Degree Programs and Minors

Agricultural and Food Business Management ................................................................. 41
Agricultural Education ....................................................................................................... 42
Agricultural Science and Technology Education Specialization ........................................ 42
Natural and Managed Environmental Education Specialization ...................................... 43
Agricultural Leadership, Training, and Development Specialization ............................... 44
Agricultural Industries and Marketing ................................................................................ 45
Agronomy .................................................. 47
Animal Production Systems ............................................................................................. 47
Animal Science .................................................................................................................. 47
Applied Economics ......................................................................................................... 48
Climatology ......................................................................................................................... 48
Crop, Soil, and Pest Management ....................................................................................... 49
Entomology ......................................................................................................................... 49
Environmental Horticulture ............................................................................................... 50
Environmental Science ..................................................................................................... 50
Food Science ..................................................................................................................... 52
Food Systems and the Environment .................................................................................. 53
Horticultural Science ......................................................................................................... 53
Integrated Pest Management in Cropping Systems .......................................................... 53
International Agriculture ................................................................................................. 54
Nutrition .............................................................................................................................. 54
Coordinated Program in Dietetics ....................................................................................... 55
Nutrition Science ................................................................................................................ 55
Science in Agriculture ........................................................................................................ 55
Science in Agriculture/Doctor of Veterinary Medicine Joint Degree ............................... 56
Scientific and Technical Communication ......................................................................... 57
Department of Rhetoric Minors .......................................................................................... 58
Designing Documents With New and Emerging Technologies ........................................ 58
Internet, Science, and Society ............................................................................................ 58
Land, Nature, and Environmental Values ........................................................................... 58
Technical Communication ................................................................................................. 58
Soil Science ........................................................................................................................ 59
Sustainable Agriculture ..................................................................................................... 59
Water Science ....................................................................................................................... 59
College of Agricultural, Food and Environmental Sciences

General Information

Since the 1880s, thousands of students have come to study at the College of Agricultural, Food and Environmental Sciences (COAFES). The stature of the college and its programs has attracted an excellent faculty and student body. It is consistently ranked among the top colleges of agriculture in the United States. In 2001-2002, more than 1100 students were enrolled in COAFES undergraduate programs. The student body has a near equal split of women and men. The college’s majors represent a broad spectrum of programs in the applied sciences of soil, plant, animal, food and environment, education, communication, business, and the social sciences. As the college prepares for the future it has undertaken a comprehensive planning process. Under the overarching priority of emphasizing exemplary education for undergraduate and graduate students, the five goals are:

- Promoting safe and healthy foods,
- Improving environmental quality,
- Enhancing agricultural systems,
- Revitalizing Minnesota’s rural communities, and
- Serving urban communities.

COAFES is located on the St. Paul campus. The Minnesota Agricultural Experiment Station borders the campus and supports a comprehensive research program. The experiment station provides a sizable teaching laboratory for undergraduate and graduate education.

The goal of COAFES is to provide students with varied educational experiences and an environment that promotes professional competence, the capacity to attain career success in agriculture (including food or related professions), and a sense of social responsibility.

Admission

Requirements for admission to COAFES for high school graduates, non-degree seeking students, and transfer students are explained below. For more information, call COAFES Admissions, 612-624-3045 or 1-800-866-AGRI (toll-free).

Deadlines—The Office of Admissions typically accepts applications for fall semester beginning October 1 of the preceding year and admits students as long as space is available. Freshman applicants who meet the admission requirements and apply by December 15 are guaranteed space in the following fall semester class. Final deadlines are June 1 for fall semester and October 15 for spring semester.

High School Graduates—High school graduates need to complete the University’s high school course preparation requirements (see Freshman Admission in the General Information section of this catalog).

Transfer Students—Students may apply for admission to COAFES from other colleges or universities. Applicants may be accepted if they meet the entrance requirements of COAFES and of the major they wish to enter. Transfer applicants who graduated from high school during 1987 or later must have

- passed intermediate algebra with a grade of at least C;
- at least a C average in transfer coursework;
- demonstrated a solid foundation in math and science;
- completed other high school preparation requirements, including foreign language. (See High School Course Preparation on page 17.)

Applicants who did not complete this coursework during high school may submit equivalent college coursework. COAFES may admit some students who have not met these requirements. Students who are admitted but lack preparation requirements must complete all deficiencies early in their program.

Applicants who graduated from high school before 1987 must meet current entrance standards except for the high school preparation and foreign language requirements.

After a transfer applicant has been accepted as a student, the Office of Admissions and COAFES evaluates all previous college work according to the standards of the University and COAFES. The student is then provided with a Transfer Credit Evaluation showing how previous work has been evaluated.

Transfer students must complete all specific course and area distribution requirements of COAFES regardless of the number of credits accepted for transfer. Therefore, students who begin degree work elsewhere and intend to transfer later should carefully plan pre-transfer courses to meet as many COAFES requirements as possible.

Note: A maximum of 4 internship or practical experience credits may be transferred into COAFES.

Change of College Within the University—To transfer to COAFES from another college within the University, students must meet COAFES entrance requirements. Students must complete an Application for Change of College and apply for transfer at the Registration Center on the campus where they are currently registered or where they last attended classes. Application deadlines are consistent with posted University admission deadlines.

Non-degree Seeking—Non-degree seeking admission is primarily for students who are pursuing coursework in COAFES departments, but not seeking a degree or for students who are preparing to apply to a graduate program offered by COAFES departments but have prerequisites to satisfy. Admission may be processed at any time before the first day of class. The non-degree seeking category is also open to staff members in COAFES departments taking courses through the Regents Scholarship Program and COAFES graduates returning for coursework.

Students who enter COAFES as non-degree seeking students with the intention of transferring later to the Graduate School should be aware of restrictions on the number of non-degree seeking credits that may be transferred to a graduate program. See the Graduate School Catalog.
### Key to Majors

<table>
<thead>
<tr>
<th></th>
<th>AgBu</th>
<th>AgEd</th>
<th>AIM</th>
<th>ApEc</th>
<th>APS</th>
<th>BAE</th>
<th>CSPM</th>
<th>EH</th>
<th>ES</th>
<th>FdSc</th>
<th>Nutr</th>
<th>PreLA</th>
<th>ScAg</th>
<th>STC</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AgBu</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Agricultural and Food</td>
</tr>
<tr>
<td><strong>AgEd</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Business Management</td>
</tr>
<tr>
<td><strong>AIM</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Agricultural Education</td>
</tr>
<tr>
<td><strong>ApEc</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Applied Economics</td>
</tr>
<tr>
<td><strong>APS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Animal Production Systems</td>
</tr>
<tr>
<td><strong>BAE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Biosystems and Agricultural Engineering</td>
</tr>
<tr>
<td><strong>CSPM</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Crop, Soil, and Pest Management</td>
</tr>
<tr>
<td><strong>EH</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Environmental Horticulture</td>
</tr>
<tr>
<td><strong>ES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Environmental Science</td>
</tr>
<tr>
<td><strong>FdSc</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Food Science</td>
</tr>
<tr>
<td><strong>Nutr</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Nutrition</td>
</tr>
<tr>
<td><strong>PreLA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pre-Landscape Architecture</td>
</tr>
<tr>
<td><strong>ScAg</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Science in Agriculture</td>
</tr>
<tr>
<td><strong>STC</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Scientific and Technical Communication</td>
</tr>
</tbody>
</table>

### Finding your way around the college

<table>
<thead>
<tr>
<th><strong>Interests</strong></th>
<th><strong>COAES majors</strong></th>
<th><strong>Occupations</strong></th>
<th><strong>Primary COA departments</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Animals</td>
<td>AIM, APS, BAE, ScAg</td>
<td>Animal breeder, designer of animal housing, animal nutritionist, dairy inspector, equipment designer</td>
<td>Animal Science; Biosystems and Agricultural Engineering</td>
</tr>
<tr>
<td>Animal production (beef, dairy, poultry, swine)</td>
<td>AIM, APSI, ScAg, AgEd</td>
<td>Livestock production specialist, farm manager, animal nutrition consultant for feed company, artificial insemination technician, representative for breeding and registry associations, animal equipment technician, meat industry representative, inspector</td>
<td>Animal Science; Agricultural Education</td>
</tr>
<tr>
<td>Biotechnology</td>
<td>BAE, FdSc, ES, ScAg</td>
<td>Lab technician, scientist, bioremediation specialist</td>
<td>Agronomy &amp; Plant Genetics; Biosystems and Agricultural Engineering; Animal Science; Food Science &amp; Nutrition; Horticulture; Soil, Water, and Climate</td>
</tr>
<tr>
<td>Business and financial management</td>
<td>AIM, AgBu, AgEc, AgEd</td>
<td>Loan officer, commodity merchant, sales representative, market analyst, government adviser, operations manager, food/grain broker, accounts specialist, financial planner, administrative manager, plant manager, farm manager, general manager</td>
<td>Applied Economics; Agricultural Education</td>
</tr>
<tr>
<td>Communication</td>
<td>AgEd, AIM, STC</td>
<td>Group process facilitator, interviewer, extension specialist, educator, state and county fair manager, agricultural journalist, public relations specialist, breed association and special interest groups promotion and public relations</td>
<td>Agricultural Education; Rhetoric</td>
</tr>
<tr>
<td>Environmental horticulture (landscape, nursery floriculture)</td>
<td>EH</td>
<td>Landscape design and management, nursery/garden center management and production, floral designer flower and foliage grower</td>
<td>Entomology; Horticultural Science; Plant Pathology; Soil, Water, and Climate</td>
</tr>
<tr>
<td>Environmental science</td>
<td>AgEd, BAE, ES, ScAg</td>
<td>Soil scientist, environmental protection analyst, waste manager, recycling specialist, environmental scientist, bioremediation specialist, teacher</td>
<td>Agricultural Education; Biosystems and Agricultural Engineering; Soil, Water, and Climate</td>
</tr>
<tr>
<td>Field crop production (corn soybeans, wheat, oats, barley, sunflowers, hay, flax)</td>
<td>AIM, CSPM, ScAg, AgEd</td>
<td>Seed producer/conditioner, agronomist, crop consultant, farmer, elevator/co-op manager, regulatory agent, plant protection representative, horticulturist, crop production specialist, seed technologist, machinery and systems designer</td>
<td>Biosystems and Agricultural Engineering; Applied Economics; Food Science and Nutrition</td>
</tr>
<tr>
<td>Food</td>
<td>FdSc</td>
<td>Food product developer, production manager quality control supervisor, food inspector, technical service representative</td>
<td>Food Science and Nutrition</td>
</tr>
<tr>
<td>Food processing and food safety</td>
<td>BAE, FdSc</td>
<td>System designer for handling and preparing food, engineer for transporting and storing grain and feed, packaging consultant, plant manager</td>
<td>Biosystems and Agricultural Engineering; Food Science and Nutrition</td>
</tr>
<tr>
<td>Horticultural food crops (fruits, vegetables)</td>
<td>AIM, CSPM, ScAg</td>
<td>Vegetable grower, orchard manager, greenhouse or garden center worker, nursery stock producer, plant breeder, arboriculture assistant, bedding plant grower</td>
<td>Agronomy &amp; Plant Genetics; Horticultural Science; Soil, Water, and Climate</td>
</tr>
<tr>
<td>Human nutrition</td>
<td>Nutr</td>
<td>Dietitian, nutrition educator, hospital consultant, medical student</td>
<td>Food Science and Nutrition</td>
</tr>
<tr>
<td>Insects</td>
<td>AIM, CSPM, EH, ScAg</td>
<td>Crop/environmental consultant, research biologist, biological control specialist, technical/sales representative, public health inspector, commercial honey producer, plant health care specialist</td>
<td>Entomology, Plant Pathology</td>
</tr>
<tr>
<td>International agriculture</td>
<td>AgBu, AgEd, AIM, ApEc, FdSc, Nutr</td>
<td>Peace Corps volunteer, agricultural development specialist, international trade economist</td>
<td>Applied Economics; Agricultural Education; Food Science and Nutrition</td>
</tr>
<tr>
<td>Landscape design</td>
<td>EH, PreLA</td>
<td>Landscape architect, site planner, urban planner, recreation consultant, landscape designer</td>
<td>Horticultural Science; Landscape Architecture (CALA)</td>
</tr>
<tr>
<td>Plants</td>
<td>AIM, CSPM, EH, ScAg</td>
<td>Plant breeder, nursery/greenhouse manager, plant health care specialist</td>
<td>Agronomy &amp; Plant Genetics; Horticultural Science; Plant Pathology; Soil, Water, and Climate</td>
</tr>
<tr>
<td>Sales and marketing</td>
<td>AgBu, ApEc, AIM, AgEd, FdSc</td>
<td>Company sales representative, seller of products to farmers, seller of agricultural products to food companies, inventory controller, district sales manager, advertiser, training and development personnel, technical sales</td>
<td>Applied Economics; Agricultural Education; Food Science and Nutrition; Rhetoric</td>
</tr>
<tr>
<td>Soil and water resources</td>
<td>BAE, CSPM, ES, ScAg</td>
<td>Pollution control agent, land/water use planner, waste manager, fertilizer sales representative, landscape designer, irrigation and drainage system designer, conservationist, soil scientist</td>
<td>Applied Economics; Agricultural Education; Biosystems and Agricultural Engineering; Soil, Water, and Climate</td>
</tr>
<tr>
<td>Teaching</td>
<td>AgEd</td>
<td>Middle, high school, or adult agriscience/agribusiness teacher, natural resources, horticulture, agrimechanics teacher, extension educator, Peace Corps volunteer; international development agent; FFA and 4H adviser; environmental education teacher, nature or environmental center educator</td>
<td>Agricultural Education</td>
</tr>
<tr>
<td>Technical communication</td>
<td>STC</td>
<td>Technical writer, scientific illustrator, educational video producer, document designer, manager of telecommunications, training and development specialist</td>
<td>Rhetoric</td>
</tr>
<tr>
<td>Turfgrass</td>
<td>EH</td>
<td>Golf course superintendent, grounds maintenance, athletic facilities manager, lawn service owner</td>
<td>Entomology; Horticultural Science; Plant Pathology; Soil, Water, and Climate</td>
</tr>
<tr>
<td>Veterinary medicine</td>
<td>ScAg</td>
<td>Veterinarian</td>
<td>Animal Science</td>
</tr>
</tbody>
</table>
Degrees/Majors

Bachelor Degrees—The major curricula of COAFES lead to a bachelor of science.

