



University  
of Minnesota  
Bulletin

1931-33

College of Agriculture

## *Board of Regents*

The Honorable Wenda Moore, Minneapolis, Chairman; The Honorable Lauris D. Krenik, Madison Lake, Vice Chairman; The Honorable Charles H. Casey, West Concord; The Honorable William B. Dosland, Moorhead; The Honorable Willis K. Drake, Edina; The Honorable Erwin L. Goldfine, Duluth; The Honorable David M. Lebedoff, Minneapolis; The Honorable Verne Long, Pipestone; The Honorable Charles F. McGuiggan, Marshall; The Honorable David K. Roe, St. Paul; The Honorable Mary T. Schertler, St. Paul; The Honorable Michael W. Unger, St. Paul.

## *Administrative Officers*

C. Peter Magrath, President  
Frederick M. Bohlen, Vice President for Finance and Operations  
Lyle A. French, Vice President for Health Sciences  
Nils Hasselmo, Vice President for Administration and Planning  
Stanley B. Kegler, Vice President for Institutional Relations  
Kenneth H. Keller, Vice President for Academic Affairs  
Frank B. Wilderson, Vice President for Student Affairs

## *College of Agriculture Administration*

James F. Tammen, Dean (277 Coffey Hall, 373-0921)  
Keith Wharton, Assistant Dean (277 Coffey Hall, 373-0921)  
Malcolm J. Purvis, Interim Assistant Dean, International Agricultural Programs (277 Coffey Hall, 373-1498)  
Alan E. Anderson, Coordinator, Prospective Student Services (277 Coffey Hall, 373-0921)  
James C. Sentez, Student Training Officer, International Agricultural Programs (277 Coffey Hall, 373-1498)  
Deane A. Turner, Director, Career Development and Placement, and Coordinator, Professional Experience Program (277 Coffey Hall, 373-0923)

# College of Agriculture

UNIVERSITY OF MINNESOTA

## **Where to Write for Information**

### **Admissions and Records**

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

### **Student Financial Aid**

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

### **Housing Information (Residence Halls and Off Campus)**

Housing Office  
190 Coffey Hall  
1420 Eckles Avenue  
University of Minnesota  
St. Paul, Minnesota 55108  
(612) 373-0822

### **College of Agriculture Office**

277 Coffey Hall  
1420 Eckles Avenue  
University of Minnesota  
St. Paul, Minnesota 55108  
(612) 373-0921

### **College of Agriculture Departmental Offices**

Refer to section IV of this bulletin.

### **Campus Assistance Center**

209 Eddy Hall  
192 Pillsbury Drive S.E.  
University of Minnesota  
Minneapolis, Minnesota 55455  
(612) 373-1234

## How to Use This Bulletin

This bulletin is the official source of information about the College of Agriculture. Its purpose is to provide you with the guidance you need to plan a course of study and to meet college and University requirements. You are expected to be familiar with the contents of the bulletin. In it you will find a message from the college dean, general information, descriptions of college curricula, course listings, and the faculty members of the college listed by department. See the table of contents and index for an outline of the information provided. Consult also the student checklist on page 8. For an orientation to the Twin Cities campus, see the maps at the back of the bulletin.

The information in this bulletin is current as of the time of publication. However, course offerings, program requirements, regulations, and policies change frequently. Advisers, department offices, and the college office make every effort to provide current information to students, but it is your responsibility to know the policies, regulations, and degree requirements that affect you. For information about curriculum and course changes, check with the College of Agriculture Office, 277 Coffey Hall, 1420 Eckles Avenue, University of Minnesota, St. Paul, Minnesota 55108; telephone number (612) 373-0921.

## Other Sources of Information

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

**General Information Bulletin**—The College of Agriculture is one college of many at the University of Minnesota. For information about the entire University, obtain a copy of the *General Information Bulletin*, available from the Office of Admissions and Records, 130 Coffey Hall.

**Class Schedule**—Each quarter you will receive a *Class Schedule* with your registration materials. The schedule lists University-wide course offerings complete with class hours, rooms, instructors, and prerequisites. The *Class Schedule* also contains registration instructions, a calendar of events for the quarter, final examination schedules, and other pertinent information.

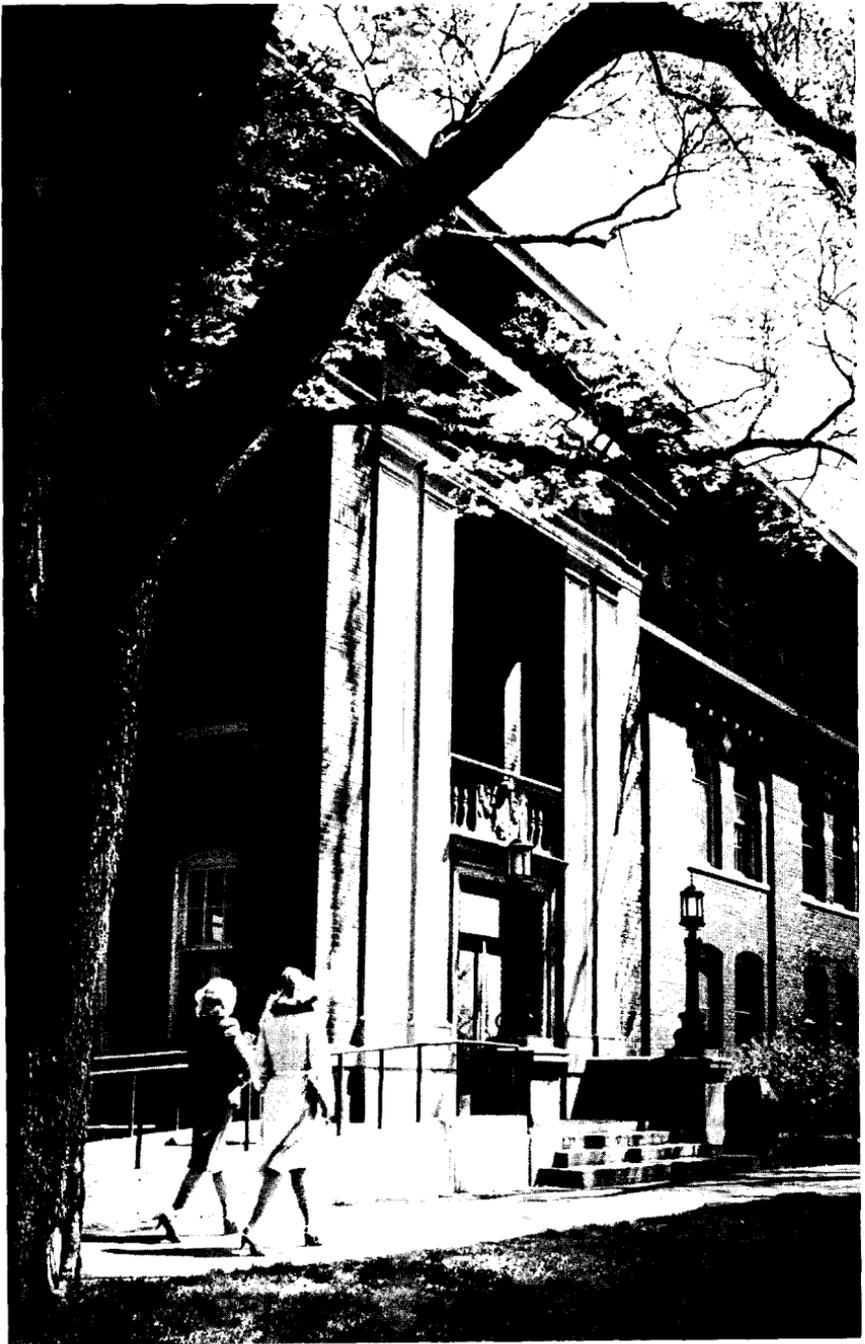
**Official Daily Bulletin Column**—The Official Daily Bulletin column of the University newspaper, the *Minnesota Daily*, prints announcements of course changes, study opportunities, meetings, and activities. You are expected to be aware of any announcements that affect you.

**Other College Bulletins**—You may find it necessary to consult other college bulletins to meet interdisciplinary program requirements or all-college requirements. You may obtain these bulletins from the Office of Admission and Records, 130 Coffey Hall.

## 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, 100 Church Street S.E., University of Minnesota, Minneapolis, Minnesota 55455, (612) 373-7969, or to the Director of the Office of Civil Rights, Department of Education, Washington, D.C. 20202, or to the Director of the Office of Federal Contract Compliance Programs, Department of Labor, Washington, D.C. 20210.



## TABLE OF CONTENTS

Where to Write for Information .....	2
How to Use This Bulletin .....	3
Letter From Dean James F. Tammen .....	6
I. General Information .....	7
Overview of Curricula .....	7
Degrees Offered .....	9
Admission .....	9
Financial Aid .....	11
Orientation-Registration .....	11
Registration .....	11
Petition Procedures .....	13
Credits and Class Attendance .....	13
Special Study Opportunities .....	14
Double Major .....	15
Grading System .....	15
Scholastic Requirements .....	17
Scholastic Conduct .....	18
Requirements for Graduation .....	19
Career Development and Placement Office .....	19
All-University Personnel Services .....	20
Student Organizations .....	20
II. Curricula in Agriculture .....	21
Major and Minor Requirements .....	21
All-College Requirements .....	83
Agricultural Science and Industries Curriculum Requirements .....	86
Resource and Community Development Curriculum .....	88
Curricula Relating to Agriculture .....	88
Agricultural Engineering .....	88
Pre-Biological Sciences .....	89
Pre-Veterinary Medicine .....	89
III. Course Listings .....	91
IV. Departmental Offices and Faculty .....	136



*Agriculture in its broadest sense is the greatest single endeavor in Minnesota and, indeed, the entire Upper Midwest. The vitality of Minnesota agriculture depends upon the graduation each year of talented, highly motivated individuals well educated in the agricultural arts and sciences. Our College of Agriculture is the only college in the state offering an education leading to the baccalaureate and advanced degrees. Our programs include studies in the plant and animal sciences, economics, business and management, food processing, human nutrition, extension education, communication, and several areas relating directly to the quality of our environment and the quality of our lives. Since the outstanding faculty of the college not only teach but also conduct research and serve as specialists in continuing education, they are uniquely prepared to offer the highest quality education.*

*There have not been enough graduates over the past few years to meet the demands of our vital, growing, changing agricultural industry. In the foreseeable future there will be growing shortages in most fields. We encourage you to enter our college and become a part of one of the most fundamental and vital endeavors of our state and nation. I join with the faculty of the college in personally wishing you a rewarding experience during the course of your studies.*

A handwritten signature in cursive script that reads "James F. Tammen". The signature is fluid and elegant, with a large initial 'J'.

James F. Tammen  
Dean, College of Agriculture

# I. GENERAL INFORMATION

This section of the bulletin contains an overview of the curricula of the college and a checklist that, in chronological order, outlines student responsibilities from admission through graduation. It also provides detailed information about the following: degrees, admission, financial aid, orientation-registration, registration, petition procedures, credits and class attendance, special study opportunities, double majors, the grading system, scholastic requirements, graduation requirements, the placement service, student personnel services, and student organizations.

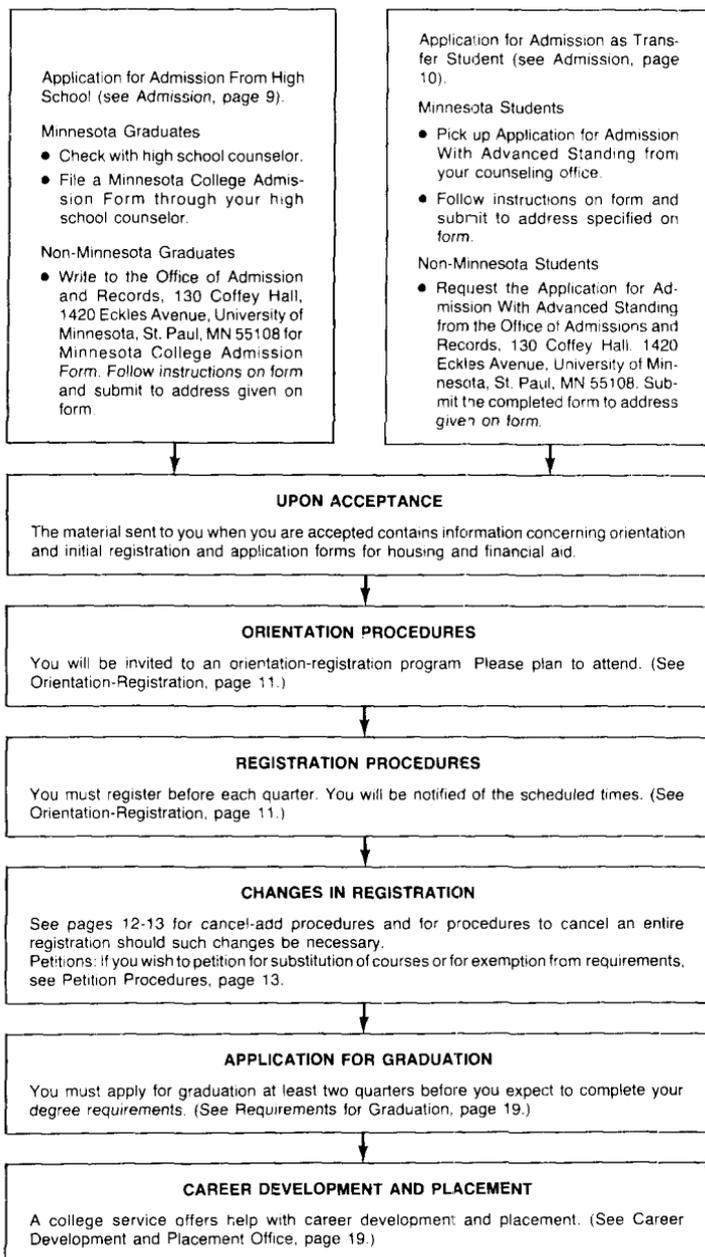
## Overview of Curricula

As a science and an industry, agriculture is a dynamic profession that presents challenging opportunities in a variety of areas. In response to this diversity, the College of Agriculture has designed six broad curricula offering 22 majors. The curricula and majors, which are listed below, 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
  - Fisheries
  - Wildlife
5. Food Science and Nutrition Curriculum
  - Consumer Food Science
  - Food Science and Technology
  - Hospitality and Food Service Management
  - 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, Curricula in Agriculture.

## Checklist of Procedures—Application Through Graduation



## 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, 1420 Eckles Avenue, University of Minnesota, St. Paul, Minnesota 55108.

**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, see the *General Information Bulletin* of the University (available through the Office of Admissions and Records, 130 Coffey Hall, 1420 Eckles Avenue, University of Minnesota, St. Paul, Minnesota 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.

Send requests for information to the College of Agriculture Office, 277 Coffey Hall, 1420 Eckles Avenue, University of Minnesota, St. Paul, Minnesota 55108, or call (612) 373-0921.

**High School Graduates**—If you are a high school graduate in the upper 60 percent 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 one unit must be in natural science or agriculture, and three must be in mathematics, including the following: one unit in elementary algebra, one unit in plane geometry, and one unit in higher algebra or its equivalent.

## General Information

---

Participation in high school vocational agriculture activities is recognized as excellent preparation for the study of agriculture at the collegiate 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, F 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 Record of Advanced Standing 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. 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, Curricula in Agriculture, and note especially the all-college requirements on pages 83-86.

*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 collegiate 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 are required. Normally, adult special students are not enrolled for a long time, but only as long 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 information.

**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 for more information.

## Financial Aid

**Freshmen**—Entering freshmen interested in loans, scholarships, or grants should contact their high school guidance office for application forms. Forms are also available from the Office of Student Financial Aid, 199 Coffey Hall, 1420 Eckles Avenue, University of Minnesota, St. Paul, Minnesota 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.

Prospective freshmen must apply through high school counselors or principals and have their applications mailed to the Office of Student Financial Aid by March 1. Late applications receive lower priority for financial assistance. In addition to this application, students must have their parents or guardians 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 more information about financial aid, consult the University's *General Information Bulletin*.

**Presently Enrolled Students, Transfer Students**—Undergraduate and graduate students may obtain application forms and information by contacting a University financial aid office. Applications should be completed by March 1.

## 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 fee payment process. The University agrees to provide certain instruction and facilities; you agree to attend and pay fees for the classes you have chosen. Although changes sometimes occur in course listings, the responsibility for accurate, timely registration and fee payment rests primarily with you. Copying errors, excessive changes, failure to observe procedures, and late registration and fee 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.

## General Information

---

**Auditor**—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 the regular fee. 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 fee 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 independent study. You will usually also need approval of the course instructor. Pick up an independent study permission slip in the departmental office, and return the completed slip to the Office of Admissions and Records, 130 Coffey Hall. Enter a course you are going to take by independent study on your registration card with a "Y" after the course number (e.g., Rhet 3280Y).

**Extra Credit Registration**—With the course instructor's approval, you may earn one to three 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 slip for extra credit registration at the departmental 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 fees, grades, and cancellations apply. Enter a course you are going to take for extra credit on your registration card with an "X" after the course number (e.g., Rhet 3280X).

**Cancel-Add Procedures**—Use a Cancel-Add 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 six weeks of a quarter require your adviser's signature on the Cancel-Add form; a grade of W is assigned.
2. Withdrawal from a course after the sixth week of a quarter is strongly discouraged unless there are extenuating circumstances.<sup>1</sup> Cancellations during the seventh and eighth weeks of a quarter require adviser's and your instructor's signatures on the Cancel-Add form. The instructor must indicate whether you are passing or failing at the time of cancellation. If passing, a grade of W is assigned. If failing, a grade of N is assigned.
3. Cancellations after the eighth week of a quarter require the signatures of the adviser, instructor, and Scholastic Standing Committee representative on the Cancel-Add form.<sup>1</sup> *These cancellations are seldom approved by the Scholastic Standing Committee.* If a cancellation is approved, a grade of W or N is assigned, under the conditions stated in item 2 above.

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

You must have your adviser's signature to add a class during the first three days of classes of a quarter. After this time, you must have *both* your adviser's and instructor's signatures.

