Admission	7	Graduate Degrees	7
Adult Special Students	8	Graduation Requirements	16
High School Graduates	7	Graduation With Distinction	16
Minority	8	Honor Point System	14
Senior Citizens	8	Honor System	15
Transfer Students	7	Horticultural Science	50, 102
Adult Special Students	7	Independent Study	9
Agrarian Studies Minor	70	Integrated Crop-Pest Management	35
Agricultural and Applied Economics	77	International Agriculture Minor	54
Agricultural Business Administration	19	Landscape Architecture	54, 105
Agricultural Economics	21	Large Animal Clinical Sciences	119
Agricultural Education	23, 81	Maps of Campus	127, 128, inside back cover
Agricultural Engineering	26, 84-85	Master of Agriculture Degree	7
Agricultural Engineering Technology	26, 84	Music Credits	11
Agricultural Journalism	28, 86	Nutrition and Dietetics	57
Agricultural Science and Industries		Orientation-Registration	9
Curriculum Requirements	6, 74	PEP—Professional Experience Program	12
Agriculture, General Courses	115	Personnel Services, All-University	16
Agronomy and Plant Genetics	33, 87	Petition Procedures	11
All-College Requirements	72	Physical Education Credits	11
Animal Science	35, 89	Plant Health Technology	59
Appeal System	15	Plant Pathology	108
Auditing	9	Plant Physiology	115
Baccalaureate Degrees	6	Programs	19
Biological Sciences	37	Publications	1
Cancel-Add Procedures	10	Records, Access to	3
Cancellation of Entire Registration	10	Registration	9
Career Services Office	15	Repeating Courses	15
Checklist of Procedures—		Residency Requirements	16
Application Through Graduation	5	Resource and Community Development	61, 117
Class Attendance	11	Resource Economics	61
CLEP Tests	11	Rhetoric	109
Consumer Food Science	37	ROTC	13
Continuing Education and Extension Credits	8	Rural Sociology	117
Course Descriptions	77	Scholastic Conduct	15
Course Load	11	Scholastic Requirements	14
Credit by Examination (Independent Study)	9	Soil Science	63, 112
Credits and Class Attendance	11	Soil and Water Resource Management	65
Curricula in Agriculture	6	Special Study Opportunities	12
Dean's List	14	Statistics	118
Degrees Offered	6	Student Organizations	17
Department Offices	3	Study-Travel	12
Directory	3	Symbols	13-14, 77
Double Major	13	Technical Communication	67-69
Economics of Public Services	39	Veterinary Biology	120
Elective Credits, Use of	11	Veterinary Medicine	70, 120
Enrichment Program		Veterinary Pathobiology	120
International Agriculture	12	Wildlife	45
Journalism	12		
Entomology	41, 93		
Extra Credit Registration	10		
Faculty	121		
Financial Aid	8		
Fisheries	44		
Fisheries and Wildlife	43-46, 95		
Food Science and Nutrition	97		
Food Science and Technology	46		

UNIVERSITY OF MINNESOTA TWIN CITIES CAMPUS WEST BANK



1ST ST. S.

2ND ST. S.