Graduate Degrees—COAFES departments offer master of science and doctor of philosophy degrees through the Graduate School. For more information, see the Graduate School Catalog. COAFES also offers a master of agriculture degree, with an emphasis in horticultural science. Interested students should contact the Department of Horticultural Science or COAFES Student Services, 190 Coffey Hall, 1420 Eckles Avenue, St. Paul, MN 55108.

Majors
COAFES offers the following 12 interdisciplinary majors and areas of emphasis. Detailed information about each follows in the Degree Programs section. A matrix lists general interests and occupations with corresponding majors and primary COAFES departments on the previous page.

Agricultural and Food Business Management
Business management
Financial management
Food processing, wholesaling, and retailing
Marketing and sales management

Agricultural Education
Agricultural science and technology education
Agricultural leadership, training, and development
Natural and managed environmental education

Agricultural Industries and Marketing
Animal industries
Crops/Soils industries
Food industries
Horticultural industries

Animal Production Systems
Beef
Dairy
Equine
Poultry
Sheep
Swine

Applied Economics
Management and finance
Marketing
Food retailing
Regional and public economics
Resources and environment
Trade and development

Crop, Soil, and Pest Management

Environmental Horticulture
Greenhouse production and retail floriculture
Turfgrass management
Landscape design, implementation, and management
Nursery production and garden center management

Environmental Science
Environmental education:
General environmental education
Natural and managed environmental systems
Environmental management:
Bioremediation
Environmental measurement
Waste management
Land and water resources:
Hydrology—water resources
Land use management
Soil science
Sustainable agriculture
Water resource management

Food Science
Nutrition
Coordinated program in dietetics
Nutrition science

Science in Agriculture
Animal science
Biotechnology
Food science
Nutrition
Plant sciences
Science in agriculture/doctor of veterinary medicine joint degree
Soil science

Scientific and Technical Communication

Pre-professional Opportunities
Students may prepare in COAFES for the following upper division/professional programs.
Pre-biosystems and agricultural engineering
Pre-landscape architecture
Pre-medicine and dentistry
Pre-veterinary medicine

Double Majors
Students may find it advantageous to complete the requirements for a second major as part of their undergraduate program. In some cases this can be done by concentrating electives in the second area and thereby completing a second major without taking more than the minimum number of credits required for a bachelor’s degree. In most cases, however, completing both majors requires that students take additional credits. For further information or an application, students should go to the COAFES Student Services Office. Students must file the application form before completing the required coursework for the second major.

Minors
To receive a minor, students must have an average GPA of 2.00 or higher, and a C- or better in the courses used in a program. To identify the appropriate electives, students should consult with an adviser.

Honors
The COAFES Honors Program provides a special educational opportunity for all COAFES students who qualify and accept the challenge of broadening, deepening, and enriching their education. The program gives students and faculty from diverse areas of interest and expertise the opportunity to interact with each other academically and socially. Honors students explore broad and varied aspects of agriculture through an honors colloquium course series (Agri 1000) and enhance their backgrounds through an honors experience course (Agri 3101). The honors experience course is student-designed and is supervised by COAFES faculty. Completion of the honors program, along with meeting the GPA requirement, leads to the cum laude degree designations in all COAFES majors.

For more information or an application, check with the COAFES Student Services Office.
Graduation Requirements

Bachelor’s Degrees—Candidates are recommended for graduation after they
• complete the prescribed curriculum, including required courses and electives to meet the total number of credits required;
• earn a GPA of at least 2.00 in all coursework at the University;
• earn a GPA of at least 2.00 in coursework in the major and have a grade of at least C- in all courses labeled as professional courses in the major;
• earn a coefficient of completion of at least .75 in all coursework. See Academic Progress in the Policies section of this catalog.

Graduation application deadlines are set by the Office of the Registrar. The deadline is published in the Class Schedule. Students are responsible for knowing these deadlines. Extensions of deadlines are rarely granted. Students may turn in their application, with an APAS report or official program sheet signed by their adviser, to the One Stop Student Services Center, St. Paul, 130 Coffey Hall.

COAFES students are expected to maintain an academic standing that will enable them to meet minimum requirements for graduation. COAFES monitors academic progress each semester using the standards spelled out in the Policies section of this catalog.

Students who wish to use excess credits earned as an undergraduate for credit in the Graduate School should consult the Graduate School Catalog for current policies or the Graduate School Office, University of Minnesota, 316 Johnston Hall, 101 Pleasant Street S.E., Minneapolis, MN 55455.

Appeal System—Decisions by an adviser or a department’s Scholastic Standing Committee or a subcommittee of a department’s Scholastic Standing Committee may be appealed to the COAFES Scholastic Standing Committee, 190 Coffey Hall, whose decision in turn may be appealed to the COAFES dean.

Advising

The faculty of COAFES is committed to providing quality advising for students. To accomplish that goal, almost all advising is done by the regular faculty. All advisers have volunteered to advise undergraduates and have gone through training to familiarize themselves with the curriculum as well as with University policies and resources.

New students in COAFES are assigned an academic adviser. Advisers guide students through major curriculum requirements, help with course selection, provide references for scholarships and employment, supervise internships, provide advice and counsel, and listen to students’ questions and concerns. Advisers also inform students about other resources at the University.

Most students prefer to have an adviser whose specialty matches their interests. If a student’s interests or career goals change, the student may change advisers. For information or assistance in changing advisers, students should consult their major coordinator or the COAFES Student Services Office.

Advisers know the curriculum of students’ majors and have a working knowledge of most of the required courses. Most advisers also know some of the basic requirements of other COAFES majors or programs and can help students consider other options if interests change.

Advisers help students with petitions when it is appropriate to request a variation from specific program requirements.

Advisers keep a record of students’ work. Most advisers have advising files for the students assigned to them. They get regular academic progress reports and updated transcripts from the COAFES Student Services office.

Advisers often write letters of recommendation for scholarship, job, or graduate school applications.

Petition Procedures
To request permission to depart from usual procedures, students must complete a petition form available at the COAFES Student Services Office, 190 Coffey Hall, or at the One Stop Student Services Center in St. Paul, 130 Coffey Hall. All submitted petitions must be signed by an adviser. Some majors also require the signature of the major coordinator as well. Students present petitions to the COAFES Student Services Office for review by the Scholastic Standing Committee. A copy of the decision may be picked up about one week later.

Special Learning Opportunities and Resources

Undergraduate Research Opportunities Program (UROP)—The University of Minnesota’s UROP offers financial awards to undergraduates for research, scholarly, or creative projects undertaken in partnership with a faculty member. Applications are accepted in the fall and early spring each year.

For more information or an application packet, students should contact the COAFES Student Services Office, 190 Coffey Hall (612-624-9299).

Professional Experience Program (PEP)—COAFES juniors and seniors may participate in PEP, a program 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 either fall or spring semester or during the summer. Students earn 1-3 credits for satisfactory completion of a PEP program. Students may enroll in two different PEP programs, for a total of 6 credits. Salaries are paid by the cooperating businesses, industries, producers, and agencies participating in the program. For more information, students should contact their adviser or the COAFES Career Services Office, 190 Coffey Hall (612-624-2710).

Scholarships

COAFES has an extensive scholarship program for freshmen, transfer students, and continuing students. Scholarship brochures and applications are usually available in December. Students can pick them up in 190 Coffey Hall. Deadlines for applications are published in the applications and brochures.

International Programs

Two types of study abroad that can especially enhance degree work in COAFES are field study and integrated classroom study. Students may also seek internship credit from COAFES for academic projects arranged as a part of a MAST Experience Abroad (see below). For details, consult with Career Services.

Some scholarships are available through COAFES to help defray costs of overseas study-travel. A written report is required. Preference is given to proposals from non-English speaking countries. Students must initiate and plan the project with the aid of a faculty adviser. For more information, contact the COAFES Career Services Office, 190 Coffey Hall (612-624-2710).

MAST Experience Abroad—The MAST Experience Abroad program provides qualified individuals the opportunity to broaden their agricultural/horticultural skills and knowledge as well as develop or improve international language skills.
Practical training programs of 3 to 12 months are available to individuals between the ages of 18 and 30. Participants gain a cross-cultural experience by living and working with a host family in Australia, Austria, Brazil, Denmark, Finland, France, Germany, Italy, the Netherlands, New Zealand, Sweden, Switzerland, or the United Kingdom. Departure dates are in January, April, June, and September. For more information, students should contact the MAST International office, 240 Vocational and Technical Education Building (612-624-3740).

Other Study Abroad Opportunities—COAFES encourages study abroad for language acquisition or cultural learning. The resulting credits can often be used as electives. The University and other institutions sponsor a broad range of intensive language programs and area studies programs. For more information, see Study Abroad in the General Information section of this catalog.

Career Information

To help students secure employment after graduation, the Career Services Office, 190 Coffey Hall, announces job opportunities and helps arrange interviews with employers. The office manages the recruiting activity for both full-time and internship positions. Beginning their freshman year, students are encouraged to take advantage of the Career Services Office. A wide range of information is available at their Web site at <www.coafes.umn.edu/career>.

Student Organizations

COAFES Student Board—The COAFES Student Board promotes student involvement in issues related to the quality and content of education both in and out of the classroom. The board creates channels of communication between the students, faculty, and administration of COAFES. Through the board, students participate in matters such as consideration of proposed curricula, questions related to instruction, improvement of educational facilities, development of administrative policy, and establishment of the goals of COAFES. COAFES students may file for election to the board or may serve as a representative of one of the clubs or organizations affiliated with the college. Further information related to the board and its operation may be obtained in 190 Coffey Hall.

Agricultural Ambassadors—Selected COAFES undergraduates volunteer their time to serve as goodwill ambassadors for the college. They foster communications among the college, prospective students, and the community at large. Each ambassador gains experience in public relations and recruitment and develops communications skills through public speaking engagements and small group discussions with prospective students. Agricultural ambassadors develop leadership and management skills by participating on the executive board and special committees. For more information, students should contact the COAFES Student Services Office, 190 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 following colleges: COAFES, Biological Sciences, Natural Resources, Human Ecology, 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 Minnesota Student Association and the Assembly Committee on Student Affairs (ACSA). COAFES students may file for election to this board. For more information, inquire at the Office for Student Affairs, 130 Coffey Hall.

The Twin Cities Student Unions Board of Governors—The Twin Cities Student Unions Board of Governors is an advisory board for the St. Paul Student Center and Coffman Memorial Union.* Composed of students elected to represent various academic and student organizations on the Minneapolis and St. Paul campuses, the board formulates policies for operation of the student unions and establishes its budget. Information about the student unions, their operations, and opportunities to serve on various planning or programming committees, is available by calling 612-624-4738.

* Coffman Memorial Union is currently undergoing renovation and is expected to reopen winter 2003. For relocation information, call 612-624-4636, e-mail renovation@coffman.umn.edu, or visit the Web site at <www.coffman.umn.edu>.