A change in the grading system selected for a course from S-N to A-N or vice versa must be made during the first two weeks of a quarter and requires your adviser's signature on the Cancel-Add form. The choice of grading system may not be changed after the end of the second week of classes.

**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 Cancellation form (*not a Cancel-Add 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.

### Petition Procedures

Petitions are required for departures from either college or major graduation requirements. Petitions for departures from major requirements are submitted to the department and those for departures from college or curriculum requirements to the college office.

If you wish to substitute another course for a major or curriculum requirement, have your petition approved *before* you register for the course. Do not assume that it will be approved; find out for sure. Check with your department regarding major requirements and with the college office for all others.

### 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 Boynton 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 in University-approved, cocurricular activities (the Office of Student Affairs certifies absences for such 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 only when emergencies (items b and c above) are involved as an appeal agency.

**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.

## General Information

---

**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, 101 Pleasant Street S.E., University of Minnesota, Minneapolis, Minnesota 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 nine credits in physical education and a maximum of six 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, 277 Coffey Hall.

**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, 277 Coffey Hall.

**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 in international agriculture 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 Scholastic Standing Committee 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. You earn four credits for satisfactory completion of a PEP program; you may enroll in two PEP programs for a total of eight credits. Students receive salaries from the cooperating industries, producers, agencies, and farm families participating in the program.

Students register for the program in Continuing Education and Extension through the College of Agriculture and pay a per-credit fee plus a special service fee.

PEP course offerings do not appear in the class schedules. Departments offering the PEP option list it as course number 5000 in the Course Listings section of this bulletin. For additional information, consult your adviser or inquire at the college office, 277 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.

Talk with an adviser in agricultural journalism for more information.

**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, 15 Church Street S.E., University of Minnesota, Minneapolis, Minnesota 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 a Double Major Application form. You must file the form before you complete the required course work for your second major.

## Grading System

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:

## General Information

---

- A—Representing achievement that is outstanding relative to the level necessary to meet course requirements.
- B—Representing achievement that is significantly above the level necessary to meet course requirements.
- C—Representing achievement that meets the basic course requirements in every respect.
- D—Representing 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 department offering the course. Consult the course listings 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 percent 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, at 277 Coffey Hall, 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 sixth week, the approval of the instructor and adviser are required for withdrawal. However, withdrawal from a course after the sixth week is strongly discouraged unless extenuating circumstances exist. Cancellations following the ninth 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 departmental 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 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.

## General Information

---

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, departmental scholastic standing committee, and subcommittees of the college Scholastic Standing Committee may be appealed to the college Scholastic Standing Committee, and decisions by this committee 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 the provision of the Student Self-Government Honor System, the students in the College of Agriculture, rather than the faculty, conduct examinations and quizzes. The honor system is operated on the assumption that honesty prevails among a large majority of students. Students place themselves on their honor not to give or receive aid during examinations. The responsibility of honesty is between student and student; the faculty does not place students on their honor.

A student who observes an act of dishonesty during an examination period may take some appropriate step at the time to halt the act or may report the incident later to the classroom instructor or to a member of the College of Agriculture Honor System Commission. In consultation with the Honor System Commission, the instructor will review the incident and will make a decision about how to deal with the matter. Details related to the operation of the honor system are published in a brochure that is available in the college office, 277 Coffey Hall.

The honor system is a preventive rather than a punitive system, and is designed to provide for greater freedom of action on the part of students. New students are urged to discuss the honor system with students currently or previously registered in the college.

## 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 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.

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.

## **Requirements for Graduation**

**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 in the section on Scholastic Requirements.

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 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 percent of the graduating class; "with distinction" to the next 7 percent 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 Development and Placement Office**

To help you secure employment after graduation, the Career Development and Placement Office, 272 Coffey Hall, announces job opportunities and assists in arranging interviews with employer representatives. Representatives of more than 100 firms and agencies annually visit the campus to interview degree candidates. Although the Career Development and Placement Office concentrates on full-time jobs for graduates, staff members frequently arrange summer jobs for students with companies offering internships or other types of employment.

### All-University Personnel Services

Numerous specialized personnel services are provided by the University for all students. See the *General Information Bulletin* for details about services. 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. 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.

## II. CURRICULA IN AGRICULTURE

This section contains, in alphabetical order, descriptions of all the major programs offered by the college. Department addresses and phone numbers are provided for each program.

The course requirements listed for each major program are for high school graduates directly entering the College of Agriculture. 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 about the all-college requirements, the agricultural science and industries curriculum requirements, the resource and community development curriculum, and the related curricula of agricultural engineering, pre-biological sciences, and pre-veterinary medicine.

### **Agricultural Business Administration**

Department of Agricultural and Applied Economics  
231 Classroom-Office Building  
1994 Buford Avenue  
University of Minnesota  
St. Paul, Minnesota 55108  
(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.

### **Agricultural Business Administration 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.

## Curricula in Agriculture

---

### A. Communication, Language, Symbolic Systems

Math 1111—College Algebra and Analytical Geometry (5)

(or) Math 1201—Pre-Calculus (5)

Rhet 1101—Communication I (4)

Rhet 1102—Communication II (4)

Rhet 1222—Public Speaking (4)

Rhet 3551—Professional Writing (4)

(or) Rhet 3562—Scientific and Technical Writing (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)

Biol 1011—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 1031, 1035—Introductory Physics: Measurement and Applications and Laboratory (4, 1)

Phys 1032, 1036—Introductory Physics: Measurement and Applications and Laboratory (4, 1)

BioC 1301, Biol 1011, Chem 1001 are strongly recommended.

### C. The Individual and Society—15 credits minimum

See All-College Requirements (pages 84-85). 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 (pages 85-86).

### 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 1100—Introduction to FORTRAN Programming I (2)
- (or) AgET 1030—Introduction to 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 3100—Introduction to Computers and Computer Data Processing (4)
- (or) 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

- AgEc 1000—Orientation to Agricultural and Applied Economics (1)
- AgEc 1020—Principles of Macroeconomics (5)
- AgEc 1030—Principles of Microeconomics (4)
- Acct 1024—Principles of Financial Accounting I (3)
- Acct 1025—Principles of Financial Accounting II (3)
- Acct 3001—Principles of Managerial Accounting (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 or 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 1010, 3205, 3215, 3410, 3606, 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  
1994 Buford Avenue  
University of Minnesota  
St. Paul, Minnesota 55108  
(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

## Curricula in Agriculture

---

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

### Agricultural Economics 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—Communication I (4)
- Rhet 1102—Communication II (4)
- Rhet 1222—Public Speaking (4)
- Rhet 3551—Professional Writing (4)
- (or) Rhet 3562—Scientific and Technical Writing (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 (page 86).

#### C. The Individual and Society—15 credits minimum

See All-College Requirements (pages 84-85). 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 (pages 85-86).

#### 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)
- 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)

*Pregraduate<sup>1</sup>*

At least 11 credits selected from:

- 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, agricul-

<sup>1</sup>This option is recommended for students who plan to enter graduate school.

## Curricula in Agriculture

---

tural 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 1010, 3205, 3215, 3410, 3606, and 3615 may be used.

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

### Agricultural Economics Minor Requirements

The department offers two minors: The minor in agricultural economics is highly structured to require minimal advising by departmental faculty. The minor in applied economics is much more flexible and must be developed with the assistance of an adviser from the department.

#### 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

Division of Agricultural Education  
Vocational-Technical Education Building  
University of Minnesota  
St. Paul, Minnesota 55108

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 joint registration in the College of Education in the final quarter of their sophomore year. 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.

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 admission to the College of Agriculture and, after being accepted, apply to the College of Education during the first quarter they are enrolled.

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.

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.

## **Agricultural Education 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 (page 86).

### **B. Physical, Biological, and Analytical Sciences**

See Agricultural Science and Industries Curriculum Requirements (pages 86-87).

### **C. The Individual and Society—14 credits minimum**

See All-College Requirements (pages 84-85). 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)

## Curricula in Agriculture

---

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

See All-College Requirements (pages 85-86).

### E. Professional and Supporting Courses in the Major—44 credits minimum

- 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 Agricultural Specialization*

- 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 1401—Principles of Animal Nutrition (5)
- Ent 1005—Economic Entomology (4)
- Hort 1010—Home Horticulture (4)
- Soil 1122—Introductory Soil Science (4)
- Plus 26 additional credits in technical agriculture

#### *Vocational Horticulture Specialization*

- 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)
- PIPp 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 14 additional credits in technical agriculture

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

## **Agricultural Engineering Technology**

Department of Agricultural Engineering  
213 Agricultural Engineering  
1390 Eckles Avenue  
University of Minnesota  
St. Paul, Minnesota 55108  
(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.

### **Agricultural Engineering Technology 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—Communication I (4)
- Rhet 1102—Communication II (4)
- Rhet 1222—Public Speaking (4)
- Rhet 3551—Professional Writing (4)
- (or) Rhet 3562—Scientific and Technical Writing (4)

#### **B. Physical, Biological, and Analytical Sciences**

- BioC 1301—Elementary Biochemistry I (5)
- Biol 1011—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 1031, 1035—Introductory Physics: Measurement and Applications and Laboratory (4, 1)
- Phys 1032, 1036—Introductory Physics: Measurement and Applications and Laboratory (4, 1)

Plus one additional course selected from category B of the Agricultural Science and Industries Curriculum Requirements (pages 86-87).

## *Curricula in Agriculture*

---

### **C. The Individual and Society**—14 credits minimum

See All-College Requirements (pages 84-85). 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 (pages 85-86).

### **E. Professional Courses in the Major**

AgET 1010—Technical Drawing (4)

AgET 1030—Introduction to Computer Programming (3)

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)

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 3010—Architectural Drafting (4)

AgET 3800—Rural Sanitation and Water Supply (4)

### **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.**

## **Agricultural Engineering Technology and Agricultural Mechanization 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 are 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 3010—Architectural Drafting (4)

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 3010—Architectural Drafting (4)

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  
1364 Eckles Avenue  
University of Minnesota  
St. Paul, Minnesota 55108  
(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 or to industries closely related to agriculture. Employment possibilities include working on staffs of agricultural 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; and serving on advertising and marketing staffs of mass media agencies or industries.

Students must meet the requirements for entrance of the School of Journalism and Mass Communication in addition to those of the College of Agriculture. (Requirements for the journalism school include completing 39 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 three 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.

## Curricula in Agriculture

---

The curriculum requires 180 credits for graduation. Students can choose to complete one of the four sequences in journalism: news-editorial, advertising, broadcast journalism, and photographic communication. Also, students can adapt their programs to specialize in science writing, public relations, or other special areas. *Note:* The curricula in both journalism and agricultural journalism are currently under review. Students should inquire in the Department of Information and Agricultural Journalism office about possible revisions in major requirements.

### Agricultural Journalism 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 Department of Information and Agricultural Journalism.

#### A. Communication, Language, Symbolic Systems—21 credits minimum

Jour 1001—Introduction to Mass Communications (2)

Jour 1005—Visual Communication (3)

Rhet 1101—Communication I (4)

Rhet 1102—Communication II (4)

Rhet 1222—Public Speaking (4)

(or) Spch 1101—Fundamentals of Speech-Communication: Oral Communication (4)

Rhet 3551—Professional Writing (4)

(or) Rhet 3562—Scientific and Technical Writing (4)

(or) Comp 1027—Intermediate Communication (4)

#### 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 1011—General Biology (5)

Biol 1103—General Botany (5)

Biol 1106—General Botany (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 1031, 1035—Introductory Physics: Measurement and Applications and Laboratory (4, 1)

Phys 1032, 1036—Introductory Physics: Measurement and Applications and Laboratory (4, 1)

#### C. The Individual and Society—22 credits minimum

See All-College Requirements (pages 84-85). One course required in the area of Development of Civilization.

AgEc 1020—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

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

See All-College Requirements (pages 85-86).

**E. Professional Courses in the Major**

You must complete the requirements for one of the four sequences listed below. Work closely with your adviser to select appropriate electives. Adjustments in either the news-editorial or advertising sequence can be made for those interested in public relations.

*News-Editorial Sequence—41-45 credits*

AgJo 3530—Publicity (4)

Jour 1101—Reporting (5)

Jour 3121—Public Affairs Reporting (4)

(or) AgJo 3122—Agricultural and Rural Affairs Reporting (4)

Jour 3155—Publications Editing (4)

(or) AgJo 3159—Publications Editing (4)

Jour 3776—Mass Communications Law (4)

Jour 5131—Interpretive Reporting (4)

(or) Jour 5133—Science Communication (4)

Jour 5501—Communication and Public Opinion I (4)

(or) AgJo 5534—Rural Communication Media (4)

Jour 5601—History of Journalism (4)

One of the following courses:

Jour 3173—Magazine Writing and Editing (4)

Jour 5141—Opinion Writing in America (4)

Jour 5143—Interpretation of Science and Technology (4)

AgJo 5561—Writing for Publication (4)

4-8 additional credits in agricultural journalism or journalism at the 3000 level or above

*Advertising Sequence—45 credits*

Jour 1201—Principles of Advertising (4)

Jour 3231—Advertising Graphics (4)

Jour 3241—Advertising Copywriting (4)

Jour 5251—Psychology of Advertising (4)

Jour 5261—Advertising: Media Analysis (4)

Jour 5274—Current Advertising Development and Problems (4)

Jour 5501—Communication and Public Opinion I (4)

Mktg 3000—Principles of Marketing (4)

5 credits in introductory psychology

For advertising management emphasis:

Jour 5263—Advertising Campaign Planning and Media Strategy (4)

Plus 4 additional credits in advertising at the 3000 level or above

For creative emphasis:

Jour 5272—Advertising Copy-Graphics (4)

Plus 4 additional credits in advertising at the 3000 level or above

*Broadcast Journalism Sequence—48-50 credits*

AgJo 3430—Broadcasting in Rural America (4)

Jour 1101—Reporting (5)

Jour 3121—Public Affairs Reporting (4)

Jour 3401—Basic Cinematography (4)

Jour 3451—Television and Radio News (5)

Jour 3776—Mass Communications Law (4)

Jour 5402—Film Production (5)

(or) Jour 5444—Television and Radio Documentary (4)

## Curricula in Agriculture

---

Jour 5442—Advanced Television News (5)

Jour 5611—Development of American Broadcasting (4)

Spch 3201—Introduction to Broadcasting Production (5)

One of the following courses:

Jour 5501—Communication and Public Opinion I (4)

Jour 5615—Development of Photojournalism and Documentary Films (5)

Jour 5721—Mass Media in a Dynamic Society (4)

Additional speech courses are recommended.

*Photographic Communication Sequence*—43 credits

Jour 1101—Reporting (5)

Jour 3121—Public Affairs Reporting (4)

(or) Jour 3173—Magazine Writing (4)

(or) Jour 3231—Advertising Graphics (4)

(or) Jour 3241—Advertising Copywriting (4)

(or) Jour 3486—Radio and Television Script Writing (4)

Jour 3301—Photojournalism (4)

Jour 3776—Mass Communications Law (4)

Jour 5353—Photographic Communication (4)

(or) Jour 3401—Basic Cinematography (4)

Jour 5376—Advanced Photojournalism (5)

(or) Jour 5402—Film Production (5)

Jour 5501—Communication and Public Opinion I (4)

(or) Jour 5721—Mass Media in a Dynamic Society (4)

Jour 5615—Development of Photojournalism and Documentary Film (5)

Plus 8 journalism or agricultural journalism credits at the 3000 level or above  
Additional speech courses are recommended.

### F. Supporting Courses—39 credits minimum

15 credits in beginning courses in agriculture or forestry in addition to AgEc 1020 and AgEc 1030.

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.

## Agricultural Journalism 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 (28-30 credits)

Required Courses:

Jour 1001—Introduction to Mass Communications (2)

Jour 1005—Visual Communication (3)

AgJo 3530—Publicity (4)

(or) AgJo 3111—Journalistic Techniques (5)

- AgJo 3159—Publications Editing (4)<sup>1</sup>
- AgJo 5561—Writing for Publication (4)<sup>1</sup>
- AgJo 3430—Broadcasting in Rural America (4)
- AgJo 5301—Functional Photography (3)<sup>1</sup>

Optional Courses (at least one):

- AgJo 3122—Agricultural and Rural Affairs Reporting (4)
- AgJo 5534—Rural Communication Media (4)
- AgJo 3230—Basic Typography (4)<sup>1</sup>
- 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 (29 credits)**

Required Courses:

- Jour 1001—Introduction to Mass Communications (2)
- Jour 1005—Visual Communication (3)
- Jour 1201—Principles of Advertising (4)
- Jour 3231—Advertising Graphics (4)<sup>1</sup>
- Jour 3241—Advertising Copywriting (4)<sup>1</sup>
- Mktg 3000—Principles of Marketing (4)

Optional Courses (at least two):

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

You may supplement these with other advertising courses such as:

- Jour 5251—Psychology of Advertising (4)
- Jour 5261—Advertising: Media Analysis (4)<sup>1</sup>

## **Agronomy**

Department of Agronomy and Plant Genetics  
303 Agronomy  
1509 Gortner Avenue  
University of Minnesota  
St. Paul, Minnesota 55108  
(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.

<sup>1</sup>Preregistration is required because enrollment is limited and restricted.

## Curricula in Agriculture

---

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.

### Agronomy 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 (page 86).

#### B. Physical, Biological, and Analytical Sciences

BioC 1301—Elementary Biochemistry I (5)

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

Biol 1011—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 1031, 1035—Introductory Physics: Measurement and Applications and Laboratory (4, 1)

Two additional courses selected from category B of the Agricultural Science and Industries Curriculum Requirements (pages 86-87).

#### C. The Individual and Society—14 credits minimum

See All-College Requirements (pages 84-85). 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 (pages 85-86).

#### 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)

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)

Agro 5040—Management of Cropping Systems (3)

Two of the following courses:

- 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 5050—Herbicides (3)
- Agro 5200—World Food Supply Problems (4)
- AgET 1030—Introduction to Computer Programming (3)
- AgET 3215—Machinery and Equipment (4)
- AnSc 3401—Principles of Animal Nutrition (5)
- Ent 5210—Integrated Pest Management (5)
- FR 5231—Range Management (3)
- Soil 3210—Soil Physical Properties (4)
- Soil 3220—Soil, Water Management, and Conservation (3)
- Soil 3416—Soil Fertility (5)
- Soil 3419—Fertilizer Technology (2)
- Soil 3520—Soil Morphology, Classification, and Genesis (4)
- Soil 3610—Soil Biology (3)
- Soil 5512—Soil Geography (3)
- Soil 5632—Soil Microbiology and Plant Growth (4)

#### **F. Supporting Courses**

- Ent 1005—Economic Entomology (4)
- GCB 3022—Genetics (4)
- PIPa 1001—Introductory Plant Pathology (5)
- 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.