PARKING LOT NO. 95

134

ART

LAW BUILDING

WILLEY HALL

WEST BANK UNION

PARKING LOT NO. 61

TH 12

WEST BANK UNION

ANDERSON HALL

BLEGEN HALL

MANAGEMENT AND ECONOMICS

SOCIAL SCIENCES

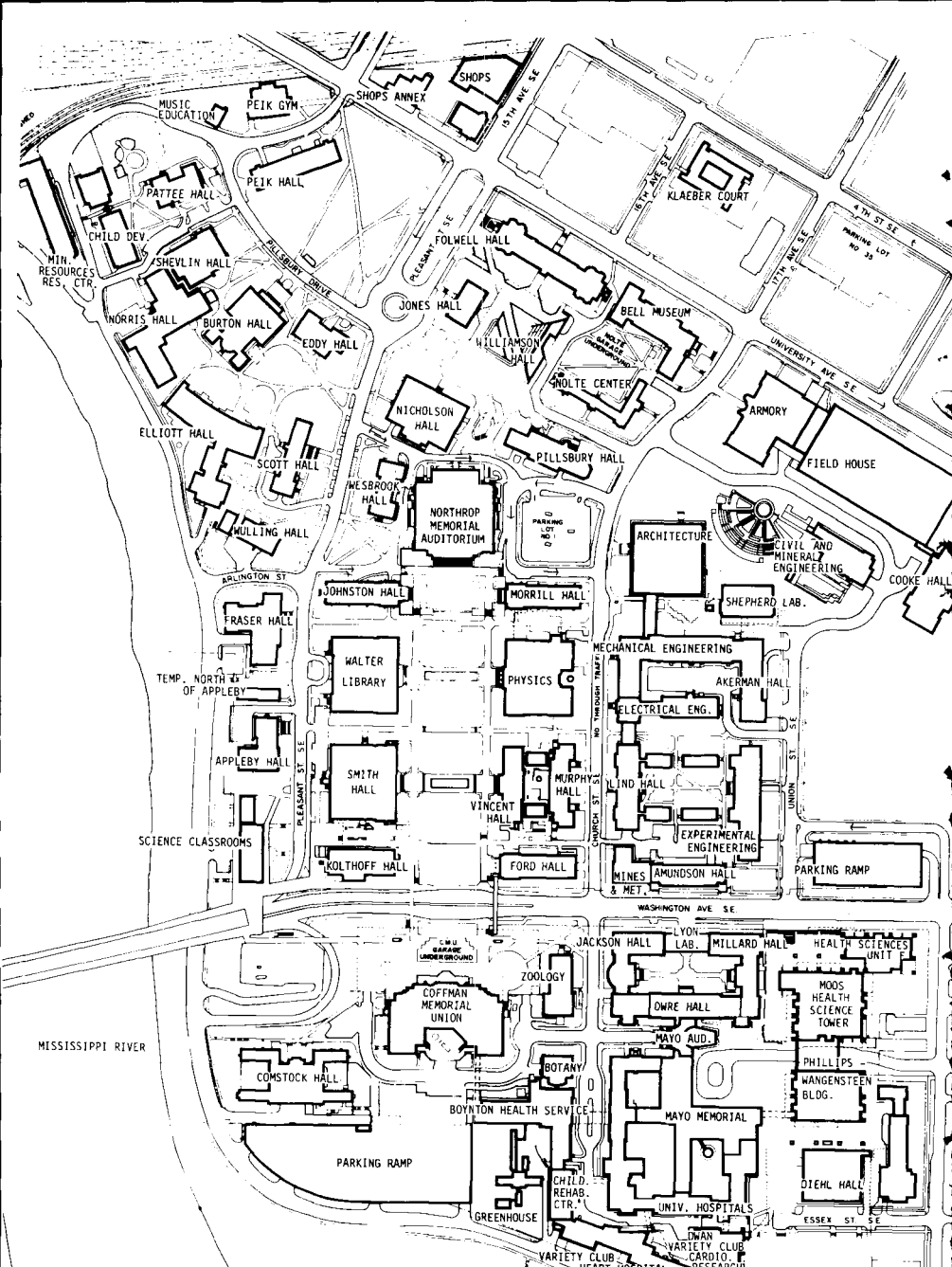
O. MEREDITH WILSON LIBRARY

PARKING LOT NO. 93

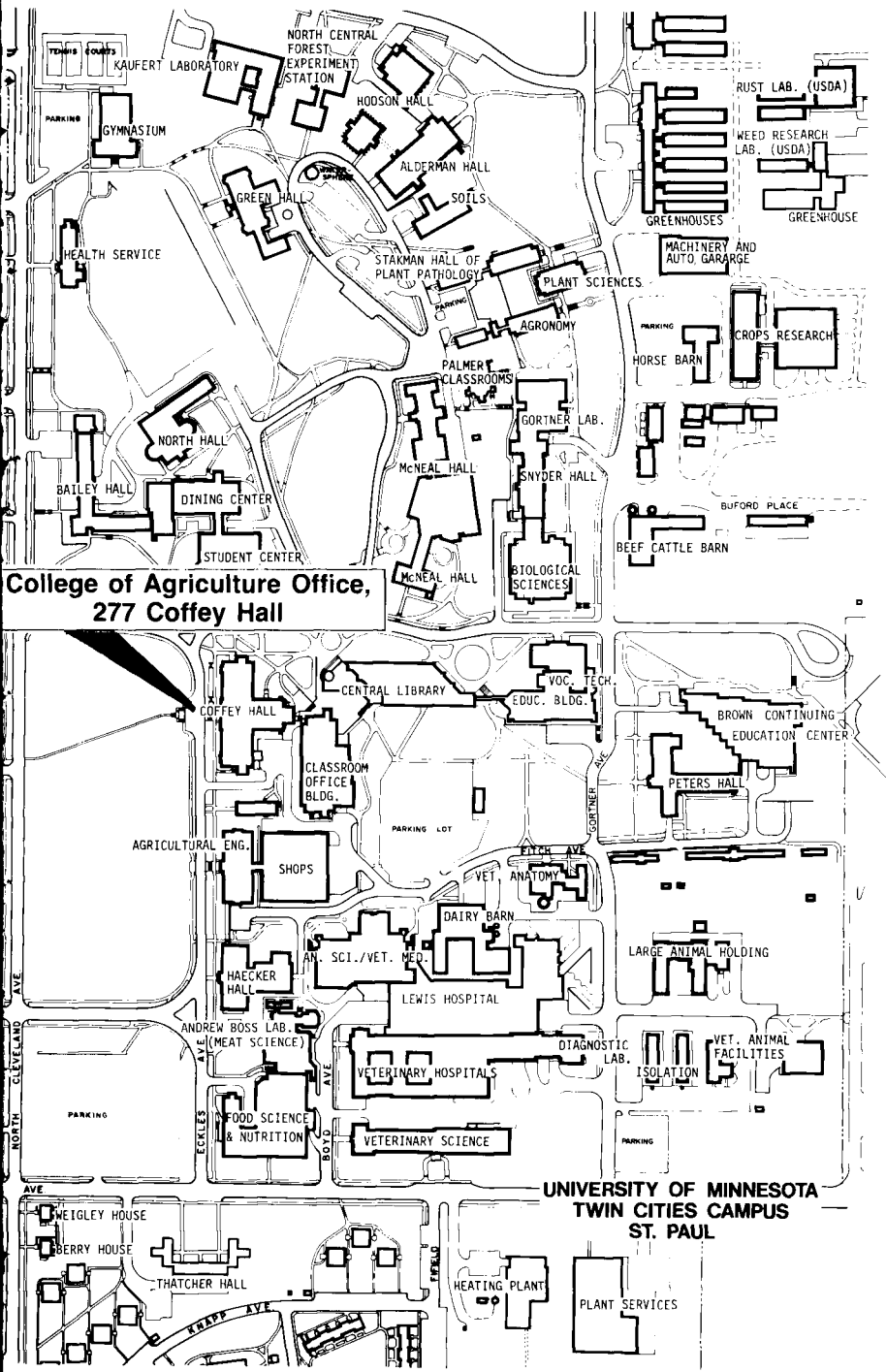
RARIG CENTER

P.L.

4TH ST. S.



**UNIVERSITY OF MINNESOTA
TWIN CITIES CAMPUS
EAST BANK**



**College of Agriculture Office,
277 Coffey Hall**

**UNIVERSITY OF MINNESOTA
TWIN CITIES CAMPUS
ST. PAUL**

University of Minnesota Bulletin
(USPS 651-720)
Office of Admissions and Records
110 Williamson Hall
231 Pillsbury Drive S.E.
Minneapolis, MN 55455

Second-Class
Postage
Paid
Minneapolis
Minnesota