Student Representation on College and University Committees—All COAFES committees and most all-University committees have student representatives. For college committees, selection is made by the COAFES Student Board. All-University committees publish announcements in The Minnesota Daily and on bulletin boards around campus.

Other COAFES Student Organizations—Many of the undergraduate programs sponsor student clubs. For more information, students should check with their advisor or the COAFES Student Services Office, 190 Coffey Hall.

Other clubs affiliated with COAFES include:

- Agricultural Education Club
- Alpha Zeta Fraternity (an honor and service fraternity)
- Block and Bridle
- Gopher Dairy Club
- Gopher Crops and Soils
- Food Science Club
- Horticulture Club
- National AgriMarketing Association, Student Chapter (NAMA)
- Minnesota Collegiate Agri-Women
- Minnesota Economics Student Association (MESA)
- National Society for Minorities in Agriculture, Natural Resources and Related Sciences (MANRRS)
- Environmental Studies Club
- Student Organization of Nutrition and Dietetics (SOND)
- American Society of Agricultural Engineers, Student Branch
- Rhetoric’s Association of Student Technical Communicators (R.A.S.T.E.C.)
- Students in Honors
- Frenatar: Entomology Student Association
- Pre-Vet Med Club
- The Sheep and Goat Club
- Alpha Epsilon Delta (Pre-Med and Pre-Vet)
- American Association of Bovine and Swine

When asked about their plans as COAFES students, 67% hope to do undergraduate research, 56% plan on doing an internship, and 39% expect to study or travel abroad.
Following is a list of COAFES departments. Several departments and units also have formal affiliations or administrative links to other colleges:

Agriculture and Food Business Management has links with the Carlson School of Management (CSOM); Agricultural Education has links with the College of Education and Human Development (CEHD); Biosystems and Agricultural Engineering has links with the Institute of Technology (IT); Food Science and Nutrition has links with the College of Human Ecology (CHE).

Each department offers courses, and most departments have ties with several of the undergraduate majors offered by COAFES.

Agricultural, Food, and Environmental Education
Roland Peterson, head
320 Vocational and Technical Education Building
1954 Buford Avenue
St. Paul, MN 55108
624-2221

Affiliated majors
• Agricultural Education

Agronomy and Plant Genetics
Burle B. Gengenbach, head
411 Borlaug Hall
1991 Upper Buford Circle
St. Paul, MN 55108
625-8761

Affiliated majors
• Agricultural Industries and Marketing
• Crops and Soils Resources Management
• Science in Agriculture

Animal Science
Abel Ponce de León, head
305 Haecker Hall
1364 Eckles Avenue
St. Paul, MN 55108
624-1205

Affiliated majors
• Agricultural Industries and Marketing
• Animal Production Systems
• Science in Agriculture

Applied Economics
Vernon Eidman, head
231 Classroom Office Building
1994 Buford Avenue
St. Paul, MN 55108
625-0231

Affiliated majors
• Agricultural Industries and Marketing
• Applied Economics

Biosystems and Agricultural Engineering
Kevin A. Janitt, head
213 Agricultural Engineering
1420 Eckles Avenue
St. Paul, MN 55108
625-7733

Affiliated majors
• Biosystems and Agricultural Engineering (IT)
• Environmental Science
• Food Science

Entomology
Mark Ascerno, head
219 Hodson Hall
1980 Folwell Avenue
St. Paul, MN 55108
624-3278

Affiliated majors
• Agricultural Industries and Marketing
• Crops and Soils Resources Management
• Environmental Horticulture
• Science in Agriculture

Food Science and Nutrition
Joseph Warthesen, head
225 Food Science and Nutrition
1334 Eckles Avenue
St. Paul, MN 55108
624-3086

Affiliated majors
• Agricultural Industries and Marketing
• Food Science
• Nutrition

Horticultural Science
Karl Rosen, interim head
305 Alderman Hall
1970 Folwell Avenue
St. Paul, MN 55108
624-3606

Affiliated majors
• Agricultural Industries and Marketing
• Environmental Horticulture
• Science in Agriculture

Plant Pathology
Francis L. Pfeifer, head
495 Borlaug Hall
1991 Upper Buford Circle
St. Paul, MN 55108
625-8200

Affiliated majors
• Agricultural Industries and Marketing
• Crops and Soils Resources Management
• Environmental Horticulture
• Science in Agriculture

Rhetoric
Dale L. Sullivan, head
202 Haecker Hall
1364 Eckles Avenue
St. Paul, MN 55108
624-7750

Affiliated majors
• Agricultural Industries and Marketing
• Scientific and Technical Communication

Soil, Water, and Climate
Edward A. Nater, interim head
439 Borlaug Hall
1991 Upper Buford Circle
St. Paul, MN 55108
625-9734

Affiliated majors
• Agricultural Industries and Marketing
• Crops and Soils Resources Management
• Environmental Horticulture
• Environmental Science
• Science in Agriculture
College of Agricultural, Food and Environmental Sciences

Degree Programs and Minors

Agricultural and Food Business Management

B.S.
The agricultural and food business management major is offered jointly by COAFES and the Carlson School of Management. The curriculum emphasizes using concepts and methods from economics and business management in the identifying, analyzing, and solving management problems related to food, agriculture, natural resources, and economic development. The program provides a balance between applied economics and business management studies, with a limited amount of applied science. Students may elect a variety of courses in their junior and senior years to accommodate special interests and career goals.

Graduates of the curriculum are prepared for a wide range of employment opportunities in the food system and other agribusinesses. Examples of employment areas include finance and banking, management, input, commodity and food marketing, sales, administration, public and industrial relations, production management, economic and statistical analysis, managerial accounting, management information systems, and transportation.

Students completing the program may also pursue graduate studies in preparation for research, teaching, or continuing education positions in academic institutions, government agencies, or industry.

Admission Requirements—Students are admitted to the major after satisfactory completion of a pre-agricultural and food business management program. Admission standards are developed in conjunction with the Carlson School of Management. Application deadlines are April 15 for fall semester and October 15 for spring semester.

To be considered for admission, students must meet the following pre-program requirements:

• Complete or have in progress coursework to total 60 credits by the time of admission.
• Complete the following management “tool” courses on an A-F grading basis before entering the program:
  —Acct 2050
  —ApEc 1101, 1102 or Econ 1101, 1102
  —OMS 1550
  —Math 1142 or Math 1271
• Earn a GPA of at least 2.80 in all coursework.
• Earn a GPA of at least 2.50 in the tool courses and at least a C- in each tool course.

COAFES students who plan to major in agricultural and food business management and have not completed the pre-agricultural and food business management program are assigned a faculty adviser, but retain pre-major status until they are accepted into the program.

Additional information about admission to the program and application materials can be obtained from the major coordinator for the agricultural and food business management program, 217 Classroom Office Building, from the Department of Applied Economics Web site at <www.apec.umn.edu>, or from the COAFES Student Services Office, 190 Coffey Hall.

Degree Requirements
Students must complete at least 120 credits to graduate, including at least 64 credits in the major. Frequently, courses in the foundation requirements also apply toward completion of the liberal education requirements. All required courses must be taken A-F, and a grade of at least C- is required in all professional courses and area of emphasis courses.

Required Courses

Foundation Requirements (at least 24 cr)
Rhet 1101—Writing to Inform, Convince, and Persuade (4 cr)
Rhet 1152—Writing on Issues of Science and Technology (4 cr)
Rhet 1223—Oral Presentations in Professional Settings (3 cr)
Rhet 3257—Scientific and Technical Presentations (3 cr)
Math 1142—Short Calculus (4 cr)
or Math 1271—Calculus I (4 cr)

Note: Students contemplating graduate work are encouraged to take both Math 1271 and 1272.

Complete 4 credits of physical and 4 credits of biological sciences from courses listed below:
Agro 1101—Biology of Plant Food Systems (4 cr)
Biol 1001—Introductory Biology I (4 cr)
Biol 1009—General Biology (4 cr)
Chem 1011—General Principles of Chemistry (4 cr)
Chem 1021—Chemical Principles I (4 cr)
FScN 1021—Introductory Microbiology (4 cr)
Geo 1001—The Dynamic Earth (4 cr)
Geog 1403W—Biogeography of the Global Garden (4 cr)
Geog 1425-1426—The Atmosphere (4 cr)
Hort 1001—Plant Propagation (4 cr)
IofT 1101—Environmental Issues and Solutions (4 cr)
Phys 1001W—Energy and the Environment (4 cr)
Soil 1125—The Soil Resource (4 cr)

Ethics and Responsible Management of Agriculture, Food, and Environmental Systems

Students must take one course (3 cr) from the list below that fosters one or more of the following objectives:

• Responsible judgment about the management of natural resources and the environment;
• Responsible judgment regarding ethical and policy issues related to agriculture;
• Application of global perspectives to agriculture, food, and environmental issues and decisions;
• Application of a historical perspective to the role of science and technology.

This course must be taken A-F and passed with grade of C- or better.
Agro 1103, 3203W, AnSc 1011, Biol 1051, 4501, EEB 3001, EE 1701W, ES 1011, FScN 1102, Geo 3005, Geog 3401W, HSci 3211, 3331, NRES 3011W, 3061W, PBio 1212W, PIPa 1001, or ScAg 1501

Professional Requirements

Applied Economics
ApEc 1001—Orientation (1 cr)
ApEc 1101—Principles of Microeconomics (3 cr)
ApEc 1102—Principles of Macroeconomics (3 cr)
College of Agricultural, Food and Environmental Sciences

ApEc 3001—Applied Microeconomics: Consumers, Producers, and Markets (4 cr)
ApEc 3002—Applied Microeconomics: Managerial Economics (4 cr)
ApEc 3006—Applied Macroeconomics: Government and the Economy (3 cr)
ApEc 3007—Applied Macroeconomics: Policy, Trade, and Development (3 cr)
ApEc 3501—Agribusiness Finance (3 cr)
ApEc 4821—Agribusiness Management (5 cr)

Carlson School of Management
Acct 2050—Introduction to Financial Reporting (4 cr)
Acct 3001—Introduction to Management Accounting (3 cr)
Mgmt 3001—Fundamentals of Management (3 cr)
Mktg 3001—Principles of Marketing (3 cr)
OMS 1550—Business Statistics: Data Sources, Presentation, and Analysis (4 cr)

Areas of Emphasis (12 cr)
All Emphases
Students must take a minimum of two courses (6-8 cr) in ApEc or Econ and a minimum of two courses (6-8 cr) in CSOM or DHA (3245, 4121, or 4343 only). These requirements may be met by selecting courses in one of the following areas of emphasis.

Business Management
Acct 3201—Intermediate Management Accounting (2 cr)
Acct 5100—Corporate Financial Reporting (4 cr)
ApEc 3451—Food and Agricultural Sales (3 cr)
ApEc 4096—Professional Experience Program: Internship (1-3 cr)
ApEc 4481—Futures and Options Markets (3 cr)
ApEc 5711—U.S. Agricultural and Environmental Policy (3 cr)
BLaw 3058—The Law of Contracts and Agency (4 cr)
Fina 4241—Corporate Financing Decisions (4 cr)
Fina 4242—Corporate Investment Decisions (4 cr)
HRIR 3021—Human Resource Management and Industrial Relations (3 cr)
HRIR 3032—Training and Development (2 cr)
HRIR 3042—the Individual and Organizational Performance (2 cr)
Mgmt 4002—Managerial Psychology (4 cr)
Mgmt 4008—Entrepreneurial Management (4 cr)

Financial Management
Acct 5101—Asset Valuation and Income Determination (4 cr)
Acct 5125—Auditing Principles and Procedures (4 cr)
Acct 5160—Financial Statement Analysis (4 cr)
ApEc 4096—Professional Experience Program: Internship (1-3 cr)
ApEc 4481—Futures and Options Markets (3 cr)
ApEc 5751—Agribusiness Finance (3 cr)
BLaw 3058—The Law of Contracts and Agency (4 cr)
Econ 3701 or 4721H—Money and Banking (3 cr)
Econ 4432W—International Finance (3 cr)
Econ 4751—Financial Economics (3 cr)
Fina 4211—Financial Markets and Interest Rates (2 cr)
Fina 4225—Banking Institutions (2 cr)
Fina 4241—Corporate Financing Decisions (4 cr)
Fina 4242—Corporate Investment Decisions (4 cr)
Fina 4321—Portfolio Management and Performance Evaluation (4 cr)
Fina 4322—Security Analysis (4 cr)
Fina 4641—International Finance and Risk Management (4 cr)
Ins 5100—Corporate Risk Management (2 cr)

Marketing, Sales, and Food Industry Management
ApEc 3411—Grain Marketing Economics (3 cr)
ApEc 3421—Livestock and Meat Marketing Economics (3 cr)
ApEc 3451—Food and Agricultural Sales (3 cr)
ApEc 3821—Retail Center Management (3 cr)
ApEc 4096—Professional Experience Program: Internship (1-3 cr)
ApEc 4103—World Food Problems (3 cr)
ApEc 4451W—Food Marketing Economics (3 cr)
ApEc 4481—Futures and Options Markets (3 cr)
ApEc 5711—U.S. Agricultural and Environmental Policy (3 cr)
ApEc 5751—Agribusiness Finance (3 cr)
DHA 3245—Nonstore Retailing (3 cr)
DHA 4241—Retail Promotion (3 cr)
DHA 4242—Retail Buying (3 cr)

Econ 4751—Financial Economics (3 cr)

General Education Requirements
All Emphases
Areas of Emphasis (12 cr)

Individualized Area of Emphasis
Students preparing for career opportunities that emphasize skills such as accounting, communications, law, or information systems may use this alternative to design an area of emphasis. A program of study under the emphasis must be approved by the adviser and the major coordinator. At least 6 of the 12 credits must be completed after receiving approval.