## **Agronomy and Integrated Crop-Pest Management 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.

## *Curricula in Agriculture*

---

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:

- 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 5040—Management of Cropping Systems (3)
- Agro 3200—Undergraduate Seminar (1)

Optional 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)

### **B. Integrated Crop-Pest Management Minor**

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

- Ent 1005—Economic Entomology (4)
- PIPa 1001—Introductory Plant Pathology (5)
- 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)

Optional 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 (3)
- AgET 3215—Machinery and Equipment (4)
- Agro 3020—Growth, Development, and Culture of Field Crops (5)
- Agro 5040—Management of Cropping Systems (3)
- Ent 5215—Insects in Relation to Plant Diseases (4)
- Ent 5250—Principles of Economic Entomology (4)
- Hort 3031—Fruit Science (4)
- Hort 3072—Turf Management (4)
- Hort 5034—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)

## Animal Science

Department of Animal Science  
120 Peters Hall  
1404 Gortner Avenue  
University of Minnesota  
St. Paul, Minnesota 55108  
(612) 373-0975

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, livestock buyers, and a variety of other positions in the meat packing industry, dairy industry, feed industry, 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.

### Animal Science 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 (page 86).

#### B. Physical, Biological, and Analytical Sciences

See Agricultural Science and Industries Curriculum Requirements (pages 86-87).

#### C. The Individual and Society—14 credits minimum

See All-College Requirements (pages 84-85). 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 (pages 85-86).

#### 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 5602—Sheep Production (4)

AnSc 5603—Beef Cattle Production (4)

AnSc 5604—Dairy Farm Management (4)

AnSc 5605—Poultry Production (4)

AnSc 5608—Swine Management and Nutrition (5)

## Curricula in Agriculture

---

One of the following courses:

AnSc 5401—Swine Nutrition and Feeding (3)

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)

Stat 1051—Introduction to Ideas of Statistics (4)

## Consumer Food Science

Department of Food Science and Nutrition

225 Food Science and Nutrition

1334 Eckles Avenue

University of Minnesota

St. Paul, Minnesota 55108

(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.

## Consumer Food Science 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. To graduate in this program, you must earn a grade of C or better in the required organic chemistry and biochemistry courses in category B and in Stat 5020 in category E.

### A. Communication, Language, Symbolic Systems

- Math 1142—Short Calculus (5)
- Rhet 1101—Communication I (4)
- (or) Comp 1001—Introductory Composition (4)
- Rhet 1102—Communication II (4)
- (or) Comp 1002—Introductory Composition (4)
- Rhet 1222—Public Speaking (4)
- Rhet 3551—Professional Writing (4)
- (or) Rhet 3562—Scientific and Technical Writing (4)

### B. Physical and Biological Sciences

- Biol 1011—General Biology (5)
- Biol 5001—Biochemistry (4)
- Chem 1004—General Principles of Chemistry (5)
- Chem 1005—General Principles of Chemistry (5)
- 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 (pages 84-85). 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 (pages 85-86).

### 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)

## Curricula in Agriculture

---

- 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)
- AgEc 5591—Consumption Economics (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)

#### *Sociopsychology<sup>1</sup>*

- 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)

#### *Communication<sup>1</sup>*

- FScN 3400—Food Demonstration Techniques (3)
- Jour 1301—Beginning Photojournalism (4)

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

- 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 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 (3<sup>1</sup>)
- FScN 5136—Food Process Engineering II (3<sup>1</sup>)
- 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:

- PhsI 1002—Human Physiology (4)
- (or) PhsI 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  
1994 Buford Avenue  
University of Minnesota  
St. Paul, Minnesota 55108  
(612) 373-1755

<sup>1</sup>This course will carry four credits effective fall quarter 1982.

## Curricula in Agriculture

---

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 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.

### Economics of Public Services 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—Communication I (4)

Rhet 1102—Communication II (4)

Rhet 1222—Public Speaking (4)

Rhet 3254—Advanced Public Speaking (4)

(or) Rhet 3266—Discussion Methods (4)

Rhet 3551—Professional Writing (4)

(or) Rhet 3562—Scientific and Technical Writing (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 1011—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) Bot 1106—General Zoology (5)

Geo 1001—Physical Geology (5)

Geo 1007—Environmental Geology (5)

- Phys 1031, 1035—Introductory Physics: Measurement and Applications and Laboratory (4, 1)  
Phys 1032, 1036—Introductory Physics: Measurement and Applications and Laboratory (4, 1)  
Soil 1122—Introductory Soil Science (4)

**C. The Individual and Society**

See All-College Requirements (pages 84-85). 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 (pages 85-86).

**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)  
RCD 5099—Interdisciplinary Seminar I (4)  
RCD 5100—Interdisciplinary Seminar II (4)  
RCD 5101—Interdisciplinary Seminar III (2)  
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)

## Curricula in Agriculture

---

- 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, Fisheries, and Wildlife  
219 Hodson Hall  
1980 Folwell Avenue  
University of Minnesota  
St. Paul, Minnesota 55108  
(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.

**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.

## Entomology 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, Fisheries, and Wildlife.

## **INSECT POPULATION MANAGEMENT OPTION**

### **A. Communication, Language, Symbolic Systems**

See Agricultural Science and Industries Curriculum Requirements (page 86).

### **B. Physical, Biological, and Analytical Sciences**

BioC 1301—Elementary Biochemistry I (5)

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

Biol 1011—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 3004—Fundamentals of Ecology (4)

MicB 3103—General Microbiology (5)

Phys 1031, 1035—Introductory Physics: Measurement and Applications and Laboratory (4, 1)

### **C. The Individual and Society—14 credits minimum**

See All-College Requirements (pages 84-85). 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 (pages 85-86).

### **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**

Agro 1010—Principles of Agronomy (4)

Agro 1011—Principles of Agronomy—Discussion (1)

Agro 5030—Weed Control (5)

PIPa 1001—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 (page 86).

## Curricula in Agriculture

---

### B. Physical, Biological, and Analytical Sciences

- BioC 5001, 5025—Biochemistry and Laboratory (4, 2)
- Biol 1011—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 1031, 1035—Introductory Physics: Measurement and Applications and Laboratory (4, 1)
- Phys 1032, 1036—Introductory Physics: Measurement and Applications 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 (pages 84-85). 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 (pages 85-86).

### 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 3004—Fundamentals of 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

Department of Entomology, Fisheries, and Wildlife  
219 Hodson Hall  
1980 Folwell Avenue  
University of Minnesota  
St. Paul, Minnesota 55108  
(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 background necessary in these professional fields. You should recognize that these curricula satisfy only minimum requirements for professional employment; the master's degree is the desired, if not required, preparation for many management, many administrative, and most research positions. The doctor of philosophy degree may be required for some research positions and for teaching at the college level. You are advised to include some graduate-level study in your educational program.

Beginning freshmen and new students with advanced standing are admitted with a pre-fisheries and wildlife curriculum status. Admission is based on previous academic performance and other indicators of scholastic potential. Apply before March 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 you to establish definite curriculum goals for the major or to have an early opportunity to seek another curriculum if scholastic performance or interest is lacking. A faculty adviser works closely with preprofessional students.

## **Pre-Fisheries and Wildlife Requirements**

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

### **A. Communication, Language, Symbolic Systems—17-27 credits**

- Rhet 1101—Communication I (4)
- Rhet 1102—Communication II (4)
- Rhet 1222—Public Speaking (4)
- Math 1142—Short Calculus (5)<sup>1</sup>

### **B. Physical and Biological Sciences—49 credits**

- Biol 1011—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)
- EBB 3004—Fundamentals of Ecology (4)
- FW 1001—Orientation in Fisheries and Wildlife (2)
- FW 3052—Introduction to Fisheries and Wildlife Biology and Management (4)
- Phys 1031, 1035—Introductory Physics: Measurement and Applications and Laboratory (4, 1)
- Phys 1032, 1036—Introductory Physics: Measurement and Applications and Laboratory (4, 1)
- VB 1120—Comparative Vertebrate Morphology (5)

### **C. The Individual and Society—14 credits minimum**

- See All-College Requirements (pages 84-85). One course required in the area of Development of Civilization.
- AgEc 1020—Principles of Macroeconomics (5)
  - Pol 1001—American Government and Politics (5)
- One course elected in an area of Development of Civilization (4 or 5)

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

## Curricula in Agriculture

---

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

See All-College Requirements (pages 85-86).

## Fisheries Major Requirements

You must complete the courses listed below in categories E, F, and G in addition to the pre-fisheries and wildlife requirements for the major in fisheries.

### E. Fisheries Junior-Senior Core Courses—58 or 59 credits

- AnSc 3301—Systemic Physiology (6)
- EBB 5601—Limnology (4)
- EBB 5606—Ecology of Fishes (5)
- (or) FW 5456—Field Ecology of Fishes (5)<sup>1</sup>
- (or) 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)
- MicB 3103—General Microbiology (5)
- Stat 5021—Statistical Analysis I (5)
- Stat 5022—Statistical Analysis II (5)

### F. Supporting Courses—31-33 credits

- Bot 5231—Introduction to the Algae (5)
- (or) Bot 5811—Freshwater Algae (5)<sup>1</sup>
- Chem 1006—Principles of Solution Chemistry (4)
- Chem 3100, 3101—Quantitative Analysis and Laboratory (3, 2)
- CSci 3103—Introduction to Programming Languages and Problem Solving (3)
- CSci 3131 or 3134—FORTRAN Laboratory or Pascal Laboratory (2)
- (or) AgET 1030—Introduction to Computer Programming (3)
- EBB 5112—Invertebrate Biology (5)
- Ent 3175—Introductory Entomology (5)
- (or) Ent 5020—Field Entomology (5)<sup>1</sup>
- Rhet 3562—Scientific and Technical Writing (4)

### G. Electives to complete the 190 credits required for graduation with the bachelor of science degree. See your adviser for recommended courses. The calculus sequence Math 1211(5), 1221(5), and 1231(5) is strongly recommended.

## Fisheries Graduate Study Preparation Major Requirements

Students with high academic ability whose educational objectives are directed toward research or university teaching may, after completing the pre-fisheries and wildlife requirements with a B average, elect this option. The option is intended as preparation for graduate work leading to the M.S. or Ph.D. degree. Students will select elective courses appropriate to their areas of interest in consultation with a fisheries adviser.

### E. Fisheries Junior-Senior Core Courses—58 or 59 credits

- AnSc 3301—Systemic Physiology (6)
- EBB 5601—Limnology (4)

<sup>1</sup>Offered during the Itasca summer session.

- EBB 5606—Ecology of Fishes (5)
- (or) FW 5456—Field Ecology of Fishes (5)<sup>1</sup>
- (or) 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)
- MicB 3103—General Microbiology (5)
- Stat 5021—Statistical Analysis I (5)
- Stat 5022—Statistical Analysis II (5)

**F. Supporting Courses—34-36 credits**

- Chem 3301, 3305—Elementary Organic Chemistry I and Laboratory (4, 2)
- Chem 3302, 3306—Elementary Organic Chemistry II and Laboratory (4, 2)
- CSci 3103—Introduction to Programming Languages and Problem Solving (3)
- CSci 3131 or 3134—FORTRAN Laboratory or Pascal Laboratory (2)
- (or) AgET 1030—Introduction to Computer Programming (3)
- Math 1211—Calculus I (5)
- Math 1221—Calculus II (5)
- Math 1231—Calculus III (5)
- Rhet 3562—Scientific and Technical Writing (4)

**G. Electives to complete the 190 credits required for graduation with the bachelor of science degree. Work closely with your adviser to select suitable courses.**

## Wildlife Major Requirements

You must fulfill the requirements listed in categories E, F, and G below in addition to the pre-fisheries and wildlife requirements for a major in wildlife.

**E. Wildlife Junior-Senior Core Courses—60-65 credits**

- AnSc 3301—Systemic Physiology (6)
- Bot 3201—Introductory Taxonomy (3)
- One of the following chemistry sequences:
  - Sequence One
    - Chem 3301, 3305—Elementary Organic Chemistry I and Laboratory (4, 2)
    - Chem 3302, 3306—Elementary Organic Chemistry II and Laboratory (4, 2)
  - Sequence Two
    - BioC 1301—Elementary Biochemistry I (5)
    - BioC 1302, 1303—Elementary Biochemistry II and Laboratory (3, 2)
- EBB 5014—Ecology of Plant Communities (5)
- (or) EBB 5814—Community Structure and Functioning (5)<sup>1</sup>
- EBB 5817—Vertebrate Ecology (5)<sup>1</sup>
- (or) Ent 5400—Experimental Ecology (3)
- FW 5129—Mammalogy (5)
- EBB 5134—Introduction to Ornithology (5)<sup>1</sup>
- (or) EBB 5834—Field Ornithology (5)
- FW 5281—Senior Seminar: Wildlife (1)
- FW 5561—Wildlife Ecology, Management I (4)
- FW 5562—Wildlife Ecology, Management II (4)

<sup>1</sup>Offered during the Itasca summer session.

## Curricula in Agriculture

---

- FW 5563—Wildlife Ecology, Management III (3)
- FW 5564—Field Problems in Wildlife Resource Management (4)
- Geo 1001—Physical Geology (5)
- (or) Soil 1122—Introductory Soil Science (4)
- VB 5603—Parasites of Wildlife (3)
- (or) VB 5604—Diseases of Wildlife (3)

### F. Supporting Courses—12-14 credits

- CSci 3103—Introduction to Programming Languages and Problem Solving (3)
- CSci 3131 or 3134—FORTRAN Laboratory or Pascal Laboratory (2)
- (or) AgET 1030—Introduction to Computer Programming (3)
- Rhet 3562—Scientific and Technical Writing (4)
- Stat 5021—Statistical Analysis I (5)

- G. Electives to complete the 190 credits required for graduation with the bachelor of science degree. See your adviser for recommended courses. The calculus sequence Math 1211(5), 1221(5), and 1231(5) is strongly recommended.<sup>1</sup> Students interested in such areas as natural history interpretation, technical communication, paralegal work, or any field related to wildlife biology should select electives appropriate to their career or graduate study plans.

## Fisheries and Wildlife Minor Requirements

A fisheries and wildlife minor is offered for students working toward baccalaureate degrees in other natural-resource management areas, communications, education, and other fields dealing with wildlands or water resources. 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 is open to students who have completed the following prerequisites and can be declared upon completion of the following fisheries and wildlife course requirements:

### Required Background Courses—16-19 credits:

- Introductory zoology and botany; e.g., Biol 1103 and 1106 or equivalents
- Introductory ecology; e.g., EBB 3004 or equivalent
- One course in some aspect of vertebrate biology; e.g., equivalent to EBB 5114—Vertebrate Biology (4), EBB 5134—Introduction to Ornithology (5), EBB 5606—Ecology of Fishes (5), or FW 5129—Mammalogy (5)

### Required Courses—16 or 17 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 (3)

Optional Courses (at least one course from the following, for which some prerequisites may be waived by the instructor):

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

<sup>1</sup>See pre-fisheries and wildlife math requirements.

## **Food Science and Technology**

Department of Food Science and Nutrition  
225 Food Science and Nutrition  
1334 Eckles Avenue  
University of Minnesota  
St. Paul, Minnesota 55108  
(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 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.

### **Food Science and Technology 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—Communication I (4)
- Rhet 1102—Communication II (4)
- Rhet 1222—Public Speaking (4)
- Rhet 3551—Professional Writing (4)
- (or) Rhet 3562—Scientific and Technical Writing (4)
- 4 credits in statistics

## *Curricula in Agriculture*

---

### **B. Physical and Biological Sciences**

Biol 1011—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 1031, 1035—Introductory Physics: Measurement and Applications and Laboratory (4, 1)

Phys 1032, 1036—Introductory Physics: Measurement and Applications and Laboratory (4, 1)

### **C. The Individual and Society—14 credits minimum**

See All-College Requirements (pages 84-85). 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 (pages 85-86).

### **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 (3<sup>1</sup>)

FScN 5136—Food Process Engineering II (3<sup>1</sup>)

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 grading 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—Food Formulation, Product Development (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)

<sup>1</sup>This course will carry four credits effective fall quarter 1982.

- 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. Thus, courses in food per se are not acceptable as an area of emphasis, while courses in a specialized area such as nutrition are acceptable. It is assumed that a well-conceived area of emphasis will include some 3000- and 5000-level courses.

### *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 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)

### *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.

## Curricula in Agriculture

---

### *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)

### *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 governmental 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 seven 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  
1970 Folwell Avenue  
University of Minnesota  
St. Paul, Minnesota 55108  
(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.

## **Horticultural Science 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 (page 86).

### **B. Physical, Biological, and Analytical Sciences**

BioC 1301—Elementary Biochemistry I (5)

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

Biol 1011—General Biology (5)

Biol 1103—General Botany (5)

Chem 1004—General Principles of Chemistry (5)

Chem 1005—General Principles of Chemistry (5)

Phys 1031, 1035—Introductory Physics: Measurement and Applications and Laboratory (4, 1)

(or) Phys 1032, 1036—Introductory Physics: Measurement and Applications and Laboratory (4, 1)

### **C. The Individual and Society—14 credits minimum**

See All-College Requirements (pages 84-85). 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 (pages 85-86).