Internships
Internships are recommended for all students in the major. Internship credits do count toward the degree requirements.

Agricultural Education
Department of Work, Community, and Family Education
B.S.
The undergraduate agricultural education program is a collaborative partnership between COAFES and the College of Education and Human Development. Three specializations are available; the following two prepare students for Minnesota state teaching licensure:
• agricultural science and technology education
• natural and managed environmental education

The agricultural leadership, training, and development specialization prepares students for agricultural industry and leadership careers, but does not lead to teaching licensure.

Agricultural Science and Technology Education Specialization
This specialization serves students preparing to teach agriscience, agribusiness, agriculture, horticulture, food systems, agrimechanics, and natural resource management under the licensure field of agricultural education in public schools at the 5-12 level. The specialization’s broad agricultural science and technology background also prepares graduates for a wide range of agriculturally related positions in sales, management, finance, and production aspects of agriculture.

Admission Requirements—Students may be admitted to this program as freshmen or may transfer into the program any semester. They must have a GPA of 2.50 for admission and complete the Praxis I: Pre-Professional Skills Tests (PPST).

Degree Requirements
Students may graduate from this program with a minimum 2.00 GPA, but a minimum 2.50 GPA is required for recommendation for a Minnesota teaching license.

Students must complete at least 128 credits to graduate, including required courses in the major. Students also must complete the University’s liberal education requirements, including approved writing intensive (W) courses. For more information, see page 31 in this catalog.

The specialization requires a broad study of agriculture, including plant science (horticulture, agronomy, plant pathology, and entomology), animal science, natural resources, soils, economics and agribusiness, agricultural mechanization, food science, foundations of education, foundations of agricultural education, and a full-year student teaching experience.
Required Courses

Communications (11 cr)
Rhet 1101—Writing to Inform, Convince, and Persuade (4 cr)
Rhet 1223—Oral Presentations in Professional Settings (3 cr)
Rhet 3562W—Technical and Professional Writing (4 cr)

Physical and Biological Sciences (19-20 cr)
BioC 2011—Biochemistry for the Agricultural and Health Sciences (3 cr)
Biol 1009—General Biology (4 cr)
Biol 1051—Introduction to Environmental Science (3 cr)
Agro 1101—Biology of Plant Food Systems (4 cr)
Chem 1011—General Principles of Chemistry (4 cr)
MicB 2022—General Microbiology (2 cr)
Phys 1001W—Energy and the Environment (4 cr)
Phys 1110W—Introductory College Physics I (4 cr)
ScAg 1501—Biotechnology, People, and the Environment (3 cr)

Mathematics (3 cr)
Math 1031—College Algebra and Probability (3 cr)

Social Science (8 cr)
HSci 1814—Introduction to History of Science: Ancient Science to the Scientific Revolution (4 cr)
HSci 1815—Introduction to History of Science: Modern Science (4 cr)
Psy 1001—Introduction to Psychology (4 cr)
GC 1281—General Psychology (4 cr)

Agricultural Sciences and Applied Economics (40 cr)

Plant Science (6 cr)
Agri 3001—Pests and Crop Protection (3 cr)

Plus 3-4 credits from the following:
Agro 1103—Crops, Environment, and Society (4 cr)
Agro/Hort 4401—Plant Genetics and Breeding (4 cr)
Hort 1001—Plant Propagation (4 cr)
Hort 1002—Home Horticulture (3 cr)
Hort 1012—Woody Landscape Plants (3 cr)
Hort 1013—Floral Design (2 cr)
Hort 3002—Greenhouse Management (3 cr)

Animal Science (6 cr)
AnSc 1403—Companion Animal Nutrition and Care (2 cr)
AnSc 2401—Animal Nutrition (3 cr)

Plus 3-4 credits from the following:
AnSc 1101—Introductory Animal Science (4 cr)
AnSc 1511—Food Animal Products for Consumers (3 cr)
AnSc 2012—Livestock and Canine Care (3 cr)
AnSc 2301—Systemic Physiology (4 cr)
AnSc/Agro 3203W—Environment, Global Food Production, and the Citizen (3 cr)
AnSc 3221—Animal Breeding (4 cr)

Natural Resources (6 cr)
Agro/AnSc 3203W—Environment, Global Food Production, and the Citizen (3 cr)
EEB 3001—Ecology and Society (3 cr)
ES 1011—Issues in the Environment (3 cr)
ES 1051—Introduction to Environmental Science (3 cr)
FW 1002—Wildlife: Ecology, Values, and Human Impact (3 cr)
NRES 1201—Conservation of Natural Resources (3 cr)

Soils (4 cr)
Soil 1125—The Soil Resource (4 cr)
Soil 2125—Basic Soil Science (4 cr)

Applied Economics and Agribusiness (8-9 cr)
ApEc 1101—Principles of Microeconomics (3 cr)
ApEc 3451—Food and Agricultural Sales (3 cr)

Plus 2-3 credits from the following:
ApEc 1251—Principles of Accounting (3 cr)
ApEc 3401—Markets, Marketing, and Prices (2 cr)
ApEc 3811—Principles of Farm Management (3 cr)
ApEc 3821—Retail Center Management (3 cr)

Agricultural Mechanization (6 cr)
Select two of the following courses:
AFEE 2051—Current Technical Competencies (3 cr)
AFEE/Ag 3112—Technical Drawing and Production Technologies (3 cr)
AFEE/Ag 3121—Communication, Energy and Power, Transportation and Machinery Technologies (3 cr)

Food Science (3 cr)
FscN 1102—Food: Safety, Risks, and Technology (3 cr)

Professional Education (38 cr)

Foundations (15 cr)
EdHD 5001—Learning, Cognition, and Assessment in the Schools (3 cr)
EdHD 5003—Developmental and Individual Differences in Educational Contexts (3 cr)
EdHD 5005—School and Society (2 cr)
EdHD 5007—Technology for Teaching and Learning (1.5 cr)
EdHD 5009—Human Relations: Applied Skills for School and Society (1 cr)
EdPA 5341—The American Middle School (3 cr)
PubH 3003—Fundamentals of Alcohol and Drug Abuse (2 cr)
PubH 5003—Fundamentals of Alcohol and Drug Abuse (1 cr)

Agricultural Education (15 cr)
AFEE 1001—Introduction to Agricultural Education and Extension (1 cr)
AFEE 1002—Principles of Career Planning for Agricultural Professionals (1 cr)
AFEE 2096—Professional Practicum in Agricultural Education: Early Experience (1 cr)
AFEE 5111—Agricultural Education: Methods of Teaching (4 cr)
AFEE 5112—Agricultural Education Program Organization and Curriculum for Youth (3 cr)
AFEE 5114—Agricultural Education Teaching Seminar (1 cr)
AFEE 5116—Coordination of SAE Programs: Work-based Learning (2 cr)
AFEE 5118—Strategies for Managing and Advising the FFA Organization (2 cr)

Work, Community, and Family Education (8 cr)
WCFE 5697—Teaching Internships: School and Classroom Settings (2 cr)
WCFE 5698—Teaching Internship (6 cr)

Completion of standard first aid and cardiopulmonary resuscitation (CPR) training is required for licensure.

Natural and Managed Environmental Education Specialization

This specialization serves students preparing to teach agriscience, agribusiness, agriculture, horticulture, food systems, agrimechanics, and natural resource management, all under the licensure field of agricultural education in public schools at the 5-12 level. In addition, graduates have an emphasis in natural resource management and education and are prepared for work in environmental learning centers.

Admission Requirements—Students may be admitted to this program as freshmen or may transfer into the program any semester with a minimum overall GPA of 2.50 and complete the Praxis I: Pre-Professional Skills Tests (PPST).

Degree Requirements

Students may graduate from this program with a minimum 2.00 GPA, but a minimum 2.50 GPA is required for recommendation for a Minnesota teaching license.

Students must complete at least 128 credits, including required courses in the major. Students also must complete the University’s liberal education requirements, including approved writing intensive (W) courses. For more information, see page 31 in this catalog.
The specialization requires a broad study in agriculture focused on the natural and managed environmental education areas. Areas of study include the environment, land, water, climate, economics, soil, plant science, animal science, and agricultural mechanization. It also includes foundations in education, foundations in agricultural education, and a full-year student teaching experience.

### Required Courses

**Communications (11 cr)**
- Rhet 1101—Writing to Inform, Convince, and Persuade (4 cr)
- Rhet 1223—Oral Presentations in Professional Settings (3 cr)
- Rhet 3562W—Technical and Professional Writing (4 cr)

**Mathematics (3 cr)**
- Math 1031—College Algebra and Probability (3 cr)

**Physical and Biological Science (19-20 cr)**
- BioC 2011—Biochemistry for the Agricultural and Health Sciences (3 cr)
- Biol 1009—General Biology (4 cr)
  - or Biol 1051—Introduction to Environmental Science (3 cr)
- Agro 1101—Biology of Plant Food Systems (4 cr)
- Chem 1011—General Principles of Chemistry (4 cr)
- MicroB 2022—General Microbiology (2 cr)
- Phys 1001W—Energy and the Environment (4 cr)
  - or Phys 1101W—Introductory College Physics I (4 cr)
- ScAg 1501—Biotechnology, People, and the Environment (3 cr)

**Social Science (8 cr)**
- HSCI 1814—Introduction to History of Science: Ancient Science to the Scientific Revolution (4 cr)
  - or 1815—Introduction to History of Science: Modern Science (4 cr)
- Psy 1001—Introduction to Psychology (4 cr)
  - or GC 1281—General Psychology (4 cr)

**Natural and Managed Environmental Science (40 cr)**

#### Environmental (9 cr)
- ES 1011—Issues in Environment (3 cr)
  - Plus at least 6 credits from the following:
    - EEB 3001—Ecology and Society (3 cr)
    - ES 1051—Introduction to Environmental Science (3 cr)
    - FR 2104—Forest Measurement Techniques (1 cr)
    - FR 3104—Forest Ecology (4 cr)
    - FR 3251—Role of Renewable Natural Resources in Developing Countries (1 cr)
    - FW 1002—Wildlife: Ecology, Values, and Human Impact (3 cr)
    - FW 3003—Wildlife in Agricultural Land (2 cr)

#### Land, Water, Atmosphere (7 cr)
- Soil 2125—Basic Soil Science (4 cr)
  - Plus 3-4 credits from the following:
    - NRES 1201—Conservation of Natural Resources (3 cr)
    - Soil 1425—The Atmosphere (3 cr)
    - Soil 3221—Soil Conservation and Land-Use Management (3 cr)
    - Soil 3416—Plant Nutrients in the Environment (3 cr)

### Applied Economics and Agribusiness (3 cr)
- ApEc 1101—Principles of Microeconomics (3 cr)
  - or ApEc 3451—Food and Agricultural Sales (3 cr)

### Plant Science (6 cr)
- Agri 3001—Pests and Crop Protection (3 cr)
  - Plus 3-4 credits from the following:
    - Agro/Hort 4401—Plant Genetics and Breeding (4 cr)
    - Agro or Hort (Electives)

### Animal Science (6 cr)
- AnSc 2401—Animal Nutrition (3 cr)
  - Plus 3-4 credits from the following:
    - AnSc 1101—Introductory Animal Science (4 cr)
    - AnSc 1403—Companion Animal Nutrition and Care (2 cr)
    - AnSc 1511—Food Animal Products for Consumers (3 cr)
    - AnSc 2012—Livestock and Carcass Evaluation (3 cr)
    - AnSc 3203W—Environment, Global Food Production, and the Citizen (3 cr)

### Agricultural Mechanization (6 cr)
- Select 6 credits from the following:
  - AFEF 2051—Current Technical Competencies (3 cr)
  - AFEF/BIE 3121—Technical Drawing and Production Technologies (3 cr)
  - AFEF/BIE 3121—Communication, Energy and Power, Transportation and Machinery Technologies (3 cr)

### Food Science (3 cr)
- FScN 1102—Food: Safety, Risks, and Technology (3 cr)

### Professional Education (38 cr)

#### Foundations (15 cr)
- EdHD 5001—Learning, Cognition, and Assessment in the Schools (3 cr)
- EdHD 5003—Developmental and Individual Differences in Educational Contexts (3 cr)
- EdHD 5005—School and Society (2 cr)
- EdHD 5007—Technology for Teaching and Learning (1.5 cr)
- EdHD 5009—Human Relations: Applied Skills for School and Society (1 cr)
- EdPA 5341—The American Middle School (3 cr)
- PubH 3003—Fundamentals of Alcohol and Drug Abuse (2 cr)
  - or PubH 5003—Fundamentals of Alcohol and Drug Abuse (1.5 cr)

#### Agricultural Education (15 cr)
- AFEF 1001—Introduction to Agricultural Education and Extension (1 cr)
- AFEF 1002—Principles of Career Planning for Agricultural Professionals (1 cr)
- AFEF 2096—Professional Practicum in Agricultural Education: Early Experience (1 cr)
- AFEF 5111—Agricultural Education: Methods of Teaching (4 cr)
- AFEF 5112—Agricultural Education Program Organization and Curriculum for Youth (3 cr)
- AFEF 5114—Agricultural Education Teaching Seminar (1 cr)
- AFEF 5116—Coordination of SAE Programs: Work-based Learning (2 cr)
- AFEF 5118—Strategies for Managing and Advising the FFA Organization (2 cr)

### Work, Community, and Family Education (8 cr)
- WCFE 5697—Teaching Internship: School and Classroom Settings (2 cr)
- WCFE 5698—Teaching Internship (6 cr)

Completion of standard first aid and cardiopulmonary resuscitation (CPR) training is required for licensure.

### Agricultural Leadership, Training, and Development Specialization

This specialization provides a unique, futuristic educational opportunity combining agricultural science, communication, leadership, education, business and industry, training, and development. It provides a general background in agriculture, with agribusiness and industry associations. This specialization does not lead to teaching licensure.

The agricultural industry is faced with leadership and employee training and development challenges. This specialization provides students with opportunities and flexibility in employment ranging from human resource development, sales and marketing, extension, and communications in statewide, national, and international situations.
Admission Requirements—Students may be admitted to this program as freshmen or may transfer into the program any semester. They must have a GPA of 2.00 for admission.

Degree Requirements
Students must complete at least 128 credits, including required courses in the major. Students also must complete the University’s liberal education requirements, including approved writing intensive (W) courses. For more information, see page 31 in this catalog.

This specialization requires business experience as well as completion of courses. Students must maintain an overall GPA of 2.00.

Required Courses

Communications (11 cr)
Rhet 1122—Writing to Inform, Convince, and Persuade (4 cr)
Rhet 2552W—Technical and Professional Writing (4 cr)

Mathematics (3 cr)
Math 1031—College Algebra and Probability (3 cr)

Physical and Biological Sciences (14 cr)
Agro 1101—Biology of Plant Food Systems (4 cr)
or Biol 1009—General Biology (4 cr)
BioC 1011—Biochemistry for the Agricultural and Health Sciences (3 cr)
Chem 1011—General Principles of Chemistry (4 cr)
ScAg 1501—Biotechnology: People and the Environment (3 cr)

Social Science (4 cr)
Psy 1001—Introduction to Psychology (4 cr)
or GC 1281—General Psychology (4 cr)

Agricultural Sciences and Economics (52 cr)
Plant Science (9 cr)
Agri 3001—Pests and Crop Protection (3 cr)
Plus at least 6 credits from the following:
Agro 1103—Crops, Environment, and Society (4 cr)
Agro 2501—Weed Biology and Systematics (2 cr)
Agro 3005—Applied Crop Physiology and Development (2 cr)
AnSc 3203W—Environment, Global Food Production, and the Citizen (3 cr)
Hort 1001—Plant Propagation (4 cr)
Hort 1002—Home Horticulture (3 cr)
Hort 3005—Environmental Effects on Horticultural Crops (2 cr)

Animal Science (10 cr)
AnSc 1101—Introductory Animal Science (4 cr)
AnSc 1403—Companion Animal Nutrition and Care (2 cr)
or AnSc 2401—Animal Nutrition (3 cr)
Plus 3-4 credits from the following:
AnSc 1511—Food Animal Products for Consumers (3 cr)
AnSc 2012—Livestock and Carcass Evaluation (3 cr)
AnSc 3203W—Environment, Global Food Production, and the Citizen (3 cr)

Soils (7 cr)
Soil 1125—The Soil Resource (4 cr)
or Soil 2125—Basic Soil Science (4 cr)
Plus 3 credits from the following:
Soil 1425—The Atmosphere (3 cr)
Soil 3221—Soil Conservation and Land-Use Management (3 cr)
Soil 3416—Plant Nutrients in the Environment (3 cr)

Applied Economics and Agribusiness (12 cr)
ApEc 1101—Principles of Microeconomics (3 cr)
ApEc 1251—Principles of Accounting (3 cr)
ApEc 3451—Food and Agricultural Sales (3 cr)
Plus 2-3 credits from the following:
ApEc 3401—Markets, Marketing and Prices (2 cr)
ApEc 3811—Principles of Farm Management (3 cr)
ApEc 3821—Retail Center Management (3 cr)

Agricultural Mechanization (3 cr)
AFEE 2051—Current Technical Competencies (3 cr)

Agricultural Leadership and Development (6 cr)
AFEE 4221—Rural Leadership Development (3 cr)
AFEE 5361—World Development Problems (3 cr)

Experiential Education (3 cr)
AFEE 3096—Experiential Learning: Production and Business (1-3 cr)
AFEE 1001—Introduction to Agricultural Education and Extension (1 cr)
AFEE 1002—Principles of Career Planning for Agricultural Professionals (1 cr)
AFEE 5111—Agricultural Education: Methods of Teaching (4 cr)
AFEE 5331—History, Philosophy, and Systems of Extension (3 cr)

Human Resource Development/Adult Education (15 cr)
HRD 5001W—Survey: Human Resource Development and Adult Education (3 cr)
HRD 5105—Strategic Planning in Human Resource Development (3 cr)
HRD 5201—Personnel Training and Development (3 cr)
HRD 5301—Organization Development (3 cr)
Plus (three) elective credits in HRD courses.

Emphasis Areas

Students must select 10 credits in one of the following three emphasis areas:

Agricultural Science (10 cr)
Agro 2103—Grain Grading and Crop Utilization (1 cr)
Agro 2105—Seed Technology (1 cr)
Agro 2501—Weed Biology and Systematics (2 cr)
Agro 3203W—Environment, Global Food Production, and the Citizen (3 cr)
Agro 3005—Applied Crop Physiology and Development (2 cr)
AnSc 1511—Food Animal Products for Consumers (3 cr)
AnSc 2012—Livestock and Carcass Evaluation (3 cr)
AnSc 2211—Biometrics for Livestock (3 cr)
AnSc 2301—Systemic Physiology (4 cr)
FScN 1102—Food: Safety, Risks, and Technology (3 cr)
PfPa 2002—Diseases of Field Crops (3 cr)
PfPa 3002—Air Pollution, People, and Plants: The Science and the Ethics (3 cr)

Agricultural Business and Management (10 cr)
ApEc 3401—Economic Development of U.S. Agriculture (3 cr)
ApEc 3401—Markets, Marketing, and Prices (2 cr)
ApEc 3411—Grain Marketing Economics (2 cr)
ApEc 3421—Livestock and Meat Marketing Economics (2 cr)
ApEc 3811—Principles of Farm Management (3 cr)

Communication (10 cr)
Rhet 1122—Writing to Inform, Convince, and Persuade (4 cr)
Rhet 3211W—Theories of Human Communication (4 cr)
Rhet 3257—Scientific and Technical Presentations (3 cr)
Rhet 3252—Group Process, Team Building, Leadership (3 cr)
Rhet 3401—Accessing Information Through Electronic Media (3 cr)

Agricultural Industries and Marketing

B.S.

Industries related to modern agriculture include manufacturers and distributors of farm production inputs (such as equipment, structures, animal feed, health products, seeds, fertilizers, and crop protection products); assemblers, processors, manufacturers, and distributors of products originating from farms (products such as meat, milk, eggs, wool, grains, fruits, vegetables, nursery crops, flowers, and turf); and finance and insurance industries providing agricultural credit. Agribusinesses such as these regularly search for individuals who have a broad
education in the scientific (and technical) aspects of agriculture, effective work and communication skills, and quantitative and qualitative skills to solve business problems.

All departments in COAFES contribute to and are represented by the agricultural industries and marketing (AIM) major. The major provides a broad-based educational program reflecting the academic strengths of COAFES and the University at large. It also prepares students for a challenging career in agricultural industries.

The scientific knowledge and technical skills necessary to become an effective agribusiness professional are provided through requirements in the basic and agricultural sciences and are strengthened by selection of one of five areas of emphasis: animal industries, horticultural industries, crops and soils industries, food industries, or individualized emphasis.

**Degree Requirements**

Students must complete at least 120 credits to graduate, including 108 credits in the major. Besides completing the University’s liberal education requirements, all majors must complete 1) a common core of foundation courses in the areas of quantitative studies (mathematics, accounting, and statistics) and science (biology and chemistry) and 2) professional courses with three major clusters (communications, business, and agriculture). Students must complete at least 14 credits in their area of emphasis. Finally, students must complete an internship or a student project. All required courses must be taken A-F, and a grade of at least C- is required in all professional courses and area of emphasis courses.

**Required Courses**

**Foundation Requirements**

**Quantitative Foundations**

ApEc 1251—Principles of Accounting (3 cr)
Math 1031—College Algebra (3 cr)
or Math 1142—Short Calculus (4 cr)

**Plus one of the following:**

Agro 4101—Agricultural Decision-Making and Experimentation (3 cr)
AnSc 2211—Biometrics for Livestock (3 cr)
Stat 3011—Introduction to Statistical Analysis (4 cr)

**Science Foundations**

Agro 1101—Biology of Plant Food Systems (4 cr)
or Biol 1009—General Biology (4 cr)
BioC 1001—Elementary Biochemistry (3 cr)
or BioC 2011—Biochemistry for the Agricultural and Health Sciences (3 cr)
Chem 1011—General Principles of Chemistry (4 cr)

**Professional Requirements**

A grade of at least C- is required in all professional courses and the area of emphasis.

**Communications**

Rhet 1101—Writing to Inform, Convince, and Persuade (4 cr)
Rhet 1152—Writing on Issues in Science and Technology (4 cr)
or Rhet 3257—Scientific and Technical Presentations (3 cr)
Rhet 1223—Oral Presentations in Professional Settings (3 cr)
Rhet 3266—Group Process, Team Building, and Leadership (3 cr)
Rhet 3562—Technical and Professional Writing (4 cr)
Rhet 4165—Managerial and Organizational Communication, Planning, and Change (3 cr)
or Rhet 5258—Information-Gathering Techniques in Scientific and Technical Communication (3 cr)

**Business**

ApEc 1101—Principles of Microeconomics (3 cr)
ApEc 1102—Principles of Macroeconomics (3 cr)

**Three of the following:**

ApEc 3001—Applied Microeconomics: Consumers, Producers and Markets (4 cr)
ApEc 3002—Applied Microeconomics: Managerial Economics (4 cr)
ApEc 3411—Grain Marketing Economics (3 cr)

ApEc 3421—Livestock and Meat Marketing Economics (3 cr)
ApEc 3811—Principles of Farm Management (3 cr)
ApEc 3821—Retail Center Management (3 cr)
ApEc 4451—Food Marketing Economics (3 cr)
ApEc 4821—Agribusiness Management (5 cr)

**One of the following:**

ApEc 3451—Food and Agricultural Sales (3 cr)
ApEc 3501—Agribusiness Finance (3 cr)
BIE 3061—Professional Sales Management (3 cr)
Jour 3201—Principles of Advertising (3 cr)

**Agriculture**

APPE 1002—Principles of Career Planning for Agricultural Professionals (1 cr)
AgET 3213—Engineering Principles and Applications (3 cr)
or FScN 1102—Food: Safety, Risks, and Technology (3 cr) (required for food industry emphasis)
Agro 1103—Crops, Environment, and Society (4 cr)
or Hort 1001—Plant Propagation (4 cr)
AnSc 1011—Domestic Animals and Society (3 cr)
or AnSc 1101—Introductory Animal Science (4 cr) (required for animal industries emphasis)
Soil 2125—Basic Soil Science (4 cr)
or FScN 1112—Principles of Nutrition (3 cr)
Xxxx 4096—Professional Experience Program: Internship (3 cr)
or AIM 4011—Student Project/Field Investigation (3 cr)

**Areas of Emphasis**

**Animal Industries**

AnSc 1101—Introductory Animal Science (4 cr)

**Plus three of the following:**

AnSc 2301—Systemic Physiology (4 cr)
AnSc 2401—Animal Nutrition (3 cr)
AnSc 3221—Animal Breeding (4 cr)
AnSc 3511—Animal Growth and Development (3 cr)

**Crops and Soils Industries**

Agri 3001—Pests and Crop Protection (3 cr)
Agro 4005—Applied Crop Physiology and Development (4 cr)
Soil 3416—Plant Nutrients in the Environment (3 cr)

At least 4 credits from the following:

Agro 2104, 2501, 3203, 4401, 4505, 4603, 4605, Ent 3005, PlPa 2002, Soil 3221, 3612, 4111, 4511

*The emphasis in crops and soils industries is also offered at Southwest State University in Marshall, Minnesota, through a joint agreement. Students can contact Southwest State University or COAFES for more information.