### **E. Supporting Courses**

Ent 1005—Economic Entomology (4)

(or) Ent 5050—Forest Entomology (4)

PIPa 1001—Introductory Plant Pathology (5)

(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)

## Curricula in Agriculture

---

- 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 (4-6)
- (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)
- One of the following courses:

- AgET 1030—Introduction to Computer Programming (3)
- 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)
- Phys 1031—Introductory Physics: Measurement and Applications (4)  
(if not applied to category B above)
- Phys 1032—Introductory Physics: Measurement and Applications (4)  
(if not applied to category B above)

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 (4-6)
- (or) Hort 5000—Professional Experience Program (4)
- Hort 5040—Plant Growth Regulators (3)
- Plus 12-14 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—Horticulture Practicum (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 of the following courses:

- Bot 3109—Plant Anatomy (5)
- EBB 3004—Fundamentals of Ecology (4)
- GCB 3022—Genetics (4)
- Geo 1001—Physical Geology (5)
- Phys 1031—Introductory Physics: Measurement and Applications (4)
- (if not applied to category B above)
- Phys 1032—Introductory Physics: Measurement and Applications (4)
- (if not applied to category B above)
- AgET 1030—Introduction to Computer Programming (3)

One of the following courses:

- AgET 1015—Basic Architectural Drawing (4)
- AgET 3010—Architectural Drafting (4)
- Ind 1600—Drafting (3)
- LA 1025—Basic Visualization (4)

*Nursery Management*

- AgEc 1030—Principles of Microeconomics (4)
- AgEc 5020—Applied Linear Programming (4)
- (or) GCB 3022—Genetics (4)
- Agro 5030—Weed Control (5)
- GC 1513—Principles: Small Business Operations (5)
- GC 3560—Personnel Administration (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)

## *Curricula in Agriculture*

---

- Hort 3076—Arboriculture (3)
- Hort 3079—Ornamental Horticultural Business Practices (3)
- Hort 5040—Plant Growth Regulators (3)
- Hort 5046—Nursery Management and Production I (3)
- Hort 5048—Nursery Management and Production II (4)
- 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:
  - AgET 1015—Basic Architectural Drawing (4)
  - AgET 3010—Architectural Drafting (4)
  - Ind 1600—Drafting (3)
  - LA 1025—Basic Visualization I (4)

### *Turf Management*

- AgEc 1250—Principles of Accounting (4)
- AgET 1400—Surveying (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 3074—Landscape Management and Horticultural Practices (4)
- Hort 3076—Arboriculture (3)
- Hort 3097—Horticultural Practicum (4-6)
- (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 following courses:
  - Bot 3109—Plant Anatomy (5)
  - GCB 3022—Genetics (4)
  - Geo 1001—Physical Geology (5)
  - EBB 3004—Fundamentals of Ecology (4)
  - Phys 1031—Introductory Physics: Measurement and Applications (4)  
(if not applied to category B above)
  - (or) Phys 1032—Introductory Physics: Measurement and Applications (4)  
(if not applied to category B above)
  - MicB 3103—General Microbiology (5)

### *Urban Horticulture*

- AgEd 3021—Education Through Extension Methods (3)
- AgJo 3530—Publicity (4)
- EBB 3004—Fundamentals of 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)

## *Hospitality and Food Service Management*

---

Hort 3076—Arboriculture (3)

Hort 3097—Horticulture Practicum (4-6)

(or) Hort 5000—Professional Experience Program (4)

Hort 5034—Commercial Vegetable Production: Tuber, Bulb, Root Crops (3)

(or) Hort 5035—Commercial Vegetable Production: Fruit, Seed, and Leafy Types (3)

One of the following courses:

AgET 1015—Basic Architectural Drawing (4)

AgET 3010—Architectural Drafting (4)

Ind 1600—Drafting (3)

LA 1025—Basic Visualization I (4)

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

### **Horticultural Science 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 nonprofessional job entry and subsequent 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)

Chem 1004—General Principles of Chemistry (5)

Soil 1122—Introductory Soil Science (4)

Biol 1011—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, and Professional Experience Program courses.

## **Hospitality and Food Service Management**

Department of Food Science and Nutrition

225 Food Science and Nutrition

1334 Eckles Avenue

University of Minnesota

St. Paul, Minnesota 55108

(612) 373-1071

This program is intended for those interested in the field of hospitality management. The broad scope of the hospitality and food service industry and changes in life-styles among the American people have created a variety of service-related fields in which you may wish to concentrate your professional preparation. Since work in the field involves the application of theoretical principles, course work strives to balance theory and practical experience.

Hospitality and food service management majors complete a common core of courses and may choose an area of emphasis in food production, food service management, or hospitality management.

## *Curricula in Agriculture*

---

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.

### **Hospitality and Food Service Management Major Requirements**

The requirements for the major in hospitality and food service management are listed below. 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 1111—College Algebra and Analytical Geometry (5)
- (or) Math 1131—Finite Mathematics (5)
- (or) Math 1142—Short Calculus (5)
- Rhet 1101—Communication I (4)
- (or) Comp 1001—Introductory Composition (4)
- Rhet 1102—Communication II (4)
- (or) Comp 1002—Introductory Composition (4)
- Rhet 1222—Public Speaking (4)
- Rhet 3551—Professional Writing (4)
- (or) Rhet 3562—Scientific and Technical Writing (4)

#### **B. Physical and Biological Sciences**

- Biol 1011—General Biology (5)
- Chem 1004—General Principles of Chemistry (5)
- Chem 1005—General Principles of Chemistry (5)

#### **C. The Individual and Society**

See All-College Requirements (pages 84-85). 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 (pages 85-86).

#### **E. Professional Courses in the Major**

- Acct 1024—Principles of Financial Accounting I (3)
- Acct 3001—Managerial Accounting (4)
- BFin 3000—Finance Fundamentals (4)

One of the following sequences:

##### Sequence One

- FScN 1212—Scientific Principles of Food Preparation I (4)
- FScN 1213—Scientific Principles of Food Preparation II (3)

##### Sequence Two

- FScN 3110—Food Chemistry (3)
- FScN 3112—Food Chemistry Laboratory (3)

## *Hospitality and Food Service Management*

---

- FScN 1700—Introduction to the Hospitality and Food Service Industries (2)
- FScN 3123—Microbiology of Foods (5)
- FScN 3600—Principles of Nutrition (4)
- FScN 3760—Hospitality Cost Management (4)
- FScN 5100—General Seminar (1)
- IR 3002—Industrial Relations Systems: Labor Markets and the Management of Human Resources (4)
- Mgmt 3001—Fundamentals of Management (4)
- CSci 3103—Introduction to Programming Languages and Problem Solving (3)
- CSci 3134—Pascal Laboratory (2)

### **F. Area of Emphasis**

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

#### *Food Production*

This area of emphasis is designed to prepare graduates to respond to the needs of the food service industry for technically competent workers in such areas as operations, management, and food quality assurance. Food production majors should take FScN 3110-3112 rather than FScN 1212-1213.

- Biol 5001—Biochemistry (4)
- BioC 5025—Biochemistry Laboratory (2)
- Chem 3301, 3305—Elementary Organic Chemistry I and Laboratory (4, 2)
- Chem 3302, 3306—Elementary Organic Chemistry II and Laboratory (4, 2)
- FScN 1500—Meat Science (4)
- FScN 3403—Experimental Foods (4)
- FScN 3622—Nutrition in the Life Cycle (4)
- (or) FScN 5622—Human Nutrition (5)
- FScN 3720—Administrative Experience: Hospitality or Food Service Enterprise (5)
- FScN 3730—Quantity Food Purchasing and Production (5)
- FScN 3740—Design and Layout of Food Services (4)
- FScN 3752—Food and Hospitality Operations: Application of Computer Systems to Smaller Units (4)
- FScN 5135—Food Process Engineering I (3<sup>1</sup>)
- FScN 5136—Food Process Engineering II (3<sup>1</sup>)
- FScN 5360—Sensory Evaluation of Food Quality (4)
- Math 1142—Short Calculus (5)
- (or) Math 1311—Computer Calculus I (5)
- (and) Math 1321—Computer Calculus II (5)
- (and) Math 1331—Computer Calculus III (5)
- Phsl 3051—Human Physiology (5)
- (or) Phsl 1002—Human Physiology (4)

One of the following physics sequences:

#### Sequence One

- Phys 1031, 1035—Introductory Physics: Measurement and Applications and Laboratory (4, 1)
- Phys 1032, 1036—Introductory Physics: Measurement and Applications and Laboratory (4, 1)

#### Sequence Two

- Phys 1104, 1107—General Physics and Laboratory (4, 1)
- Phys 1105, 1108—General Physics and Laboratory (4, 1)

---

<sup>1</sup>This course will carry four credits effective fall quarter 1982.

## Curricula in Agriculture

---

Phys 1106, 1109—General Physics and Laboratory (4, 1)

One of the following statistics sequences:

Sequence One

Stat 3081—Experimental Techniques and Statistical Inference (5)

Sequence Two

Stat 5021—Statistical Analysis I (4)

Sequence Three

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

Soc 3802—Sociological Methods II: Statistical Inference (5)

Soc 3803—Sociological Methods III: Research Methods (5)

### *Food Service Management*

This area of emphasis is designed to prepare graduates for employment as managers of institutional or commercial food services in such organizations as hospitals, nursing homes, schools, colleges and universities, airlines, vending services, hotels, motels, restaurants, and fast food establishments.

AgEc 3410—Economic Organization of the Hospitality Industry (4)

BLaw 3058—Introduction to Law, and the Law of Contracts and Agency (4)

FScN 3472—Principles of Food Purchasing (4)

FScN 3720—Administrative Experience: Hospitality or Food Service Enterprise (5)

FScN 3730—Quantity Food Purchasing and Production (5)

FScN 3740—Design and Layout of Food Services (4)

FScN 3752—Food and Hospitality Operations: Application of Computer Systems to Smaller Units (4)

Mktg 3000—Principles of Marketing (4)

Plus 20 credits from the following courses, selected in consultation with your adviser:

Afro 1441—Afro-American History and Culture (to 1865) (4)

Afro 3061—The Black Family (4)

Amln 1771—Introduction to American Indian Studies (4)

Arch 1001—Environmental Design: Man and Environment (4)

BGS 3002—Business and Society (4)

Chic 1105—Introduction to Chicano Studies: The Beginnings (4)

EBB 3101—Ecology for Engineers and Physical Scientists (4)

FScN 1102—Technology of Food Processing (4)

FScN 1500—Meat Science (4)

FScN 3622—Nutrition in the Life Cycle (4)

FScN 3762—Hospitality Financial Management (4)

FScN 5000—Professional Experience Program (1-6)

FSoS 3001—Communication Skills and Interviewing Techniques: An Introduction (3)

Geog 3371—Urban Geography (4)

Ins 3100—Risk Management and Insurance (4)

IR 3007—Collective Bargaining Negotiations and Modern Labor Relations (4)

Mktg 3010—Buyer Behavior and Marketing Analysis (4)

Pol 1001—American Government and Politics (5)

PubH 3004—Basic Concepts in Personal and Community Health (5)

QA 1050—Elementary Managerial Statistics (4)

Soc 1002—American Community (4)

Soc 5201—Introduction to Social Psychology (4)

(or) Psy 5201—Social Psychology (4)

Soc 5951—Minority Group Relations (4)

### *Hospitality Management*

This area of emphasis is designed to prepare graduates to manage a wide range of facilities that provide services for the away-from-home public.

AgEc 3101—Microeconomic Theory (4)

AgEc 3410—Economic Organization of the Hospitality Industry (4)

BGS 3002—Business and Society (4)

BLaw 3058—Introduction to Law, and the Law of Contracts and Agency (4)

FScN 3752—Food and Hospitality Operations: Application of Computer Systems to Smaller Units (4)

FScN 3762—Hospitality Financial Management (4)

One of the following mathematics sequences:

Sequence One

Math 1131—Finite Mathematics (5)

Math 1142—Short Calculus (5)

Sequence Two

Math 1201—Pre-Calculus (5)

Math 1211—Calculus I (5)

Math 1221—Calculus II (5)

Mktg 3000—Principles of Marketing (4)

OM 3000—Introduction to Operations Management (4)

QA 1050—Elementary Managerial Statistics (4)

Plus 20 credits at the 3000 level and above in the areas of business and food science and nutrition, selected in consultation with your adviser

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

## **Landscape Architecture**

Department of Horticultural Science and Landscape Architecture

305 Alderman Hall

1970 Folwell Avenue

University of Minnesota

St. Paul, Minnesota 55108

(612) 373-1026

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, 231 Pillsbury Drive S.E., University of Minnesota, Minneapolis, Minnesota 55455; or the Office of Admissions and Records, 130 Coffey Hall, 1420 Eckles Avenue, University of Minnesota, St. Paul, Minnesota 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 8 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 admittance.
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.

### Landscape Architecture 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—Communication I (4)

Rhet 1102—Communication II (4)

Rhet 1222—Public Speaking (4)

Rhet 3551—Professional Writing (4)

(or) Rhet 3562—Scientific and Technical Writing (4)

Math 1111—College Algebra and Analytical Geometry (5)

One additional college level course in mathematics, statistics, or computer science (3)

## *Curricula in Agriculture*

---

### **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 (pages 84-85). One course required in the area of Development of Civilization.

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

See All-College Requirements (pages 85-86).

### **E. Professional and Supporting Courses in the Major**

AgET 1400—Surveying (4)

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 1001—Environmental Design: Man and Environment (4)

LA 1002—Environmental Design: Tools and Processes (4)

LA 1003—Environmental Design: Implementation and Evaluation (4)

LA 1024—Landscape Theory (4)

LA 1031—Introduction to Landscape Architecture (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  
1334 Eckles Avenue  
University of Minnesota  
St. Paul, Minnesota 55108  
(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.

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.

## **Nutrition and Dietetics 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—Communication I (4)
- Rhet 1102—Communication II (4)

## Curricula in Agriculture

---

- Rhet 1222—Public Speaking (4)
- Rhet 3551—Professional Writing (4)
- (or) Rhet 3562—Scientific and Technical Writing (4)

### B. Physical and Biological Sciences

- Anat 1004—Elementary Anatomy (4)
- BioC 5025—Laboratory in Biochemistry (2)
- Biol 1011—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)
- Phsl 3051—Human Physiology (5)
- (or) Phsl 1002—Human Physiology (4)

### C. The Individual and Society

See All-College Requirements (pages 84-85). 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 (pages 85-86).

### 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—Management of Food Service and Hospitality Business Systems (3)
- FScN 5100—General Seminar (1)
- FScN 5622—Human Nutrition (5)
- FScN 5663—Clinical Nutrition Laboratory (1-2)
- One course in each of three quarters:
  - FScN 5665—Applied Clinical Nutrition I (2)
  - FScN 5666—Applied Clinical Nutrition II (2)
  - FScN 5667—Applied Clinical Nutrition III (2)
- 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 America 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, after consultation with your adviser, substitute up to 20 credits from the courses listed below for an equivalent number of credits from the major requirements. 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  
1519 Gortner Avenue  
University of Minnesota  
St. Paul, Minnesota 55108  
(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 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.

### Plant Health Technology 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 (page 86).

#### B. Physical, Biological, and Analytical Sciences

See Agricultural Science and Industries Curriculum Requirements (pages 86-87).

#### C. The Individual and Society—14 credits minimum

See All-College Requirements (pages 84-85). 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 (pages 85-86).

#### E. Professional Courses in the Major

PIPa 1001—Introductory Plant Pathology (5)

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 Economics**

Department of Agricultural and Applied Economics  
231 Classroom-Office Building  
1994 Buford Avenue  
University of Minnesota  
St. Paul, Minnesota 55108  
(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.

### **Resource Economics 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 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.

## *Curricula in Agriculture*

---

### **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—Communication I (4)

Rhet 1102—Communication II (4)

Rhet 1222—Public Speaking (4)

Rhet 3254—Advanced Public Speaking (4)

(or) Rhet 3266—Discussion Methods (4)

Rhet 3551—Professional Writing (4)

(or) Rhet 3562—Scientific and Technical Writing (4)

### **B. Physical and Biological Sciences**

Biol 1011—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 1031, 1035—Introductory Physics: Measurement and Applications and Laboratory (4, 1)

Phys 1032, 1036—Introductory Physics: Measurement and Applications and Laboratory (4, 1)

Sequence Two

Geo 1001—Physical Geology (5)

Soil 1122—Introductory Soil Science (4)

### **C. The Individual and Society—21 credits minimum**

See All-College Requirements (pages 84-85). 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 (pages 85-86).

### **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)  
Arch 5137—Planning: Urban Function and Structure (4)

Recommended courses include:

- 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

- AgEc 3610—Community Resource Development (4)  
RCD 5099—Interdisciplinary Seminar I (4)  
RCD 5100—Interdisciplinary Seminar II (4)  
RCD 5101—Interdisciplinary Seminar III (2)  
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 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  
1529 Gortner Avenue  
University of Minnesota  
St. Paul, Minnesota 55108  
(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.

## *Curricula in Agriculture*

---

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.

### **Soil Science 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 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 (page 86).

#### **B. Physical, Biological, and Analytical Sciences**

See Agricultural Science and Industries Curriculum Requirements (pages 86-87).

#### **C. The Individual and Society—14 credits minimum**

See All-College Requirements (pages 84-85). 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 (pages 85-86).

#### **E. Professional Courses in the Major**

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

Soil 1122—Introductory Soil Science (4)

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 3918—Senior Seminar (1)

#### **F. Supporting Courses**

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

AgET 3410—Hydrology, Water Control (4)

AgET 3880—Rural Sanitation, Water Supply (4)

AgET 5400—Drainage, Irrigation (4)

CE 5420—Introduction to Water Resource Management (4)

FR 5114—Forest Hydrology (3)

Geo 5611—Groundwater Geology (4)

Plant Sciences Courses—9 credits minimum, to be selected from courses in the following areas:

Agronomy, botany, plant pathology, and plant physiology

Animal Science Courses—9 credits minimum, to be selected from the following courses or 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)

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

- AgET 1030—Introduction to Computer Programming (3)
- CSci 3101, 3131—A FORTRAN Introduction to Computer Programming and Laboratory (4, 2)
- CSci 1100, 1101—Introduction to FORTRAN Programming I, II (2, 2)

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

### Soil Science 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—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)

#### Option B:

- Geo 1001—Physical Geology (5)
- Soil 1122—Introductory Soil Science (4)
- Plus five courses from those listed below:
  - 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)
  - 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  
1529 Gortner Avenue  
University of Minnesota  
St. Paul, Minnesota 55108  
(612) 373-1062

Department of Agricultural Engineering  
213 Agricultural Engineering  
1390 Eckles Avenue  
University of Minnesota  
St. Paul, Minnesota 55108  
(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.