**Horticultural Industries**

Hort 1001—Plant Propagation (4 cr) (cannot be used for agriculture requirement above)
Hort 3002—Greenhouse Management (3 cr)

At least 7 credits from the following:

Hort 4021, 4041, 4051, 4061, 4071, 4072, 4401, 5021, 5023, 5031, 5032, 5041, 5051, 5052, 5061, 5071, 5183

**Food Industries**

ApEc 4451—Food Marketing Economics (3 cr) (cannot be used for business requirement)
FScN 1021—Introductory Microbiology (4 cr)

**Plus at least 6 credits from the following:**

FScN 1511—Food Animal Products for Consumers (3 cr)
FScN 3102—Introduction to Food Science (3 cr)
FScN 3615—Sociocultural Aspects of Food, Nutrition, and Health (3 cr)
FScN 4614—Community Nutrition (3 cr)

**Individualized Emphasis**

At least 14 cr selected in consultation with an adviser and with approval of the AIM major committee. The courses comprising the individualized emphasis must have a definite theme. A collection of unrelated courses is unacceptable.

**Final Project**

Professional Experience Program (Xxxx 4096) or AIM 4011 required.
Agronomy

Minor Only

This minor provides strong science based courses emphasizing crop management in the context of sustainable ecosystems. It is well suited for students majoring in agriculture, food and environmental education; animal science; business and economics; environmental science, or for students seeking knowledge and principles of crop production. The minor allows students to complete coursework providing the minimal background needed to prepare for the Certified Crop Advisor (CCA) exams. Students must complete a minimum of 17 credits.

Required Courses
Agro 4660—Senior Capstone (2 cr)
Agri 3001—Pests and Crop Protection (3 cr)
Soil 3416—Plant Nutrients in the Environment (3 cr)

Electives
9 credits of Agro 2xxx or higher courses selected from the following list in consultation with the minor adviser:
Agro 2104—Grain and Seed Technology (2 cr)
Agro 2501—Plant Identification in Urban and Rural Landscapes (2 cr)
Agro 4005—Applied Crop Physiology and Development (4 cr)
Agro 4401—Plant Genetics and Breeding (4 cr)
Agro 4505—Integrated Weed Management (3 cr)
Agro 4603—Field Crop Scouting and Problem Diagnosis (2 cr)
Agro 4605—Management Strategies for Crop Production (4 cr)

Animal Production Systems

B.S.

The animal production systems major prepares students for work as managers and technical advisers for animal production systems and sales, for various careers in animal industries, or for graduate study in animal related specializations. The curriculum emphasizes applied principles and includes courses in agriculture, science, mathematics, business, and social science. Areas of emphasis include dairy, beef, equine swine, sheep, and poultry. An individualized emphasis may also be pursued.

Degree Requirements

Students must complete at least 120 credits to graduate, including 55 credits in the major. Frequently, courses in the foundation requirements also apply toward liberal education requirements. All required courses must be taken A-F, and a grade of at least C- is required in all professional courses and area of emphasis courses.

Required Courses

Foundation Requirements
ApEc 1101—Principles of Microeconomics (3 cr)
BioC 1021—General Principles of Biochemistry (3 cr)
Biol 1009—General Biology (4 cr)
Chem 1011—General Principles of Chemistry (4 cr)
Math 1031—College Algebra and Probability (3 cr)
Rhet 1101—Writing to Inform, Convince, and Persuade (4 cr)
Rhet 1223—Oral Presentations in Professional Settings (3 cr)
Rhet 3562—Technical and Professional Writing (4 cr)

Professional Requirements
AFEE 1002—Principles of Career Planning in Agriculture (1 cr)
Agro 1103—Crops, Environment, and Society (4 cr)
AnSc 1101—Introductionary Animal Science (4 cr)
AnSc 1511—Food Animal Products for Consumers (3 cr)
AnSc 2211—Biometrics for Livestock (3 cr)
AnSc 2301—Systemic Physiology (4 cr)
AnSc 2401—Animal Nutrition (3 cr)
AnSc 3221—Animal Breeding (4 cr)
AnSc 4096—Professional Experience Program: Internship (2 cr)
AnSc 4403—Ruminant Nutrition (3 cr)
AnSc 4601—Pork Production Systems Management (4 cr)
AnSc 4602—Poultry Production Systems Management (4 cr)
AnSc 4603—Beef Production Systems Management (4 cr)
AnSc 4604—Dairy Production Systems Management (4 cr)

Areas of Emphasis

Beef
AnSc 2012—Livestock and Carcass Evaluation (3 cr)
AnSc 4403—Ruminant Nutrition (3 cr)
AnSc 4601—Pork Production Systems Management (4 cr)
AnSc 4613—Advanced Beef Production Systems Management (2 cr)

Dairy
AnSc 4011—Dairy Cattle Breeding (3 cr)
AnSc 4403—Ruminant Nutrition (3 cr)
AnSc 4604—Dairy Production Systems Management (4 cr)
AnSc 4614—Advanced Dairy Production Systems Management (2 cr)

Equine
AnSc 3102—Equine Management (ITV from Crookston) (3 cr)
In consultation with their adviser, students must complete at least 3 additional credits of selected equine lab courses offered during summer sessions at Crookston and 4 additional credits of other selected equine courses.

Sheep
AnSc 3102—Equine Management (ITV from Crookston) (3 cr)

Swine
AnSc 4602—Sheep Production Systems Management (4 cr)

Poultry
AnSc 4602—Poultry Production Systems Management (4 cr)

Individualized Emphasis (12 cr min)
Courses may be selected according to the student’s interest in consultation with an adviser and with the approval of the Animal Production Systems Committee.

Animal Science

Minor Only

The minor is for students who want to include animal science coursework to enhance or supplement their major program. Students have flexibility in choosing courses to meet the requirements. To complete the minor, students must complete at least 20 credits with an AnSc designator.

Required Courses
At least 10 credits must be 3xxx or higher.
Applied Economics

B.S.
The applied economics major prepares students for careers in private industry, government agencies, agribusiness, or graduate work. Students may choose one of six areas of emphasis: management and finance; marketing; food retailing; trade and development; resources and environment; or regional and public economics. Students may also, in consultation with their adviser, develop an individualized area of emphasis. The curriculum emphasizes fundamental written and oral communication skills and a strong foundation in economic principles and their applications. Areas of employment for graduates include management, finance, marketing and international trade, domestic and international development, environmental impact assessment, resource management and use, and government-related work in planning, taxation, and development. Entry-level jobs are often in merchandising and sales, credit analysis, management, and other customer contact areas.

Degree Requirements
Students must complete at least 120 credits to graduate, including 52 credits in the major. Besides completing the University’s liberal education requirements, students must complete a core of foundational requirements (writing performance and speaking performance) and professional requirements, including basic economic principles, applied micro/macroeconomic theory, accounting, and statistics. Every students’ program is capped off with 12 credits of advanced-level coursework, called an area of emphasis, tailored to meet the student’s particular interests and career interests. All required courses must be taken A-F, and a grade of at least C- is required in all professional courses and area of emphasis courses.

Required Courses
Foundation Requirements
Math 1142—Short Calculus
or Math 1271—Calculus (4 cr)

Writing Performance Courses
Rhet 1101—Writing to Inform, Convince, and Persuade (4 cr)
Rhet 1152—Writing on Issues of Science and Technology (3 cr)
Rhet 3562—Technical and Professional Writing (4 cr)

Speech Performance Courses
Rhet 1223—Oral Presentations in Professional Settings (3 cr)
Rhet 3257—Scientific and Technical Presentations (3 cr)
Rhet 3266—Group Process, Team Building, and Leadership (3 cr)

Social Science
Student in ApEc must complete 3 credits in social sciences beyond the 6 credits required for liberal education.

Ethics and Responsible Management of Agriculture, Food, and Environmental Systems
Students must take one course (3 cr) from the list below that fosters one or more of the following objectives:
- Responsible judgements about the management of natural resources and the environment;
- Responsible judgements regarding ethical and policy issues related to agriculture;
- Application of global perspectives to agriculture, food, and environmental issues and decisions;
- Application of a historical perspective to the role of science and technology.
This course must be taken A-F and passed with grade of C- or better.

Professional Requirements
ApEc 1001—Orientation to Applied Economics (1 cr)
ApEc 1101—Principles of Microeconomics (3 cr)
ApEc 1102—Principles of Macroeconomics (3 cr)
ApEc 1251—Principles of Accounting (3 cr)
or Acct 2050—Introduction to Financial Reporting (4 cr)
ApEc 3001—Applied Microeconomics: Consumers and Markets (4 cr)
ApEc 3002—Applied Microeconomics: Managerial Economics (4 cr)
ApEc 3006—Applied Macroeconomics: Government and the Economy (3 cr)
ApEc 3007—Applied Macroeconomics: Policy, Trade, and Development (3 cr)
Stat 3011—Introduction to Statistical Analysis (4 cr)
or OMS 1550—Business Statistics (4 cr)

Areas of Emphasis
At least two upper division ApEc courses (excluding 3991, 4096, 5891, 5991) must be chosen, plus two additional courses from ApEc, Econ, Carlson School of Management, or other courses listed below, for a total of 12 credits (minimum). While students are encouraged to complete credits in one of the following areas, students may select courses across the categories in consultation with their adviser.

Management and Finance
Acct 3001, 5100, 5160, ApEc 3501, 3811, 3921, 4096, 4481, 4821W, Econ 3701 or 4721, 4751, Fin 4241, 4242, HRIR 3021, Mgmt 3001

Marketing
ApEc 3411, 3421, 3451, 3821, 4096, 4451W, DHA 4241, Mktg 3001, 3010, 4030, 4040, 4050, 4060, 4080

Food Retailing
ApEc 3421, 3451, 3821, 4096, 4451W, 4481, DHA 4241, 4242, HRIR 3032, 3042, Mktg 4020, 4040, 4060, 4080, OMS 3001, 3056

Trade and Development
ApEc 3041W, 3071, 4096, 4103, 5711, 5751, BGS 3002, Econ 4041, 4301W or 4331W, 4307 or 4337, 4311, 4313, 4315, 4421W, 4432W

Resources and Environment

Regional and Public Economics
ApEc 4096, 4311, 5321, BGS 3002, Econ 3401, Econ 3501 or 4531, 3601 or 4631, 3801, 4307 or 4337, 4623, 4831W, PubH 3801, UrbS 3001

Individualized Area of Emphasis
To develop such a program, consult with adviser.

Internships
Internships are recommended for all students in the major.

Applied Economics Minor
For students who want to include a basic core of applied economics coursework to enhance or supplement their major program. Students have flexibility in choosing courses to meet the minor requirements. To complete the minor, students must complete at least 16 credits.

Required Courses
ApEc 1101—Principles of Microeconomics (3 cr)
ApEc 1102—Principles of Macroeconomics (3 cr)
ApEc electives—3xxx or higher (10 cr)

Climatology

Minor Only
The minor lets students broaden their expertise in weather and climate studies. Students who will be working for any industry or agency that depends on understanding weather and climate change will find the minor useful. Students take courses in meteorology, atmosphere, and biometeorology. Electives are in climate models, climate variations, climate change, and atmospheric boundary layer.

To complete the minor, students must complete at least 20 credits.

Required Courses
Soil 1425—The Atmosphere (3 cr)
Soil 1426—The Atmospheric Laboratory (1 cr)
Soil 5211—Environmental Biophysics and Ecology (3 cr)

Electives (13 credits)
EEB 5008—Forest Response to Quaternary Climate Change (2 cr)
EEB 5009—Quaternary Vegetation History and Climate (2 cr)
Crop, Soil, and Pest Management

B.S.
The crop, soil, and pest management major is for persons who are interested in becoming proficient in the principles and practices necessary for economically viable and environmentally sound management of the natural resource base upon which the food and fiber production system depends. Students follow a strong science-based curriculum that emphasizes crop, soil, and pest management in the context of global ecosystems. The major prepares students for careers in the production and management of field and vegetable crops and for positions as technical representatives for seed, agricultural chemical, and crop protection companies; crop advisers/consultants; extension educators; state and federal regulatory professionals; farm managers; soil and water specialists/conservationists; research technicians; and research support staff. Quality performance in the major prepares students to pursue crop, soil, and environmental science related graduate degrees. The major provides the subject matter background needed for certified crop adviser (CCA) and certified professional agronomist (CPAg) programs. By selecting the soil science area of emphasis, students meet the minimum requirements for employment by NRCS as a soil conservationist and the initial requirements to become a certified professional soil scientist (CPSSc).

Admission Requirements—Admitted to COAFES.
Note: This major is also offered at Southwest State University in Marshall, Minnesota, through a joint agreement. Students can contact Southwest State University or COAFES for more information (612-623-6754).

Degree Requirements
Students must complete at least 120 credits to graduate, including 58 credits in the major. Typically 14 credits in the foundation and major requirements also apply toward completion of liberal education requirements. All required courses must be taken A-F, and a grade of at least C- is required in all professional and area of emphasis courses.

Required Courses
Foundation Requirements

Communications
Rhet 1101—Writing to Inform, Convince, and Persuade (4 cr)
Rhet 1223—Oral Presentation in Professional Settings (3 cr)
Rhet 3562—Technical and Professional Writing (4 cr)

Quantitative Foundations
Agro 4101—Experimental Design/Plot Techniques (3 cr)
or Stat 3011—Introduction to Statistical Analysis (4 cr)
Math 1031—College Algebra and Probability (3 cr)
or Math 1142—Short Calculus (3 cr)

Physical and Biological Sciences
Agro/Hort 4401—Plant Genetics and Breeding (4 cr)
or GCD 3022—Genetics (3 cr)
BioC 1001—Elementary Biochemistry (3 cr)
or BioC 2001—Biochemistry for the Agricultural and Health Sciences (3 cr)
Biol 1009—General Biology (4 cr)
or Agro 1101—Biology of Plant Food Systems (3 cr)

Chem 1011—General Principles of Chemistry (4 cr)
EEB 3001—Ecology and Society (3 cr)

Professional Requirements (58-61 cr)

General Core (11-13 cr)
AFEE 1002—Principles of Career Planning for Agricultural Professions (1 cr)
AgET 3213—Engineering Principles and Applications (3 cr)
or AgET 5212—Safety and Health Issues in Agricultural Work Environment (2 cr)
or AnSc 1101—Introduction to Animal Science (4 cr)
or FScN 1102—Food, Safety, Risk, and Technology (3 cr)
Agro 4600—Senior Capstone: Leadership, Decision Making and Problem Solving (2 cr)
ApEc 1101—Principles of Microeconomics (3 cr)

Crop Management Core (13-14 cr)
Agro 1103—Crops, Environment, and Society (4 cr)
or Hort 1101—Plant Propagation (4 cr)
Agro 2501—Plant Identification in Urban and Rural Landscapes (2 cr)
Agro 4005—Applied Crop Physiology and Development (4 cr)
or Biol 3002—Plant Biology: Function (2 cr)
and Hort 3005—Environmental Effects on Horticultural Crops (2 cr)
or Biol 3005—Plant Function Laboratory (2 cr)
Agro 4605—Crop Management Strategies (4 cr)
or Hort 5032—Sustainable Commercial Vegetable Production Systems (3 cr)

Soil Management Core (10 cr)
Soil 2125—Basic Soil Science (4 cr)
Soil 3221—Soil Conservation and Land-use (3 cr)
Soil 3416—Plant Nutrients in the Environment (3 cr)

Pest Management core (12 cr)
Agro 4505—Integrated Weed Management (3 cr)
Agro 4603—Field Crop Scouting and Problem Diagnosis (3 cr)
Ent 3005—Insect Biology (3 cr)
or Ent 4015—Ornamental and Turf Entomology (3 cr)
PPa 2002—Diseases of Field Crops (3 cr)
or PPa 2001—Introductory Plant Pathology for Horticulturists (3 cr)

Area of Emphasis (12 cr min)

Students must designate an area of emphasis within the major before completion of 60 credits of their program or upon admission to the program with advanced standing.

An area of emphasis consists of a group of courses (12 credits minimum) selected in consultation with the student’s adviser and approved by the major coordinator. One option for fulfilling the area of emphasis is to complete part or all of one of the 18 official minors in COAFES (see page 7 for listing). The second option is to design an individualized area of emphasis around a clearly evident theme or focus that serves the student’s professional interests. Such themes might include crop science, precision agriculture, biotechnology or environmental studies. Students should consult with their advisers in constructing an individualized area of emphasis. This emphasis may include only one 1xxx course.

Entomology

Minor Only

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. With the continuing need for and 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 other environmental impact assessments. Students completing the program have a solid base of coursework for application to graduate programs.
Environmental Horticulture

B.S.
The environmental horticulture program educates and trains students in all phases of horticulture: crop production; education (botanic gardens and arboreta); service oriented activities (landscaping); plant production; use and function (design, reclamation, and restoration); and recreation (golf courses and parks). Students gain experience in how plants can be used to alter environments, restore damaged landscapes, improve the health and well-being of individuals, educate the public about science and agriculture, bring together and improve community environments, and provide recreational and practical benefits to the public.

The program offers the following areas of emphasis: landscape design, implementation, and management; nursery production and garden center management; greenhouse production and retail floriculture; and turfgrass management. An individualized program of study can be arranged. The program offers a wide range of internship opportunities and requires all students engage in a professional experience.

Degree Requirements
Students must complete at least 120 credits to graduate, including 49 credits in the major. The program requires courses in algebra, chemistry, physics, and biology. Applied courses are in horticultural science, soil science, entomology, plant pathology, and applied economics. Courses vary depending on emphasis. All required courses must be taken A-F, and a grade of at least C- is required in all professional courses and area of emphasis courses.

Required Courses

Foundation Requirements
Rhet 1101—Writing to Inform, Convince, and Persuade (4 cr)
Rhet 1223—Oral Presentations in Professional Settings (3 cr)
One other communications course (3 cr)
ApEc 1101—Microeconomics (3 cr)
BioC 2011—Biochemistry for Agricultural and Health Sciences (3 cr)
Biol 1009—General Biology (4 cr)
Chem 1011—General Principles of Chemistry (4 cr) or Chem 1021—Principles of Chemistry I (4 cr) and Chem 1022—Principles of Chemistry II (4 cr)
Math 1031—College Algebra and Probability (3 cr) or Math 1142—Short Calculus (3 cr)

Professional Requirements
Ent 4521—Forest and Shade Tree Entomology (3 cr) or Ent 3005—Insect Biology (3 cr) or Ent 4015—Ornamental and Turf Entomology
GC 1513—Principles of Small Business Management (3 cr)
Hort 1001—Plant Propagation (4 cr)
Hort 1011—Herbaceous Landscape Plants (4 cr)
Hort 1012—Woody Landscape Plants (4 cr)

To complete the minor, students must complete at least 15 credits.

Required Courses (5 cr min)
Ent 3005—Insect Biology (3 cr)
Select one of the following:
Ent 4015—Ornamental and Turf Entomology (2 cr)
Ent 4211—Forest and Shade Tree Entomology (3 cr)
Ent 4281—Veterinary Entomology (2 cr)
Ent 5021—Insect Taxonomy (4 cr)

Electives (10 cr min)
Choose additional 3xxx-5xxx courses in entomology. Special problems, special lecture, or workshop courses cannot be included in this area.

Environmental Science

B.S.
This major is for students interested in an interdisciplinary science education that prepares them to deal with environmental problems. The basic natural resources of land, air, and water are studied in the context of protecting and sustaining the environment. Students become knowledgeable about environmental issues and the science behind policy decisions. Students must complete coursework in math and science, economics, humanities, communication, and applied technical aspects of environmental problems. The environmental science core draws courses from atmospheric science, soil science, hydrology, and plant science.

Areas of emphasis include land and water resources (land use management, soil resources, sustainable agriculture, water resources); environmental management (bioremediation, environmental measurement, waste management); and environmental education (natural and managed environmental systems).
Degree Requirements
Students must complete at least 120 credits to graduate, including 60 credits in the major. The major requires courses in calculus, chemistry, physics, biology, and geology. Applied science courses are in meteorology, soil science, hydrology, and plant science. Area of emphasis courses vary by emphasis. All required courses must be taken A-F, and a grade of at least C- is required in all professional courses and area of emphasis courses.

Required Courses
Foundation Requirements
Agro 4101—Experimental Design/Plot Techniques (3 cr)
or Stat 3011—Introduction to Statistical Analysis (4 cr)
ApEc 1101—Principles of Microeconomics (3 cr)
BioC 211—Biochemistry for Agriculture and Health Sciences (3 cr)
or Chem 2301—Organic Chemistry I (3 cr)
Biol 1009—General Biology (4 cr)
Chem 1021—Chemical Principles I (4 cr)
Chem 1022—Chemical Principles II (4 cr)
Math 1142—Short Calculus (3 cr)
or Math 1271—Calculus I (4 cr)
Phys 1101—Fundamental Physics I (4 cr)
and Phys 1102—Fundamental Physics II (4 cr)
or Physics 1201—General Physics (5 cr)
and Physics 1202—General Physics (5 cr)
Rhet 1101—Writing to Inform, Convince, and Persuade (4 cr)
Rhet 1223—Oral Presentations in Professional Settings (3 cr)
Rhet 3562—Technical and Professional Writing (4 cr)

Professional Requirements
ApEc 4611—Resource Development and Environmental Economics (3 cr)
or NRES 3261W—Economics and Natural Resource Management (3 cr)
ES 1011—Issues in the Environment (3 cr)
or Agro 3203—Environment, Global Food Production, and the Citizen (3 cr)
ES 1051—Introduction to Environmental Science (3 cr)
ES 4096—Experience and Training in a Field Setting (1-4 cr)
FR 4114—Hydrology (3 cr)
or Soil 4216—Containment Hydrology (2 cr)
Geo 1001—Introduction to Geography (4 cr)
NRES 4061W—Water Quality: Management of a Natural Resource (3 cr)
PIPa 3002—Air Pollution, People, and Plants (3 cr)
or Soil 1425—The Atmosphere (3 cr)
Soil 2125—Basic Soil Science (4 cr)
Soil 3221—Soil Conservation and Water Quality Impacts (2 cr)
Soil 3416—Plant Nutrients in the Environment (3 cr)
Soil 3612—Soil and Environmental Biology (3 cr)
Soil 4021—Environmental Impact Assessment (3 cr)
Soil 4601—Soils and Pollution (3 cr)
Choose one from the following:
Agro 1103—Crops, Environment, and Society (4 cr)
Agro 4888—Issues in Sustainable Agriculture (2 cr)
PIPa 2002—Management and Control of Field Crop Diseases (3 cr)

Select additional courses from the following:
Agro 3203—Environment, Global Food Production, and the Citizen (3 cr)
Agro 4103—World Food Problems (3 cr)
Agro 4505—Integrated Weed Management (4 cr)
Ent 3001—Insects and Insect Management (1 cr)
Ent 5321—Ecology of Agriculture Systems (3 cr)
Ent 5341—Biological Control of Insects and Weeds (3 cr)
FR 3251—Role of Renewable Natural Resources in Developing Countries (1 cr)
NRES 3101—Conservation of Biodiversity (3 cr)

Sustainable Agriculture Recommended Courses
Agro 1103—Crops, Environment, and Society (4 cr)
Agro 4888—Issues in Sustainable Agriculture (2 cr)
PIPa 2002—Management and Control of Field Crop Diseases (3 cr)