## Curricula in Agriculture

---

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.

### Soil and Water Resource Management Major Requirements

Students selecting the soil and water resource management 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 or the Department of Soil Science, depending upon which department you have enrolled in.

#### A. Communication, Language, Symbolic Systems

- Math 1111—College Algebra and Analytical Geometry (5)
- (or) Math 1131—Finite Mathematics (5)
- Rhet 1101—Communication I (4)
- Rhet 1102—Communication II (4)
- Rhet 1222—Public Speaking (4)
- Rhet 3551—Professional Writing (4)
- (or) Rhet 3562—Scientific and Technical Writing (4)

#### B. Physical and Biological Sciences

- Biol 1011—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 1031, 1035—Introductory Physics: Measurement and Applications and Laboratory (4, 1)
- Soil 1122—Introductory Soil Science (4)

#### C. The Individual and Society

- See All-College Requirements (pages 84-85). 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 (pages 85-86).

#### E. Professional Courses in the Major

- AgET 1010—Technical Drawing (4)
- AgET 3410—Hydrology, Water Control (4)
- AgET 3800—Rural Sanitation and Water Supply (4)
- AgET 5400—Drainage and Irrigation (4)
- CE 5420—Introduction to Water Resources Management (4)
- FR 5200—Aerial Photo Interpretation (3)
- Soil 3210—Soil Physical Properties (4)

- Soil 3220—Soil, Water Management, and Conservation (3)
- (or) Soil 5232—Soil Physics (4)
- Soil 5240—Microclimatology (Soils) (5)
- (or) Soil 1262—Introduction to Meteorology (4)
- Soil 5512—Soil Geography and Land Use (3)
- Soil 5540—Soil Resources (4)

**F. Supporting Courses**

- AgEc 3610—Community Resource Development (4)
- RCD 1010—Issues in the Environment (3)
- RCD 3010—The Minnesota Community: Analysis of Its Organization, Change, and Development (4)
- RCD 5099—Interdisciplinary Seminar I (4)
- RCD 5100—Interdisciplinary Seminar II (4)
- RCD 5101—Interdisciplinary Seminar III (2)

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

## **Technical Communication**

Department of Rhetoric  
202 Haecker Hall  
1364 Eckles Avenue  
University of Minnesota  
St. Paul, Minnesota 55108  
(612) 373-0917

Technical communicators apply modern techniques to the dissemination of technical knowledge in industry, business, education, and government. Technical communicators develop channels of communication that range from the scientist to management and 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, oral communication, and the media. 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, aeronautics, communication, electronics, research and development, and transportation. You may pursue a career as a writer-editor, an extension specialist, a research and development director, or a training or communication manager.

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.

## **Technical Communication 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 your adviser and the Department of Rhetoric.

## *Curricula in Agriculture*

---

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

- CSci 1100—Introduction to FORTRAN Programming I (2)
- CSci 1101—Introduction to FORTRAN Programming II (2)
- Math 1111—College Algebra and Analytical Geometry (5)
- Rhet 1101—Communication I (4)
- Rhet 1102—Communication II (4)
- Rhet 1222—Public Speaking (4)
- Rhet 3562—Scientific and Technical Writing (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 1011—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 3001—Introduction to Ecology (4)
- (or) 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)
- PhsI 1002—Human Physiology (4)
- Phys 1031, 1035—Introductory Physics: Measurement and Applications and Laboratory (4, 1)
- Phys 1032, 1036—Introductory Physics: Measurement and Applications and Laboratory (4, 1)

### **C. The Individual and Society—14 credits minimum**

See All-College Requirements (pages 84-85). One course required in the area of Development of Civilization.

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

See All-College Requirements (pages 85-86).

### **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 area listed below. Some courses are required; recommended courses may be taken with the approval of your adviser. You may take courses not listed 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)

Engl 1027—Intermediate Composition (4)

- Rhet 3551—Professional Writing (4)
- 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:

- AgET 1010—Technical Drawing (4)
- AgJo 3230—Basic Typography (4)
- Dsgn 1521—Color and Design (4)
- Dsgn 1523—Visual Presentation I (4)
- Dsgn 1525—Two-Dimensional Design I (4)
- Rhet 3166—Scientific and Technical Graphics (4)
- Rhet 3176—The Use of Scientific and Technical Film (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)
- Spch 5412—Group and Organizational Communication (4)
- Spch 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)

## Curricula in Agriculture

---

- Rhet 3700—Rhetorical Theory: Persuasion and the Literature of Science (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  
Required Course:

- HSci 1813—Introduction to History of Science (modern science) (4)

Recommended Courses:

- 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 3xxx level or higher.

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

## Technical Communication Minor Requirements

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, 1102, 1222, and 3551 or 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 3551—Professional Writing (4)
- Rhet 3562—Scientific and Technical Writing (4)

Rhet 5170—Managerial Communications (4)

Rhet 5571—Writing for Special Projects (2) (Students must register for two quarters and complete four credits.)

AgJo 5561—Writing for Publication (4)

Plus one of the following courses: (Note: Courses used to fulfill All-College Requirements cannot be applied to this minor.)

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)

## 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 placed on their power of judgment and from choice by ignorance. 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 one credit in any category*. Transfer students and students who plan to transfer to the college should read the information under the heading Transfer Students in section I of this bulletin.

### A. Communication, Language, Symbolic Systems—18 credits (A-N)

To graduate from the College of Agriculture, you must complete 18 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 equivalents:

1. Freshman Communication: Rhet 1101 and 1102
2. Public Speaking: Rhet 1222
3. Professional Writing or Scientific and Technical Writing: Rhet 3551 or 3562

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

AgJo 3111

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

Foreign Languages—all beginning courses

Ling 1001, 3001

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

Phil 1001, 3201, 3231

Rhet 1147, 1220, 1221, 1226, 1251, 3166, 3254, 3266, 3700, 5147, 5165, 5170, 5175, 5257, 5400, 5500, 5561, 5600, 5700

Stat—all courses

*Notes*—You may offer transfer credits in freshman communication from other colleges and universities to satisfy the freshman communication requirements.

You may offer transfer credits in public speaking from other colleges and universities to satisfy the public speaking requirements.

## Curricula in Agriculture

---

You may take Rhet 3551 or 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 Rhet 3551 or 3562.

If you demonstrate high ability in the proficiency tests in freshman communication, public speaking, professional writing, or scientific and technical writing offered by the Department of Rhetoric, you may be excused from these course requirements. However, you must still meet the minimum requirement of 18 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 section 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, 3371, 3372, 3373

**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  
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

## Curricula in Agriculture

---

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—all humanities and literature courses

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 areas of The Individual and Society and 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—18 credits minimum (A-N)

Math 1111—College Algebra and Analytical Geometry (5)

Rhet 1101—Communication I (4)

Rhet 1102—Communication II (4)

Rhet 1222—Public Speaking (4)

Rhet 3551—Professional Writing (4)

(or) Rhet 3562—Scientific and Technical Writing (4)

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

Biol 1011—General Biology (5)

Biol 1103—General Botany (5)

(or) Biol 1106—General Zoology (5)

Phys 1031, 1035—Introductory Physics: Measurement and Applications and Laboratory (4, 1)

## 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 Five<sup>1</sup>

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 equivalents. Courses from this list that are applied to major requirements cannot be used to meet this requirement.

AgEc 5020—Applied Linear Programming (4)

AgET 1030—Introduction to Computer Programming (3)

BioC 1302 and 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 and 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 1032 and 1036—Introductory Physics: Measurement and Applications 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

<sup>1</sup>This sequence is recommended for students who plan to enter graduate school.

## Curricula in Agriculture

---

- 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 (pages 84-85). 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 (pages 85-86).
- E. Requirements in the Major**  
See individual curricula.
- F. 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.

If the specific programs do not meet your needs, you may, in consultation with your adviser, develop a program in a special area of interest in combination with supporting course work in such areas as rural sociology, soil science, or agricultural engineering. You may also complete a broad individualized program in administration or planning rather than concentration in a specialized area.

## Curricula Relating to Agriculture

### 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 for expanding production of crops and livestock in the United States and abroad, for reducing the dependence of agriculture on labor, and for using soil, water, and energy resources wisely.

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

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

## Pre-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, 1475 Gortner Avenue, University of Minnesota, St. Paul, Minnesota 55108, telephone (612) 373-3648.

## Pre-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 advised by faculty advisers in their major departments and are expected to make satisfactory progress toward completion of the degree in those majors.

For information concerning 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, 301 Veterinary Science, 1971 Commonwealth Avenue, University of Minnesota, St. Paul, Minnesota 55108.





### III. COURSE LISTINGS

**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.
- # Consent of the instructor is required prior to registration.
- △ Consent of the division, department, or school offering the course is required prior to registration.
- 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 departmental 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, faculty, and functions of the Department of Agricultural and Applied Economics as well as employment opportunities in the field.
- 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-4th 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.
- 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.

## Course Listings

---

- 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 or #)  
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 or #)  
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; generating alternative program elements and developing 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)  
Focuses on business and personal considerations and analytical procedures for evaluation opportunities and arrangements for gaining entry into farming; in analyzing business expansion alternatives; and in 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, \$5800; prereq 3820)  
Concepts to use in selecting a record system; data requirements and procedures of analysis to provide tax information, total business evaluation, and enterprise evaluation.
- 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 departmental office prior to registration.
- 3990. PROBLEMS OR INDEPENDENT STUDY.** (Cr ar; prereq #)  
Independent study, supervised reading, or research on agricultural economic problems not covered in regularly offered courses.
- 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.
- 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.
- 5271. BAYESIAN DECISION MAKING.** (4 cr, \$Econ 5271, \$Stat 5271; prereq Stat 5133)  
Axioms for personal probability and utility. Elements of statistical decision theory. Bayesian analysis of linear models.
- 5272. BAYESIAN DECISION MAKING.** (4 cr, \$Econ 5272, \$Stat 5272; prereq Econ 1002, Stat 5122...5271 recommended)  
Expected utility models for economic decisions made under conditions of uncertainty. Applications to portfolio selection, forward and futures trading, betting, contingency markets, and business planning.
- 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.
- 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, antitrust regulations, and others.
- 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.

## Course Listings

---

- 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.
- 5591. CONSUMPTION ECONOMICS.** (4 cr for undergrad, 3 cr for grad; prereq 3101 or Econ 3101)  
Analytical and empirical treatment of consumer behavior. Modern adaptations of theory to explain household consumption activities.
- 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 #)  
The 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.

### FOR GRADUATE STUDENTS ONLY

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

- 8200-8201-8202. GENERAL SEMINAR: AGRICULTURAL 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**

### 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 Listings

---

- 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.

## Agricultural Education

- 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; developing a 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.
- 5061. PROGRAM PLANNING AND EVALUATION** (3 cr; prereq sr)  
Developing 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, organizing learning resource materials, managing classroom and laboratory learning activities, curriculum planning and organization, managing 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; developing 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.

### FOR GRADUATE STUDENTS ONLY

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

#### 8001.\* RESEARCH IN AGRICULTURAL EDUCATION

#### 8010. CURRENT ISSUES IN AGRICULTURAL EDUCATION

## Course Listings

---

- 8020. SEMINAR: AGRICULTURAL EDUCATION
- 8091. FIELD PROBLEMS
- 8303. SEMINAR: GRADUATE STUDIES REVIEW

## Agricultural Engineering

### COURSES IN AGRICULTURAL ENGINEERING TECHNOLOGY (AgET)

- 1010. **TECHNICAL DRAWING.** (4 cr, §3010; 2 lect, 4 lab hrs, 2 lab hrs ar per wk)  
Drafting instruments and their uses. Lettering, scale reading, conventional symbols, tracings, and reproductions  
Multiview drawings, pictorial drawings, plats of surveys, and contour maps.
- 1015. **BASIC ARCHITECTURAL DRAWING.** (4 cr; 2 lect, 4 lab hrs, 2 lab hrs ar per wk)  
Fundamental principles of architectural design for residences. Preparation of working drawings. Site selection, construction details, and overall planning as related to interior design.
- 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.
- 1030. **INTRODUCTION TO COMPUTER PROGRAMMING.** (3 cr; prereq Math 1111; 3 lect hrs per wk)  
Elementary computer programming in BASIC. Use of teletype for input-output. Demonstrations and laboratory exercises in elementary problem solving. Elements of computer organization.
- 1090. **DIRECTED STUDIES IN AGRICULTURAL ENGINEERING.** (Cr ar)  
Independent study of topic(s) involving physical principles as applied to agricultural production and land resources.
- 1400. **SURVEYING.** (4 cr; prereq Math 1008)  
Basic principles of plane surveying; measurement of horizontal distances; leveling; measurement of angles and directions; traverse and stadia surveying; plane table surveys; contours; land descriptions; land surveying and legal aspects. Lectures and laboratory.
- 3010. **ARCHITECTURAL DRAFTING.** (4 cr, §1015; 2 lect, 4 lab hrs, 2 lab hrs ar per wk)  
Construction principles of architectural details for wood frame structures. Preparation of full set of working drawings of residence. Consideration of site selection, construction details, and overall planning.
- 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 1031; 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 1031; 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 1031, 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 1031; 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 1031; 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 1031; 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.

## Agricultural Engineering

- 3800. RURAL SANITATION AND WATER SUPPLY.** (4 cr; prereq Phys 1031, 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.
- 3970. DIRECTED STUDIES IN AGRICULTURAL ENGINEERING.** (Cr ar; see policy statement on directed studies)  
Independent study of topic(s) involving physical principles as applied to agricultural production and land resources
- 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 1AgEd 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 1032; 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 1032; 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 1032 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.
- 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.
- 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 are offered by the Institute of Technology and 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)

## Course Listings

---

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)  
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 1101 and 1102 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 Jour 1101 and Rhet 3551 or 3562 or Comp 1027)  
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, legislative bodies, etc.

- 3159. PUBLICATIONS EDITING.** (4 cr; prereq freshman composition plus advanced composition or 3530 or equiv journalism course or #)  
The publication process from copy selection, editing, and preparation to scheduling and supervising production of small publications and periodicals. Covers business, technical, educational, and general publications. Includes editing copy, writing headlines and outlines, marking and fitting copy, typesetting, proofreading, and keylining.
- 3230. BASIC TYPOGRAPHY.** (4 cr; prereq 3530 or equiv in journalism or #)  
Identification, selection, and design of typefaces. Use of typesetting machines, transfer lettering, and calligraphy. Legibility and design in layout. Preparation of type for publication including copyfitting and keylining for offset printing.
- 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 completion of rhetoric communication requirement)  
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 15 cr in communications and 15 cr in agricultural journalism or journalism and #; not for grad cr)  
Up to 12 weeks of planned experience in a selected position in agricultural communications; evaluative reports and consultations with faculty advisers and employers.
- 5100. SEMINAR IN AGRICULTURAL COMMUNICATION.** (3 cr [max 6 cr]; prereq sr and #)  
Study of selected topics through reading, discussion, lectures by resource people, and preparation and presentation of papers.
- 5301. FUNCTIONAL PHOTOGRAPHY.** (4 cr; prereq #)  
Use of photography in science and education. Includes the selection and use of equipment and film, close-up techniques, slide set production.
- 5500. RESEARCH IN COMMUNICATION STRATEGIES.** (4 cr; prereq #)  
(Same as Rhet 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, \$Rhet 5561; prereq Jour 1101 or Rhet 3551 or 3562 or bachelor's degree and #)  
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 one of following courses: Rhet 5257, Jour 5133, Engl 3085, PubH 5070 or #)  
(Same as Rhet 5600) Methods of transferring scientific and technical knowledge. Review of research in diffusion and transfer methods.
- 5936.\* SPECIAL PROBLEMS IN AGRICULTURAL COMMUNICATIONS.** (Cr ar; prereq #)  
Communications problems related to specific aspects of student's major field of study.

## Course Listings

---

### 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 and utilization of morphological features of seeds and plants in keys to aid in identification of 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 evaluation of 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 1011)  
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.
- 3020. GROWTH, DEVELOPMENT, AND CULTURE OF FIELD CROPS.** (5 cr; prereq Biol 1011, Chem 1005)  
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 1011, Chem 1005)  
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.
- 2060. FIELD PLOT DESIGN IN AGRONOMY.** (3 cr; prereq jr. ∞)  
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.

## Agronomy and Plant Genetics

- 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. MANAGEMENT OF CROPPING SYSTEMS.** (3 cr; prereq 3010, 3020, 3030, Soil 1122 or #)  
A discussion and case-study approach using principles of agronomy in making decisions on crop selection, tillage and seedbed preparation, planting; cultural practices; pest control, harvesting, and storage of major field crops.
- 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.
- 5110. ADAPTATION, DISTRIBUTION, AND PRODUCTION OF FIELD CROPS.** (3 cr, §3010; prereq Biol 1011)  
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 1011, Chem 1005)  
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 1011, Chem 1005)  
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, §PIPa 5220, §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**

## Course Listings

---

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

8380. APPLIED STATISTICS

PIPh 8251. SEMINAR: PLANT PHYSIOLOGY

## 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.

1105. ANIMAL CARE. (1 cr)

Discussion and demonstration of elementary management practices and record keeping systems involved in the care, feeding, handling, training, and housing of livestock and poultry. For students without livestock or poultry experience.

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.

1500. MEAT SCIENCE. (4 cr; prereq Biol 1011)

(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 1011, 3011 or #)

Introduction to the nature and variety, development, motivation, and evolution of animal behavior, emphasizing social interactions and communication.

- 3112. DOMESTIC ANIMAL BEHAVIOR SEMINAR.** (2 cr; prereq 3111 or Biol 1107)  
A survey of the maintenance, agonistic, reproductive, social, and learning behavior of common pet and farm 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 #1120)  
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 the International Intercollegiate Meats Judging Contest.
- 3220. PRINCIPLES OF ANIMAL BREEDING.** (5 cr; GCB 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 1011, 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, diet and ration formulation, 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.
- 5221. ANIMAL BREEDING FOR VOCATIONAL AGRICULTURE TEACHERS.** (3 cr; offered summer 1983)  
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.
- 5233. DAIRY CATTLE BREEDING.** (3 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 or without artificial insemination.
- 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.

## Course Listings

---

- 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 1983 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 1983 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 3021 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 1982 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.** (3 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. Nutrition of horses.
- 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)  
Nutrient requirements of chickens and turkeys; feed supplies, their composition and utilization in formulation of adequate diets. Role of feed additives, their use and limitations. Least cost formulations, nutritional interrelationships, and feeding systems.
- 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 1982)  
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 3021 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 1983)  
Breeds, selection, diseases, feeding, reproduction, management, and color inheritance of light horses. Demonstrations of equitation, tack, and farriery.

- 5510. MUSCLE CHEMISTRY AND PHYSIOLOGY.** (4 cr; prereq BioC 1302 or #: offered spring 1983 and alt yrs)  
(Same as FScN 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; 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 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.
- 5611. SWINE PRODUCTION.** (3 cr, §5601; prereq 1401...3220 recommended; offered summer 1983)  
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 1983)  
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 1982)  
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)  
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 around fundamental propositions, suggested and 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

## Course Listings

---

- 8091. HORMONES AND BEHAVIOR
- 8220.\* ADVANCED ANIMAL BREEDING
- 8221.\* QUANTITATIVE INHERITANCE
- 8332. PRESERVATION OF SPERMATOZOA AND EMBRYO
- 8420.\* ENERGY IN ANIMAL NUTRITION
- 8421.\* PROTEIN AND AMINO ACID NUTRITION
- 8423.\* MINERAL NUTRITION
- 8440.\* 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, Fisheries, and Wildlife

### Entomology (Ent)

- 1005. **ECONOMIC ENTOMOLOGY.** (4 cr; prereq Biol 1011 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 1011 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 1011 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.
- 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 forestry major or #)  
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.
- 5131. AQUATIC ENTOMOLOGY.** (2 cr; prereq 3175 or equiv or #; offered 1982-83 and all yrs)  
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.
- 5134.\* ADVANCED INSECT TAXONOMY.** (5 cr; prereq 3175 or equiv, 5133; offered 1982-83 and all yrs)  
Procedures of systematic entomology, systematic literature, zoological nomenclature, use of and construction of keys, and presentation of results of systematic research.
- 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 #, \*5211, †5212)  
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 1981-82 and all yrs)  
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 1982-83 and all 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 or equiv and course in ecology, #)  
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.
- 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.

## Course Listings

---

- 5400.\* EXPERIMENTAL ECOLOGY.** (3 cr; prereq 9 or 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)

- 1001. ORIENTATION IN FISHERIES AND WILDLIFE.** (2 cr)  
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 EBB 3004; 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.
- 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 cr #)  
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.

## Entomology, Fisheries, and Wildlife

- 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 EBB 3004 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.** (5 cr; prereq Stat 5021 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.** (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.** (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.** (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. 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

## Course Listings

---

- 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 (FSn)

- 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. #)  
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 I.** (4 cr; prereq Chem 1002 or 1005)  
Introduction to composition, nutritive value, and chemical and physical properties of foods; interaction and reaction of foods in food preparation procedures; evaluation of food products prepared in laboratory using quality standards; introduction to experimental study of foods.
- 1213. **SCIENTIFIC PRINCIPLES OF FOOD PREPARATION II.** (3 cr; prereq 1212)  
Batter and dough systems, with emphasis on the function and interaction of ingredients and leavening systems in baked products. Meat, fish, and poultry; processing, storage, and methods of preparation. Fats; composition processing and functions of fat in food preparation. Work analysis, work simplification, work layout, and functional storage as related to food preparation.
- 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, drying, and others.
- 1500. **MEAT SCIENCE.** (4 cr; prereq Biol 1011)  
(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.

- 1700. INTRODUCTION TO THE HOSPITALITY AND FOOD SERVICE INDUSTRIES.** (2 cr)  
Introduction to the hospitality and food service industries emphasizing their scope, current trends, growth, and relationship to the community.
- 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 f3110)  
Laboratory experiments to investigate chemical properties and reactions of selected food systems and food components.
- 3123. MICROBIOLOGY OF FOODS.** (5 cr, §MicB 3103, §VPB 3103; prereq Biol 1011 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 for food demonstrations for the general public and business. Production techniques and performance for TV and motion picture demonstrations. Effective use of media (films, slides, and other visuals) in the presentation of accurate food and nutrition information for designated audience situations. Opportunity to present one food demonstration prepared for class to an appropriate audience in the community.
- 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 1011 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 a factor in attaining and maintaining health. The role of the 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 meeting the special requirements of growth, development, adult maintenance, and aging. Consideration of 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 meeting the special requirements of growth, development, adult maintenance, and aging. Consideration of 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. Development of competency in application of nutrition principles to problems in the community.
- 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 FOOD SERVICE ORGANIZATION AND MANAGEMENT.** (4 cr; prereq sr, Mgmt 3001, regis in coordinated undergraduate program in dietetics)  
Systems of food service management in the delivery of health care services; selection, supervision, and evaluation of personnel; effective planning and communication with food service management personnel.

## Course Listings

---

- 3703. FIELD EXPERIENCE IN FOOD SERVICE MANAGEMENT.** (3 cr; prereq sr, \*3702, Mgmt 3001. regis in coordinated undergraduate program in dietetics)  
Supervised food service management experience in a health care facility.
- 3720. ADMINISTRATIVE EXPERIENCE: HOSPITALITY OR FOOD SERVICE ENTERPRISE.** (5 cr; prereq 3760. sr in hospitality and food service management or #)  
Planned management experience in a selected food service or hospitality business, including understanding the operation, planning, purchasing, personnel management, financial management, supervision, and related functions.
- 3730. QUANTITY FOOD PURCHASING AND PRODUCTION.** (5 cr; prereq 3rd-qr soph, 1212 or 3110, 3472)  
Participation in management procedures used in selection, storage, preparation, pricing, and service of food in quantity. A quantity food service used as laboratory.
- 3732. TECHNOLOGY OF CONTINENTAL CUISINE.** (3 cr; prereq 1213 or 3110 or #)  
Analysis of the technological basis for quantity preparation of cuisine as described by Escoffier and others. Application of food technology to the simplification of traditional recipe formulations and methods.
- 3740. DESIGN AND LAYOUT OF FOOD SERVICES.** (4 cr; prereq 3730)  
Arrangement and layout of food production, service, and storage areas. Purchase, maintenance, construction, and operation of equipment related to quantity food service.
- 3742. HOSPITALITY FACILITY PLANNING AND DESIGN.** (5 cr; prereq 1700)  
Hospitality management planning and design of space; mechanical, electrical, and structural requirements in hospitality facilities.
- 3750. MANAGEMENT OF FOOD SERVICE AND HOSPITALITY BUSINESS SYSTEMS.** (3 cr; prereq 3730 and Mgmt 3001; not intended for hospitality and food service management majors)  
Application of management principles in a food service. Business procedures, personnel management, financial management, cost control, and related administrative problems. Field trips may be required.
- 3752. FOOD AND HOSPITALITY OPERATIONS: APPLICATION OF COMPUTER SYSTEMS TO SMALLER UNITS.** (4 cr; prereq 3730, 3762, MIS 5100 or #)  
Use of the computer in planning, operating, and controlling production and services, personnel, logistics, finances, and quality control in a small unit food and hospitality operation.
- 3760. HOSPITALITY COST MANAGEMENT.** (4 cr; prereq Acct 1024 and 1025)  
Cost accounting applied to the hospitality services industry.
- 3762. HOSPITALITY FINANCIAL MANAGEMENT.** (4 cr; prereq 3760, 4 cr statistics)  
Financial management and forecasting applied to the hospitality industry.
- 3790. FOOD SERVICE MARKETING, ADVERTISING, AND PROMOTION.** (4 cr; prereq 1700, AgEc 1030 or Ecor 1002, or #)  
Theories and practices of market analysis, product planning, and consumer motivation as they relate to enterprises that provide hospitality to people away from home. Determining and satisfying the needs and interests of the consuming public in public dining places, clubs, hospitals, in-plant cafeterias, schools, and other institutions.
- 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, nutrition, food service, or hospitality management. 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 #...\*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 #...†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, of products consumed in food, and in waste utilization.
- 5135. FOOD PROCESS ENGINEERING I.** (3 cr [4 cr effective fall 1982]; prereq 1102 or †1102, Math 1142, Phys 1031-1032)  
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.** (3 cr [4 cr effective fall 1982]; prereq 5135)  
Engineering and processing principles and food system applications of low 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; and 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. FOOD FORMULATION, PRODUCT DEVELOPMENT.** (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 seniors should preregister with instructor)  
Fundamentals of sensory perception. Test designs and methods used in studying the sensory qualities of foods.
- 5380. FOOD PACKAGING.** (3 cr; prereq 3110, Phys 1032 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.
- 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.

## Course Listings

---

- 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, hydrogenation, 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.
- 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, §PIPa 5220, §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.
- 5663. CLINICAL NUTRITION LABORATORY.** (1 or 2 cr; S-N only; prereq 5662 or f5662 or 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 dietary management.
- 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 5622 or f5622, Biol 5001 or #)  
Description of pathology and diet therapy in diseases of the mouth, esophagus, stomach, intestine, liver, pancreas, and gallbladder.
- 5666. APPLIED CLINICAL NUTRITION II.** (2 cr; prereq 5665)  
(Continuation of 5665) Pathology and therapy in diseases of the kidney and urinary tract and anemia, allergy, hypertension, and parathyroid disease.
- 5667. APPLIED CLINICAL NUTRITION III.** (2 cr; prereq 5666)  
(Continuation of 5666) Pathology and therapy in diseases of the cardiovascular and metabolic systems.
- 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.
- 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 FOOD SERVICE MANAGEMENT IN HEALTH CARE FACILITIES.** (3 cr; prereq 3 cr elementary statistics, 6 cr economics, #)  
Management techniques applied to food services for health care facilities. Methods of analysis and control.
- 5730. VOLUME RECIPE FORMULATION, PRODUCTION, AND CONTROL.** (5 cr; prereq sr, 3110, 3740, 5360 or #)  
The technology associated with the operation of food facilities producing 3,000 to 100,000 meals per day; analysis and selection of ingredients for industrial types of food processes, identification of optimum operating conditions, and institution of controls to insure that products comply with specifications. Laboratory examination of ingredients and process control methodology.
- 5740. LARGE VOLUME KITCHEN ENGINEERING AND DESIGN.** (4 cr; prereq 3740)  
Engineering of commissaries for production, energy, equipment, space, and human resources optimization.
- 5750. SELECTED ASPECTS OF FOOD SERVICE AND HOSPITALITY BUSINESS MANAGEMENT.** (4 cr; prereq 4 cr elementary statistics, 3762, MIS 3100)  
Management techniques applied to a food service or hospitality business. Methods of analysis and control.
- 5752. FOOD AND HOSPITALITY OPERATIONS: CORPORATE APPLICATION OF COMPUTER SYSTEMS.** (4 cr; prereq 3752, Acct 3255, or #)  
Use of the computer in planning, operating, and controlling the integrated operations of production and services, personnel, logistics and finances, quality assurance, and quality control in a multiunit corporate food and/or hospitality operation.
- 5790. QUANTITY FOOD PREPARATION PRACTICES.** (3 cr; prereq baccalaureate degree and current or impending affiliation with occupational foods program in a secondary school)  
Storage, preparation, service, and pricing of selected menu items. Students investigate and seek solutions to problems related to quantity food service. Opportunity to integrate lectures, laboratory experiences, and independent study with instructional programs in occupational foods.

### FOR GRADUATE STUDENTS ONLY

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

#### 8101. RESEARCH SEMINAR

## Course Listings

---

- 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

## 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; thorough discussion of 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)  
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.
- 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)  
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.

## Horticultural Science and Landscape Architecture

---

- 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, foliage, 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.** (4-6 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 1981-82 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 1982-83 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 1982-83 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.
- 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.

## Course Listings

---

- 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 (formerly 5033). 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)  
The 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 1981-82 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.** (3 cr; prereq 1021, 1036, 1099, 1100)  
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; prereq 5046)  
Pest management and governmental 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)

- 1001. ENVIRONMENTAL DESIGN: MAN AND ENVIRONMENT.** (4 cr, §Arch 1001)  
Interaction of people with the environment, using natural and social sciences and the arts as background for readings, lectures, discussions, and workshop sessions.
- 1002. ENVIRONMENTAL DESIGN: TOOLS AND PROCESSES.** (4 cr, §Arch 1002; prereq 1001)  
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.

## *Horticultural Science and Landscape Architecture*

---

- 1003. ENVIRONMENTAL DESIGN: IMPLEMENTATION AND EVALUATION.** (4 cr. §Arch 1003; prereq 1002)  
Design projects, discussions, and readings exploring personal abilities to implement and evaluate environmental change.
- 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.
- 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.
- 3093. DETAIL SITE DESIGN.** (6 cr; prereq 3092)  
Design of small-scale site systems with complex variables.
- 3096. SPECIAL PROBLEMS IN LANDSCAPE ARCHITECTURAL HISTORY.** (1-6 cr; prereq #)
- 3097. SPECIAL PROBLEMS IN LANDSCAPE ARCHITECTURAL THEORY.** (1-6 cr; prereq #)
- 3098. SPECIAL PROBLEMS IN LANDSCAPE ARCHITECTURAL DESIGN.** (1-6 cr; prereq #)

## Course Listings

---

- 3099. SPECIAL PROBLEMS IN LANDSCAPE ARCHITECTURAL TECHNOLOGY.** (1-6 cr; prereq #)
- 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.
- 5000. PROFESSIONAL EXPERIENCE PROGRAM.** (4 cr; prereq 3092 and #: not for grad cr)  
Up to 12 weeks of experience in a position in the landscape architecture profession; evaluative reports and consultations with faculty advisers and employers.
- 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.
- 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.
- 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.
- 5131-5132-5133. SELECTED PROBLEMS IN LANDSCAPE ARCHITECTURE.** (Cr ar; prereq #)
- 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.
- 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 on 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**
- 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.** (5 cr; prereq soph, 9 cr plant science)  
Introductory course in plant diseases. Lectures, laboratory, and special problems.
- 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, §1001; 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.

## Course Listings

---

- 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.
- 5051. ADVANCED FOREST PATHOLOGY.** (3 cr; prereq 5050 or equiv; offered 1982 and alt yrs)  
Basic concepts in the etiology, epidemiology, and pathogenesis of tree diseases and wood deterioration.
- 5102. FIELD MYCOLOGY.** (5 cr; prereq 9 cr botany or #; offered at Iasca)  
General characteristics of fungi, especially those used in identification; cultural and taxonomic procedures and practices.
- 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 1001 or 5050 or MicB 3103; offered 1982 and alt yrs)  
Lectures and laboratory exercises on taxonomy, identification, life histories, genetics, and ecology of fungi.
- 5107. MYCOLOGY: BASIDIOMYCETES.** (4 cr; prereq 1001 or 5050 or MicB 3103; offered 1982 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 1981 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 1001 and 8 cr plant pathology)  
Clinical and laboratory experience in Plant Disease Clinic in diagnosis, treatment, and control of plant diseases of field crops, vegetable crops, turf, ornamentals, and trees.
- 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**
- 8111. GENETICS OF PLANT PATHOGENS**
- 8200. PLANT PATHOLOGY COLLOQUIUM**
- 8201. SEMINAR**
- 8202. SEMINAR**

## Rhetoric (Rhet)

- 1101. COMMUNICATION I.** (4 cr)  
Writing from observation and personal experience. Emphasis on expository and descriptive prose that is clear, vigorous, honest, and economical. Attention to effectively written sentences and sound paragraph construction.
- 1102. COMMUNICATION II.** (4 cr)  
Writing from research and personal observation. Emphasis on the research paper including techniques of drawing hypotheses; examining indexes and guides; selecting, evaluating, and organizing evidence; constructing paraphrases; and assembling footnotes and bibliography. Attention to effective sentences and forceful style.

- 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)
- 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.
- 1221. AN INTRODUCTION TO INTERPERSONAL COMMUNICATION.** (3 cr; prereq completion of freshman communication requirement)  
The dimensions of interpersonal communication. Theories, problems, and practical exercises of interpersonal communication. Designed to enable students to become better communicators in interpersonal situations. Principles and experiences of interpersonal communication including factors related to interpersonal perception, orientation, contents, models, choice, attraction, barriers, and breakdowns.
- 1222. PUBLIC SPEAKING.** (4 cr; prereq soph. completion of freshman communication requirement)  
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. The 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. 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. 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 departmental office prior to registration.
- 1401. INTRODUCTION TO LITERATURE.** (4 cr)  
Analysis of literary structural forms and stylistic devices: poetry, drama, and prose fiction.
- 1424. WORLD LITERATURE I.** (4 cr)  
Examination and analysis of selected master works of continental and Middle Eastern literature from the ancients through the Renaissance.
- 1425. WORLD LITERATURE II.** (4 cr)  
Examination and analysis of selected master works of continental literature from the neoclassical period to the present.
- 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.
- 1451. INTRODUCTION TO DRAMATIC LITERATURE.** (4 cr)  
Selected plays from Greek literature to the present. Emphasis on the development of dramatic art form.

## Course Listings

---

- 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 and 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 allows students to follow their particular interests.
- 3371. HUMANITIES: AMERICAN INDIVIDUALISM.** (4 cr)  
Examination and evaluation of conflicts arising from the varied individualistic traditions in America.
- 3372. HUMANITIES: RELIGION IN AMERICAN THOUGHT AND EXPERIENCE.** (4 cr)  
The diverse values centered in American religious and philosophical thinking from the 17th century to the present.
- 3373. HUMANITIES: NATIONALISM IN AMERICAN THOUGHT AND EXPERIENCE.** (4 cr)  
The growth of political and cultural nationalism in America from the 17th century to the present.
- 3374. HUMANITIES: SPECIAL PROBLEMS.** (1-5 cr; prereq #)  
Primarily for supervised reading and research on topics not covered in regularly scheduled humanities offerings.
- 3375. AGRICULTURAL HERITAGE: CHANGING IDEAS, VALUES, AND PERSPECTIVES.** (4 cr)  
Significant events and periods affecting rural agricultural peoples as expressed in historical, cultural, and literary documents. 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.
- 3471. AMERICAN LITERATURE.** (4 cr)  
Analysis of philosophical and social concepts that have shaped American culture, as reflected in literature.
- 3473. CONTEMPORARY LITERATURE.** (4 cr)  
Reading and analysis of significant modern literary works.
- 3551. PROFESSIONAL WRITING.** (4 cr; 3551 or 3562 is required of all students unless exempted through dept/ exam; prereq jr. completion of freshman communication requirement)  
Projects and reports in professional communication: the résumé, application letter, and interview; professional journals; the review of literature; specialized bibliographic tools; the feature article.

- 3562. SCIENTIFIC AND TECHNICAL WRITING.** (4 cr; 3562 or 3551 is required of all students unless exempted through dept'l exam; prereq jr. completion of freshman communication requirement)  
Methods of exposition in scientific and technical writing; types of reports: audience analysis; continuous practice in report writing; the résumé, application letter, and interview.
- 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. The scope and sequence of specialized training and development programs, the job of the typical director of training and development, and skills required for entry into the field. Students visit a training and development office in a selected business or service organization and conduct descriptive research concerning effectiveness of program involved.
- 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.** (Cr ar)  
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 3551 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.

## Course Listings

---

- 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 3551 or 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; 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). Content varies from quarter to quarter.
- 5600. TRANSFER OF TECHNOLOGY.** (4 cr; prereq one of the following courses: 5257, 5400, Jour 5133 or #)  
(Same as AgJo 5600) Methods of transferring scientific and technical knowledge and practice from those individuals and organizations who possess it to those who need it. Review of research in diffusion and transfer methods at different technical levels. Tools, methodologies, and assessment procedures for an actual program of technical or scientific subject matter. Planning state-of-the-art or frontier technology seminars and impact analyses for scientists, engineers, and/or segments of the public required.
- 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)

- 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.
- 3049. SOIL PHYSICS SURVEY.** (1 cr; prereq AEM 3016 or \*AEM 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 1982 and alt yrs)  
Round table discussions of assigned readings in the subject matter.
- 3210. SOIL PHYSICAL PROPERTIES.** (4 cr; prereq 1122, Math 1111, Phys 1031 or #)  
Physical characteristics of soil related to controlling 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 1982 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 1983 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 1984 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 1981 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 1981 and alt yrs)  
Round table discussions and assigned readings.
- 3610. SOIL BIOLOGY.** (3 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. Lecture.
- 3618. SEMINAR: BIOLOGICAL NITROGEN FIXATION.** (1 cr; S-N only; offered winter 1982 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.
- 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.
- 5232. SOIL PHYSICS.** (4 cr; prereq Math 1142, 2 qtrs physics or f 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 1982-83 and alt 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.
- 5430. CHEMISTRY OF PLANT NUTRIENT ELEMENTS IN SOILS.** (3 cr; prereq 1122)  
Amounts, kinds, and reactions of plant nutrient elements in soils and effects on plants. Fertilizer nutrient reactions, persistence and loss in soils.
- 5510. MORPHOLOGY, CLASSIFICATION, AND GENESIS OF SOILS.** (3 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.

## Course Listings

---

- 5512. SOIL GEOGRAPHY AND LAND USE.** (3 cr; prereq 1122 and 3520 or #)  
Introduction to distribution patterns of soils using soil taxonomy. Emphasis on interpretation of soil landscapes for agricultural, urban, and recreational uses. Use of soil maps and aerial photographs in various types of resource development. Lecture, laboratory, and discussion.
- 5520. SOIL DEVELOPMENT AND CLASSIFICATION.** (3 cr; prereq 5512 or #)  
Soil profile characteristics; influence of parent material, climate, topography, vegetation, and time on soil development; system of soil classification; and world distribution of major soil groups.
- 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.** (4 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. ORGANIC SOILS.** (3 cr; prereq 1122)  
Formation, classification, and properties of organic soils; their use and management. Lectures and laboratory.
- 5565. FIELD COURSE—SOIL SURVEY.** (8 cr; prereq 3520 and #; offered SSI only)  
Principles of soil survey including description of soils in acceptable terms, mapping soils on airphoto base, interpretive groupings of soils, development of descriptive legend, and classification of soils according to soil taxonomy.
- 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**
- 8322. SELECTED METHODS OF CLAY MINERAL ANALYSIS**
- 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 \$300 are available for approved projects). For further information, check with the college office.
- 1001. LEADERSHIP DEVELOPMENT: INDEPENDENT STUDY.** (1-3 cr [may be repeated for max 6 cr]; S-N only; prereq agriculture major, #)  
Agriculture students who plan to actively participate in positions of leadership in student organizations, student activities, or programs of the academic community may earn credit for such activities. Proposal stating objectives of this experience, progress reports, and final written report required.

## 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 governmental research and in 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 <sup>1</sup>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 especially emphasizing 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 <sup>1</sup>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 1982-83 and alt 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 1981-82 and alt 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. The absorption, distribution, and function of inorganic elements.
- 5184.\* PLANT GROWTH AND DEVELOPMENT.** (3 cr, §Bot 5184; prereq 5131)  
Growth of higher plants including division and differentiation of cells, development of plant organs, effects of external factors on plant growth, photosynthesis, and respiration in relation to plant development, and the nature and action of plant growth substances.
- 5185.\* PHYSIOLOGY OF PHOTOSYNTHETIC MICROORGANISMS.** (3-5 cr; prereq #: offered 1982-83 and alt 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 1981-82 and alt 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 1982-83 and alt yrs)
  - 5723. Plant Hormones and Tissue Culture.** (Cr ar; offered every yr)
  - 5725. Plant Nucleic Acids.** (Cr ar; offered 1981-82 and alt yrs)
  - 5726. Analysis of Cell Structure.** (Cr ar; offered 1982-83 and alt yrs)

## Course Listings

---

**5970.\* SPECIAL PROBLEMS IN PLANT PHYSIOLOGY.** (Cr ar)  
Research, readings, instruction.

### FOR GRADUATE STUDENTS ONLY

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

**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. This is 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, §S01 3118; S-N only; offered fall 1982 and alt yrs)

Public policies as they influence land use and soil and water resources.

**5099. INTERDISCIPLINARY SEMINAR I.** (4 cr, 5099-5100-5101†; 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. Discussions reflect diverse disciplinary contributions.

**5100. INTERDISCIPLINARY SEMINAR II.** (4 cr, 5099-5100-5101†; prereq 5099 or #)

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.

**5101. INTERDISCIPLINARY SEMINAR III.** (2 cr, 5099-5100-5101†; prereq 5100)

(Continuation of RCD 5100) Papers, presentations, and critiques on selected complex resource development problems related to resource analysis and discussion programs in Seminars I and II.

**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 RCD 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. This is a televised course involving 22 taped lectures and 10 discussion periods. Report on a specific environmental problem also required. This course offered in Continuing Education and 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.
- 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, \$Agro 5200, \$FScN 5643, \$PIPa 5220, \$LACS 5280; prereq major in agriculture, veterinary medicine, nutritional sciences, social science field or #...grad students by  $\Delta$  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. Types of 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.

## Course Listings

---

- 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.
- 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)  
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 #)  
Survey of 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. Emphasis on methods and applications.
- 5900. TUTORIAL COURSE.** (Cr ar; prereq #)  
Directed study in areas not covered by regular offerings
- 5911-5912-5913. TOPICS IN STATISTICS.** (3 cr per qtr; prereq 5122 or 5133 and #)  
Topics vary; may be repeated for credit with department approval.

## ***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 that demonstrate these concepts. 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. \$PIPa 5220. \$Soc 5675; prereq major in agriculture, veterinary medicine, nutritional sciences, social science field or #...grad students by  $\Delta$  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.

## 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.** (4 cr; prereq 6 cr systemic physiology or equiv. #; offered winter 1982 and alt yrs)

Circulatory, respiratory, digestive, metabolic, renal, endocrine, and reproductive physiology of various species of wild and domestic birds.

**5321. ADVANCED AVIAN PHYSIOLOGY.** (1 cr; prereq 5320; offered spring 1982 and alt yrs)

Survey of the physiology of some phenomena characteristic of nondomestic avian and mammalian species such as flying, diving, migration, annual reproductive cycles, circadian rhythms, hibernation, and torpidity.

**5330. WILD BIRD MEDICINE.** (2 cr; prereq 4th 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 1981 and alt yrs)

Economic and biologic relationships of animal parasites and disease to regional wildlife.

**5604. DISEASES OF WILDLIFE.** (3 cr; prereq #; offered 1982 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. DEPARTMENTAL OFFICES AND FACULTY

### Departmental Offices

#### **Agricultural and Applied Economics**

G. Edward Schuh, head, 231 Classroom-Office Building, 373-0945

#### **Agricultural Education**

R. Paul Marvin, head, Vocational-Technical Education Building, 373-1021

#### **Agricultural Engineering**

Arnold M. Flikke, head, 213 Agricultural Engineering, 373-1305

#### **Agronomy and Plant Genetics**

Herbert W. Johnson, head, 303 Agronomy, 373-0855

#### **Animal Science**

Robert W. Touchberry, head, 120 Peters Hall, 373-1488

#### **Entomology, Fisheries, and Wildlife**

Milton W. Weller, head, 219 Hodson Hall, 373-1700

#### **Food Science and Nutrition**

Elwood F. Caldwell, head, 225 Food Science and Nutrition, 373-1071

#### **Horticultural Science and Landscape Architecture**

Jane P. McKinnon, acting head, 305 Alderman Hall, 373-1028

#### **Information and Agricultural Journalism**

Donald E. Wells, head, 326 Haecker Hall, 373-0713

#### **Plant Pathology**

David W. French, head, 304 Stakman Hall of Plant Pathology, 373-0852

#### **Rhetoric**

Thomas E. Pearsall, head, 202 Haecker Hall, 373-0917

#### **Soil Science**

William P. Martin, head, 125 Soils, 373-1062

### Faculty

#### **Agricultural and Applied Economics**

##### *Professor Emeritus*

John Blackmore, Ph.D.

Willard W. Cochrane, Ph.D.

Selmer A. Engene, Ph.D.

Harold R. Jensen, Ph.D.

##### *Professor*

G. Edward Schuh, Ph.D., *head*

Fred J. Benson, Ph.D.

O. Uel Blank, Ph.D.

Boyd M. Buxton, Ph.D.

Martin K. Christiansen, 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.  
 John S. Hoyt, Jr., Ph.D.  
 Wilbur R. Maki, Ph.D.  
 Lee R. Martin, 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.  
 Frank J. Smith, Ph.D.  
 Wesley B. Sundquist, Ph.D.  
 Kenneth H. Thomas, Ph.D.  
 John J. Waelli, Ph.D.

Arley D. Waldo, Ph.D.  
 Delane E. Welsch, Ph.D.

*Associate Professor*

Jeremiah E. Fruin, Ph.D.  
 Glenn L. Nelson, Ph.D.  
 Benjamin H. Sexauer, Ph.D.  
 Robert W. Snyder, Ph.D.  
 Thomas F. Stinson, Ph.D.  
 Carole B. Yoho, M.S.

*Assistant Professor*

Jeffrey D. Apland, Ph.D.  
 Jean L. Kinsey, 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*

Arnold M. Flikke, Ph.D., *head*  
 Evan R. Allred, M.S.  
 Donald W. Bates, M.S.  
 W. Forrest Bear, Ph.D.  
 Harold A. Cloud, 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.

*Associate Professor*

Philip R. Goodrich, Ph.D.  
 Robert J. Gustafson, Ph.D.  
 Donald C. Slack, Ph.D.

*Assistant Professor*

Kevin A. Janni, Ph.D.  
 Charles A. Onstad, Ph.D.  
 Robert A. Young, Ph.D.

*Instructor*

Charles J. Clanton, M.S.

## Information and Agricultural Journalism

*Professor*

Donald E. Wells, Ph.D., *head*  
 Harold B. Swanson, Ph.D.

Leona S. Nelson, M.S.  
 John M. Sperbeck, M.S.

*Associate Professor*

Donald Breneman, M.A.  
 Wesley Grabow, Ph.D.  
 Janet K. Macy, M.S., M.Ed.

*Assistant Professor*

Mary Kay O'Hearn, B.A.

*Instructor*

Richard Reeder, M.A.

## Agronomy and Plant Genetics

*Professor Emeritus*

Charles R. Burnham, 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.  
 Laddie J. Elling, Ph.D.  
 Jon L. Geadelmann, Ph.D.  
 Burle G. Gengenbach, Ph.D.  
 John A. Goodding, Ph.D.  
 Charles E. Green, Ph.D.  
 Gary H. Heichel, Ph.D.  
 Dale R. Hicks, Ph.D.  
 Jean W. Lambert, Ph.D.

## Departmental Offices and Faculty

---

Gordon C. Marten, Ph.D.  
Gerald R. Miller, Ph.D.  
Ervin A. Oeike, 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

R. Kent Crookston, Ph.D.  
Leland L. Hardman, Ph.D.

## Animal Science

### Professor

Robert W. Touchberry, 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.  
Richard D. Goodrich, 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.

Neal P. Martin, Ph.D.  
Howard W. Rines, Ph.D.  
Steve R. Simmons, Ph.D.  
Donald L. Wyse, Ph.D.

### Assistant Professor

Lynn W. Gallagher, Ph.D.  
Randall G. Jeppson, Ph.D.  
Robert J. Jones, Ph.D.  
Robert D. McGraw, Ph.D.  
Bradley J. Majek, Ph.D.  
James H. Orf, Ph.D.  
Craig C. Sheaffer, Ph.D.  
Robert D. Wych, 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.  
James E. Pettigrew, Ph.D.  
Jonathan E. Wheaton, Ph.D.

### Assistant Professor

Neil K. Allen, Ph.D.  
Steven G. Cornelius, Ph.D.  
Fred R. Ehle, Ph.D.  
Leslie B. Hansen, Ph.D.  
James Linn, Ph.D.  
Ronny L. Moser, Ph.D.  
Jeffrey Reneau, Ph.D.  
Marshall D. Stern, Ph.D.  
Gerald R. Steuermagel, Ph.D.

## Entomology, Fisheries, and Wildlife

### Professor Emeritus

Alexander C. Hodson, Ph.D.  
William H. Marshall, Ph.D.  
Clarence E. Mickel, Ph.D.  
Allan G. Peterson, Ph.D.  
A. Glenn Richards, Ph.D.

### Professor

Milton W. Weller, Ph.D., *head*  
Marion Brooks-Wallace, Ph.D.  
Hwai-chang Chiang, Ph.D.  
Edwin F. Cook, Ph.D.  
Laurence K. Cutkomp, Ph.D.  
L. Daniel Frenzel, Jr., Ph.D.  
Basil Furgala, Ph.D.  
Gordon W. Gullion, M.A.  
Herbert M. Kulman, Ph.D.  
Roger D. Price, Ph.D.  
Edward B. Radcliffe, Ph.D.  
Thomas F. Waters, Ph.D.

### Professor and

#### Extension Entomologist

Phillip K. Harein, Ph.D.  
John A. Lofgren, M.S.

### Associate Professor

Ira A. Adelman, Ph.D.  
James A. Cooper, Ph.D.  
Richard L. Jones, Ph.D.  
Peter A. Jordan, Ph.D.  
George R. Spangler, Ph.D.

### Associate Professor and

#### Extension Specialist

Mark E. Ascerno, Ph.D.

### Assistant Professor

Jerrel B. Christensen, Ph.D.  
Roger D. Moon, Ph.D.  
David W. Ragsdale, Ph.D.  
Gary L. Williams, Ph.D.  
Richard H. Yahner, Ph.D.

### Assistant Professor

#### and Extension Entomologist

David M. Noetzel, M.S.

### Assistant Professor

#### and Extension Specialist

James R. Kitts, Ph.D.

## Food Science and Nutrition

### *Professor Emeritus*

Samuel T. Coulter, Ph.D.  
Margaret D. Doyle, Ph.D.  
Harold Macy, Ph.D.  
Elmer L. Thomas, Ph.D.

### *Professor*

Elwood F. Caldwell, Ph.D., *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.  
P. V. J. Hegarty, Ph.D.  
Theodore P. Labuza, Ph.D.  
Larry L. McKay, Ph.D.  
Howard A. Morris, Ph.D.  
Lura M. Morse, Ph.D.  
Vernal S. Packard, Jr., Ph.D.  
Irving J. Pflug, Ph.D.  
Patricia B. Swan, Ph.D.  
Sita R. Tatini, 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.  
Gary A. Reinucci, Ph.D.

Oscar P. Snyder, Jr., Ph.D.  
Zata M. Vickers, Ph.D.  
Joseph J. Warthesen, Ph.D.  
Isabel 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.  
Marjorie F. Fruin, Ph.D.  
Allen S. Levine, Ph.D.  
Louise M. Mullan, Jr., M.S.  
Dennis A. Savaiano, Ph.D.  
Joanne L. Slavin, Ph.D.  
David E. Smith, Ph.D.

### *Instructor*

Madge Hanson, M.S.  
Donna P. Meiske, M.S.  
Robert P. Olson, B.S.  
Jeanne K. Rousu, M.S.

### *Lecturer*

Lorraine F. Anderson, M.S.  
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*

Arvo Kallio, Ph.D.  
Robert E. Nylund, Ph.D.  
Orrin C. Turnquist, Ph.D.

### *Professor*

Jane P. McKinnon, M.S., *acting head*  
Peter D. Ascher, Ph.D.  
Mark L. Brenner, Ph.D.  
David W. Davis, Ph.D.  
Francis de Vos, Ph.D.  
C. Gustav Hard, Ph.D.  
Leonard B. Hertz, Ph.D.  
Aly Lasheen, Ph.D.  
Florian I. Lauer, Ph.D.  
Pen H. Li, Ph.D.  
Robert Mullin, Ph.D.  
Harold M. Pellett, Ph.D.  
Paul E. Read, Ph.D.  
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.  
Sharon Desborough, Ph.D.  
Shirley T. Munson, M.S.  
Peter J. Olin, M.L.A.  
Joseph R. Sowokinos, Ph.D.  
Bert T. Swanson, Ph.D.

### *Assistant Professor*

Paul F. Boldt, Ph.D.  
Van W. Cline, M.L.A.  
Mervin Eisel, M.S.  
David S. Koranski, Ph.D.  
Albert H. Markhart III, Ph.D.  
Luther Waters, Jr., Ph.D.

### *Assistant Extension Horticulture Specialist*

Deborah L. Brown, M.S.

### 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. Froseiser, 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.  
Ward C. Stienstra, Ph.D.  
James A. Tammen, Ph.D.  
Roy D. Wilcoxson, 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.  
Francis L. Pfleger, Ph.D.  
Alan P. Roelfs, Ph.D.  
Paul G. Rothman, Ph.D.  
Darroll C. Skilling, Ph.D.  
Elwin L. Stewart, Ph.D.  
Richard J. Zeyen, Ph.D.

#### *Assistant Professor*

James S. Baumer, Ph.D.  
Robert A. Blanchette, Ph.D.  
Thomas H. Nicholls, Ph.D.  
James A. Percich, Ph.D.  
Erik L. Stromberg, Ph.D.  
P.S. Teng, Ph.D.

#### *Assistant Extension Specialist*

Fred C. Morgan, 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*

Richard O. Horberg, Ph.D.  
Sarah E. McBride, Ph.D.  
Earl E. McDowell, Ph.D.  
Thomas M. Scantlan, Ph.D.  
Arthur E. Walzer, Ph.D.

#### *Assistant Professor*

J. Michael Bennett, Ed.D.  
Richard W. Ferguson, Ph.D.  
Warren Y. Gore, M.A.  
Laurie S. Hayes, Ph.D.  
Margaret L. Somers, Ph.D.  
Lyman K. Steil, Ph.D.  
Victoria M. Winkler, Ph.D.

### Soil Science

#### *Professor Emeritus*

Harold F. Arneman, Ph.D.  
Alfred C. Caldwell, Ph.D.  
John M. MacGregor, Ph.D.

#### *Professor*

William P. Martin, 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.  
Curtis J. Overdahl, Ph.D.  
Lowell D. Hanson, Ph.D.

Richard H. Rust, Ph.D.  
Edwin L. Schmidt, Ph.D.  
Charles A. Simkins, Ph.D.  
James B. Swan, Ph.D.

#### *Associate Professor*

Terence H. Cooper, Ph.D.  
Clifton F. Halsey, M.S.  
Gary L. Malzer, Ph.D.  
Jean A. E. Molina, Ph.D.

#### *Assistant Professor*

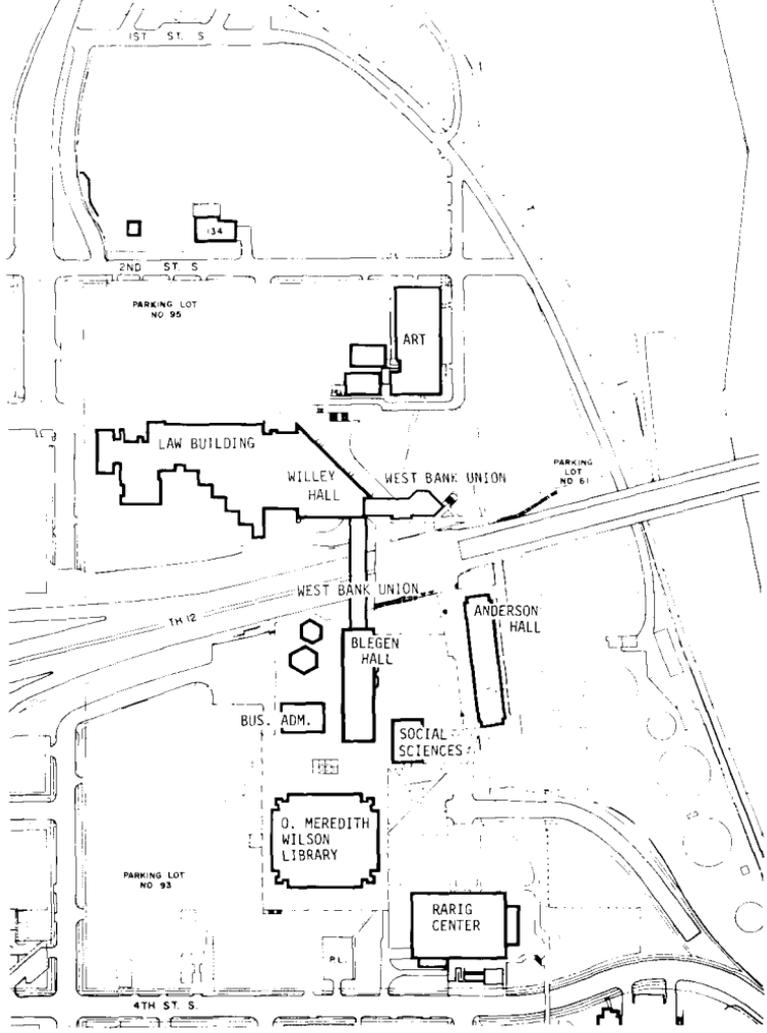
Paul R. Bloom, Ph.D.  
Robert C. Munter, M.S.  
Mark W. Seeley, Ph.D.

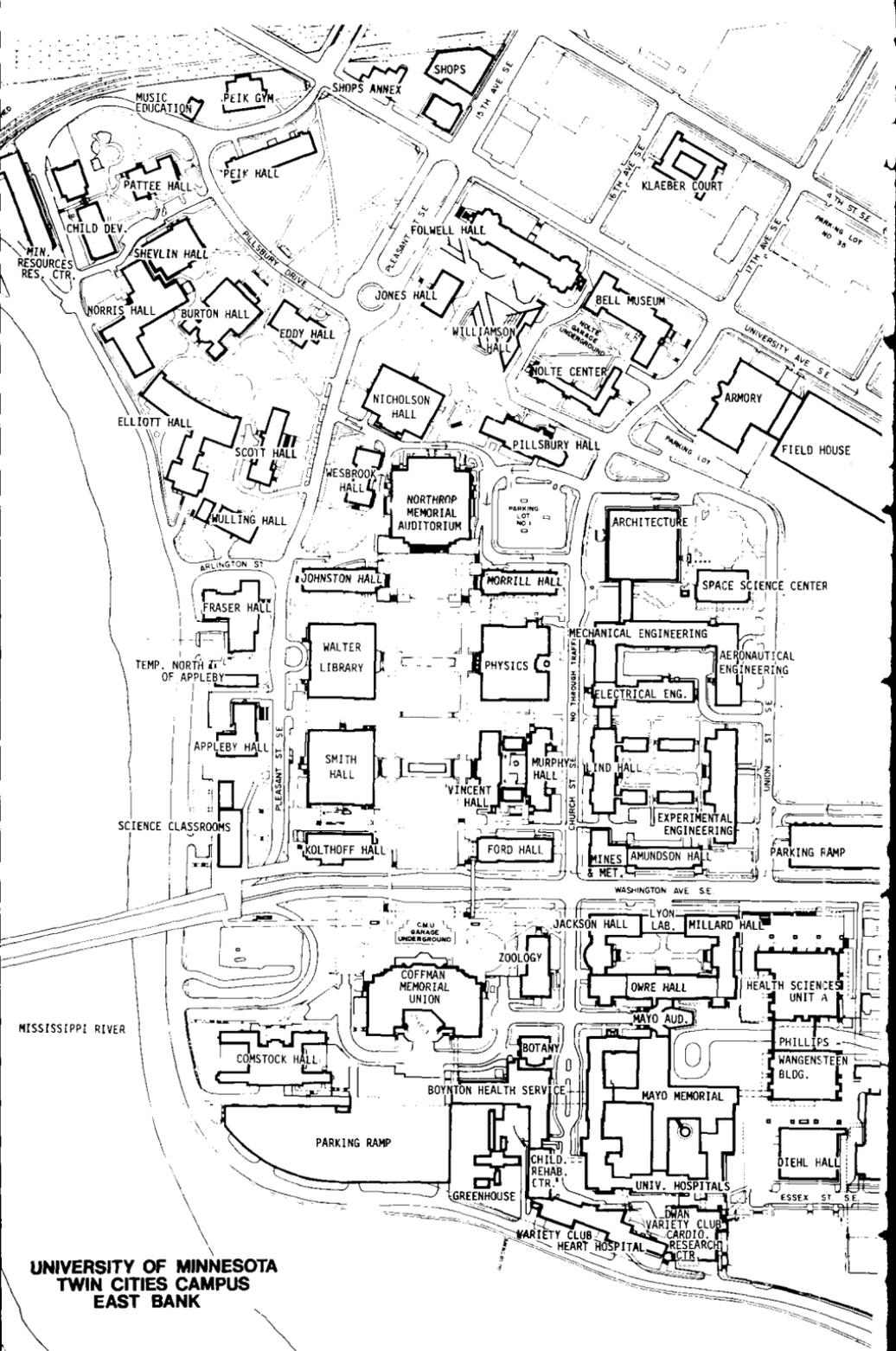


# INDEX

Academic Enrichment and Honors Program	14	General Information	7
Administration	1	Grading System	15
Admission	9	Graduate Degrees	9
Adult Special Students	10	Graduation Requirements	19
High School Graduates	9	Graduation With Distinction	19
Minority Admissions	10	Honor Point System	17
Senior Citizens	11	Honor System	18
Transfer Students	10	Horticultural Science	56, 118
Adult Special Students	10	Hospitality and Food Service Management	61
Agricultural and Applied Economics	91	How to Use This Bulletin	3
Agricultural Business Administration	21	Independent Study	12
Agricultural Economics	23	Integrated Crop-Pest Management	37
Agricultural Education	26, 95	Landscape Architecture	65, 120
Agricultural Engineering	88, 98	Large Animal Clinical Sciences	134
Agricultural Engineering Technology	29	Letter From the Dean	6
Agricultural Journalism	31, 100	Maps of Campus	143, 144, inside back cover
Agricultural Science and Industries Curriculum	7, 86	Master of Agriculture Degree	9
Agriculture, General Courses	130	Music Credits	14
Agronomy and Plant Genetics	35, 102	Nutrition and Dietetics	69
All-College Requirements	83	Objectives of the College	3
Animal Science	39, 104	Orientation-Registration	11
Auditing	12	Other Sources of Information	2
Baccalaureate Degrees	9	Overview of Curricula	7
Cancel-Add Procedures	12	PEP—Professional Experience Program	15
Cancellation of Entire Registration	13	Personnel Services, All-University	20
Career Development and Placement Office	19	Petition Procedures	13
Checklist of Procedures		Physical Education Credits	14
Application Through Graduation	8	Plant Health Technology	72
Class Attendance	13	Plant Pathology	123
CLEP Tests	13	Plant Physiology	131
CLE Requirements—(All College Requirements)	83	Pre-Biological Sciences	89
Consumer Food Science	40	Pre-Fisheries and Wildlife	49
Continuing Education and Extension Credits	10	Pre-Veterinary Medicine	89
Course Listings	91	Reading Courses	12
Course Load	13	Registration	11
Credit by Examination (Independent Study)	12	Repeating Courses	18
Credits and Class Attendance	13	Residency Requirement	19
Curricular in Agriculture	21	Resource and Community Development	6, 88, 132
Dean's List	17	Resource Economics	73
Degrees Offered	9	Rhetoric	124
Departmental Offices	136	ROTC	15
Double Major	15	Rural Sociology	133
Economics of Public Services	43	Scholastic Conduct	18
Elective Credits	14	Scholastic Requirements	17
Limitations on Use of	14	Soil and Water Resource Management	77
Use in the Graduate School	14	Soil Science	75, 128
Withholding From Graduation	14	Special Study Opportunities	14
Enrichment Program in International Agriculture	14	Statistics	133
Enrichment Program in Journalism	15	Student Organizations	20
Entomology	46, 108	Study-Travel	14
Extra Credit Registration	12	Technical Communication	79
Faculty	136	Veterinary Biology	135
Financial Aid	11	Veterinary Pathobiology	135
Fisheries	50	Where to Write for Information	2
Fisheries and Wildlife	48, 110	Wildlife	51
Food Science and Nutrition	112		
Food Science and Technology	53		

UNIVERSITY OF MINNESOTA  
TWIN CITIES CAMPUS  
WEST BANK





MUSIC EDUCATION

PEIK GYM

SHOPS ANNEX

SHOPS

PATTEE HALL

PEIK HALL

FOLWELL HALL

KLAEBER COURT

MIN RESOURCES RES. CTR.

CHILD DEV.

SHEVLIN HALL

NORRIS HALL

BURTON HALL

EDDY HALL

JONES HALL

WILLIAMSON HALL

BELL MUSEUM

NOLTE CENTER

ARMORY

FIELD HOUSE

ELLIOTT HALL

SCOTT HALL

NICHOLSON HALL

PILLSBURY HALL

MULLING HALL

WESBROOK HALL

NORTHROP MEMORIAL AUDITORIUM

ARCHITECTURE

SPACE SCIENCE CENTER

FRASER HALL

JOHNSTON HALL

MORRILL HALL

TEMP. NORTH 4<sup>th</sup> OF APPELBY

WALTER LIBRARY

PHYSICS

MECHANICAL ENGINEERING

AERONAUTICAL ENGINEERING

APPELBY HALL

SMITH HALL

VINCENT HALL

MURPHY HALL

ELECTRICAL ENG.

IND. HALL

EXPERIMENTAL ENGINEERING

SCIENCE CLASSROOMS

KOLTHOFF HALL

FORD HALL

MINES AMUNDSON HALL & MET.

PARKING RAMP

WASHINGTON AVE SE

MISSISSIPPI RIVER

CMU BARAGE UNDER GROUND

JACKSON HALL

LYON LAB.

MILLARD HALL

COFFMAN MEMORIAL UNION

ZOOLOGY

OWRE HALL

HEALTH SCIENCES UNIT A

COMSTOCK HALL

BOTANY

MAYO AUD.

PHILLIPS WANGENSTEEN BLDG.

PARKING RAMP

BOYNTON HEALTH SERVICE

CHILD. REHAB. CTR.

MAYO MEMORIAL

DIEHL HALL

GREENHOUSE

UNIV. HOSPITALS

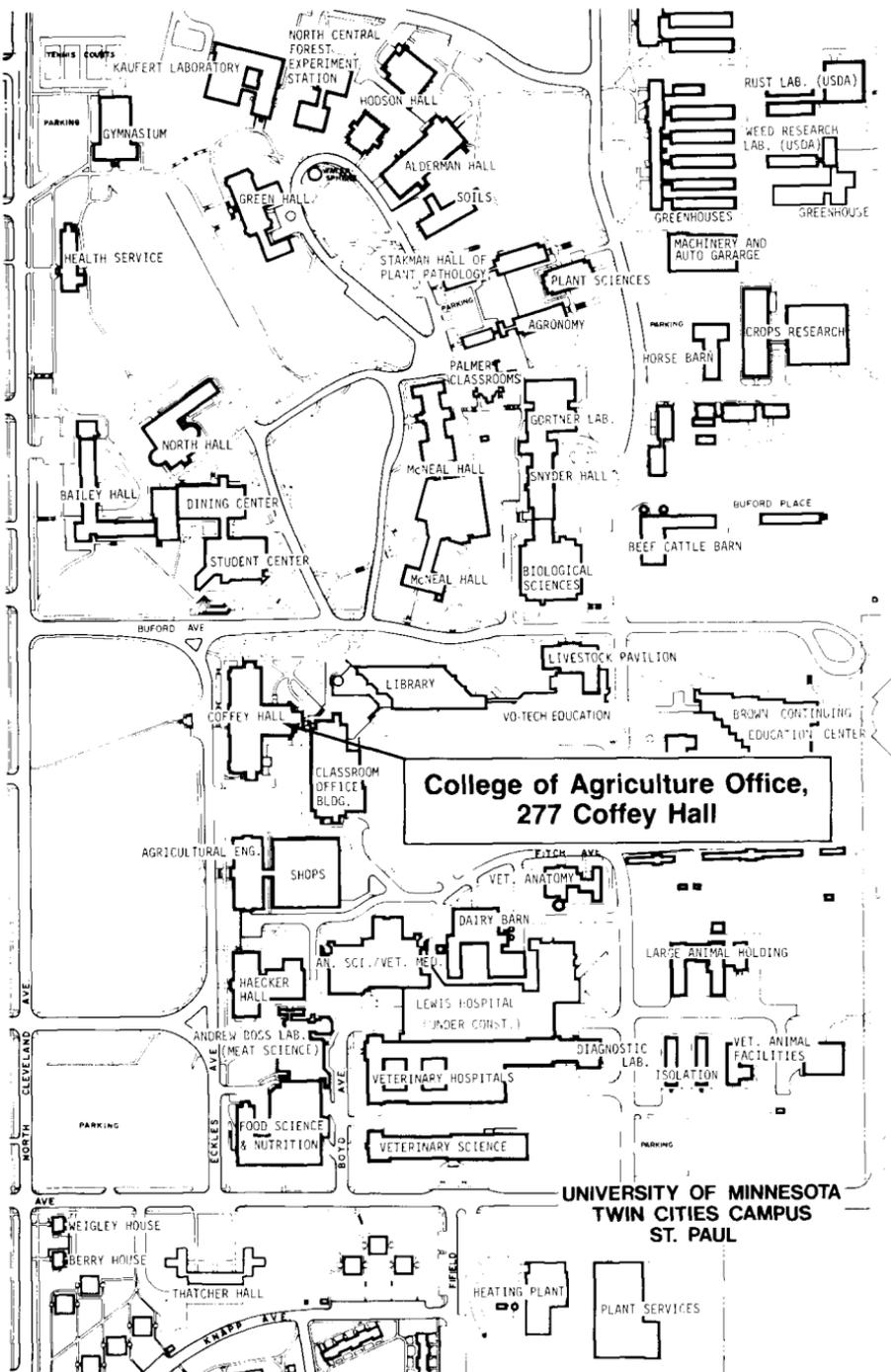
VARIETY CLUB HEART HOSPITAL

UNIV. VARIETY CLUB

CARDIO. RESEARCH CTR.

ESSEX ST SE

**UNIVERSITY OF MINNESOTA  
TWIN CITIES CAMPUS  
EAST BANK**



**College of Agriculture Office,  
277 Coffey Hall**

**UNIVERSITY OF MINNESOTA  
TWIN CITIES CAMPUS  
ST. PAUL**