Select additional courses from the following:
Agro 3203—Environment, Global Food Production, and the Citizen (3 cr)
Agro 4103—World Food Problems (3 cr)
Agro 4505—Integrated Weed Management (4 cr)
Ent 3001—Insects and Insect Management (1 cr)
Ent 5321—Ecology of Agriculture Systems (3 cr)
Ent 5341—Biological Control of Insects and Weeds (3 cr)
FR 3251—Role of Renewable Natural Resources in Developing Countries (1 cr)
NRES 3101—Conservation of Biodiversity (3 cr)

Water Resources
Hydrology Recommended Courses
Students completing the hydrology emphasis may be eligible for state and federal certification as hydrologists.
FR 4114—Forest Hydrology and Watershed Management (3 cr)
CE 3502—Fluid Mechanics (3 cr)
CE 4512—Open Channel Hydraulics (3 cr)
or GeoE 4351—Ground Water Mechanics (3 cr)
EEB 4601—Limnology (3 cr)

Areas of Emphasis (12 cr)
Land and Water Resources
Land Use Management Recommended Courses
FR 4131—GIS for Natural Resource Analysis (3 cr)
or Geog 5361—Principles of Geographic Information Science (4 cr)
Soil 5511—Field Study of Soils (2 cr)
Soil 5555—Wetland Soils (3 cr)
Select additional courses from the following:
FR 4262—Remote Sensing of Natural Resources (3 cr)
Geo 4701—Geomorphology (3 cr)
Geo 4703—Glacial Geology (4 cr)
Geo 5108—Principles of Environmental Geology (3 cr)
Geog 3355W—Environmental Quality (3 cr)
Geog 3361W—Land Use, Landscapes, and the Law (3 cr)
Geog 3401W—Geography of Environmental Systems (3 cr)
Hort 5071—Landscape and Reclamation Ecology (3 cr)
PA 5013—Law and Urban Land Use (3 cr)
Soil Science Required Courses
Students must complete required courses for a soil science license.
Soil 4511—Field Study of Soils (2 cr)
Soil 4216—Containment Hydrology (2 cr)
or Soil 5232—Vadose Zone Hydrology (3 cr)
Soil 5515—Soil Genesis and Landscape Relations (3 cr)
Select 5 credits from the following:
Geo 4703—Glacial Geology (4 cr)
Soil 3521—Soil Judging (1 cr)
Soil 4121—Microbial Ecology and Applied Microbiology (3 cr)
Soil 5211—Environmental Biophysics and Ecology (3 cr)
Soil 5555—Wetland Soils (3 cr)

Sustainable Agriculture Recommended Courses
Agro 1103—Crops, Environment, and Society (4 cr)
Agro 4888—Issues in Sustainable Agriculture (2 cr)
PIPa 2002—Management and Control of Field Crop Diseases (3 cr)

Select additional courses from the following:
Agro 3203—Environment, Global Food Production, and the Citizen (3 cr)
Agro 4103—World Food Problems (3 cr)
Agro 4505—Integrated Weed Management (4 cr)
Ent 3001—Insects and Insect Management (1 cr)
Ent 5321—Ecology of Agriculture Systems (3 cr)
Ent 5341—Biological Control of Insects and Weeds (3 cr)
FR 3251—Role of Renewable Natural Resources in Developing Countries (1 cr)
NRES 3101—Conservation of Biodiversity (3 cr)

Water Resources
Hydrology Recommended Courses
Students completing the hydrology emphasis may be eligible for state and federal certification as hydrologists.
FR 4114—Forest Hydrology and Watershed Management (3 cr)
CE 3502—Fluid Mechanics (3 cr)
CE 4512—Open Channel Hydraulics (3 cr)
or GeoE 4351—Ground Water Mechanics (3 cr)
EEB 4601—Limnology (3 cr)
FR 5153—Forest and Wetland Hydrology (3 cr)
Soil 5555—Wetland Soils (3 cr)
Geo 5701—General Hydrogeology (3 cr)
Math—1271/1272 Calculus I and II (4/4 cr)
Math 2243—Linear Algebra and Differential Equations (3 cr)
WRS 5001—Field Methods in Water Resources (3 cr)

Water Resource Management Recommended Courses
Soil 5555—Wetland Soils (3 cr)
EEB 4601—Limnology (3 cr)
Ent 5361—Aquatic Insects (3 cr)
FR 4114—Forest and Wetland Hydrology (3 cr)
FR 4461—Water Quality: The International Dimension (3 cr)
FR 5153—Forest and Wetland Hydrology (3 cr)
Geo 5108—Principles of Environmental Geology (3 cr)
Geo 5701—General Hydrogeology (3 cr)
Hort 5071—Landscape and Reclamation Ecology (3 cr)
WRS 5001—Field Methods in Water Resources (3 cr)
WRS 5101—Water Resources: Individuals and Institutions (3 cr)

Environmental Management
Bioremediation Recommended Courses
CE 4562—Remediation Technology (3 cr)
Chem 2301—Organic Chemistry I (3 cr)
Chem 2302—Organic Chemistry II (3 cr)
Soil 4121—Microbial Ecology and Applied Microbiology (3 cr)
Soil 5601—Principles of Waste Management (3 cr)
PubH 5111—Preventing Pollution (3 cr)
PubH 5180—Environmental Microbiology (4 cr)

Environmental Measurement Recommended Courses
PlPa 3002—Air Pollution, People and Plants (3 cr)
PubH 5103—Exposure to Environmental Hazards (2 cr)
PubH 5111—Preventing Pollution (3 cr)
PubH 5112—Risk Analysis: Application to Risk-Based Decision Making (3 cr)
PubH 5176—Hazardous Materials and Waste Management (3 cr)
PubH 5180—Environmental Microbiology (4 cr)
PubH 5190—Environmental Chemistry (3 cr)
PubH 5200—Environmental Health (2 cr)
Soil 4121—Microbial Ecology and Applied Microbiology (3 cr)
Soil 5601—Principles of Waste Management (3 cr)

Environmental Education (Natural and Managed Environmental Systems)

Professional Education
Students electing to teach K-12 should select this grouping of courses to become certified. Students should meet early in their program with an adviser from the Agricultural, Food, and Environmental Education Division. Program requirements are detailed on page 43.

General Environmental Education Recommended Courses
CI 5502—Special Topics: Outdoor Science Education (1-8 cr)
CI 5747—Global and Environmental Education: Content and Practice (3 cr)
EEB 3361—Visions of Nature: The Natural World and Political Thought (3 cr)
FR 5403—Fundamentals of Natural Resource Education (3 cr)
Hort 5071—Restoration and Reclamation Ecology (3 cr)
NRES 3202W—Environmental Conflict Management, Leadership, and Planning (3 cr)

or NRES 3011W—Ethics and Leadership in Resource Management (3 cr)
NRES 4811—Natural Resources Interpretation (3 cr)
NRES 3205—Field Ecology in NRES (4 cr)
NRES 4101—Conservation of Biodiversity (3 cr)
Rec 5301—Wilderness and Adventure Education (3 cr)
Rec 5311—Programming Outdoor and Environmental Education (3 cr)
Rhet 3383—In Search of Nature (3 cr)
Soil 5601—Principles of Waste Management (3 cr)

Final Project
Internship requirement—students must complete ES 4096.

Food Science

B.S.
Food science is the application of science to the study of food. Chemistry, microbiology, physics, and engineering are scientific disciplines involved in food science.

• Chemistry—because foods undergo chemical reactions when they are heated, frozen, mixed with each other, and stored.
• Microbiology—because many foods are made by microorganisms (e.g., bread, cheese, yogurt, sauerkraut, tempeh) and because microorganisms cause extensive, rapid, and often dangerous spoilage.
• Physics and engineering—because foods must be constructed, moved through the factory, made safe, and distributed intact to the consumer.

Food science involves creating new food products and making current products more stable, nutritious, convenient, reliable, and safe. Food science begins with an understanding of the plants and animals that will become food, and ends with an understanding of why people choose to eat the foods they eat.

The food science program is a collaborative partnership between COAFES and the College of Human Ecology.

Degree Requirements
Students must complete at least 120 credits, including the University’s liberal education requirements, and maintain an overall GPA of at least 2.00. All required courses must be taken A-F, and FScN courses must be completed with a grade of at least C-.
Required Courses

Foundation Courses
BioC 3021—Biochemistry (3 cr)
or BioC 4331—Biochemistry I (4 cr)
and BioC 4332—Biochemistry II (4 cr)
Biol 1009—General Biology (4 cr)
Chem 1021—Chemical Principles I (4 cr)
Chem 1022—Chemical Principles II (4 cr)
Chem 2301—Organic Chemistry I (3 cr)
Chem 2302—Organic Chemistry II (3 cr)
Math 1271—Calculus I (4 cr)
Math 1272—Calculus II (4 cr)
MicB 3301—Biology of Microorganisms (5 cr)
Rhet 1101—Writing to Inform, Convince, and Persuade (4 cr)
Rhet 1223—Oral Presentations in Professional Settings (3 cr)
Rhet 3562W—Technical and Professional Writing (4 cr)
Stat 3011—Introduction to Statistical Analysis (4 cr)
Select one of the following physics series: Phys 1101/1102, Phys 1201/1202, Phys 1301/1302. Note: Phys 1301 and 1302 are recommended.
Select one of the following courses: BioC 4025, Chem 2111, Chem 2311, FScN 4613

Professional Courses
FScN 1102—Food: Safety, Risks, and Technology (3 cr)
FScN 1112—Principles of Nutrition (3 cr)
FScN 3102—Introduction to Food Science (3 cr)
FScN 4111—Food Chemistry (3 cr)
FScN 4121—Food Microbiology and Fermentations (3 cr)
FScN 4122—Laboratory Methods in Microbiology and Fermentations (2 cr)
FScN 4131—Food Quality (3 cr)
FScN 4312—Food Analysis (4 cr)
FScN 4331—Food Process Engineering I (3 cr)
FScN 4332—Food Process Engineering II (4 cr)
One of the following FScN courses with a capstone component:
FScN 4341, 4342, 4343, 4344, 4345, 4346

Food Science Minor
Complete at least 20 FScN credits from the following list:
FScN 1102, 3102, 4111, 4121, 4122, 4131, 4312, 4331, 4332

Food Systems and the Environment

Minor Only
This is an interdisciplinary minor based in COAFES. This minor serves students from other colleges who have an interest in and a desire to acquire some breadth about food systems and the environment. Students completing this minor will be better prepared to:
• Understand the complexity of modern global food systems.
• Understand the interdependence of rural and urban societies.
• Understand the environmental impact of consumer driven food systems choices.
• Manage natural resources used for food and fiber for the benefit of society.
• Make more responsible personal and public decisions impacting food systems and the environment.

This minor is limited to non-COAFES majors. Interested students should contact the minor adviser (612-625-6754) or the COAFES Student Services Office (612-625-7254).

Integrated Pest Management in Cropping Systems

Minor Only
Students selecting this interdisciplinary minor learn how the environment and cropping systems interact with the biology of the major agronomic or horticultural crop pests. Students also learn to select and apply efficient, environmentally sound pest management procedures. Courses come from agronomy and plant genetics; entomology; horticultural science; plant pathology; and soil, water, and climate.

The minor provides sufficient knowledge and skills for employment in agricultural crop protection, product development and sales, crop management consultation, pest regulation, research, or application of agricultural crop protection materials. To complete the minor, students must complete at least 20 credits.
Required Courses
Agro 2501—Plant Identification for Urban and Rural Landscapes (2 cr)
Agro 4505—Biology, Ecology, and Management of Invasive Plants (4 cr)
Ent 5211—Insect Pest Management (3 cr)
PlPa 5204—Epidemiology and Plant Disease Resistance (4 cr)
Choose one of the following management courses:
Agro 4605—Management Strategies for Crop Production (3 cr)
Hort 4041—Nursery Production and Management I (3 cr)
Hort 4051—Floriculture Production and Management I (3 cr)
Hort 4061—Turf and Landscape Management (4 cr)
Hort 5031—Sustainable Fruit and Vegetable Production (4 cr)
Soil 3222—Soil Conservation and Land Use Management (3 cr)
Choose one of the following applied courses:
Agro 4603—Field Crop Scouting and Problem Diagnosis (3 cr)
Agro 4888—Issues in Sustainable Agriculture (2 cr)
PlPa 5202—Field Plant Pathology (2 cr)
Soil 3612—Soil and Environmental Biology (3 cr)

International Agriculture
Minor Only
For COAFES students who want to add an international dimension to their degree, or for non-COAFES students who want to acquire experience and knowledge in international agriculture. Students have flexibility in planning the minor. To complete the minor, students must complete at least 20 credits. Contact COAFES Student Services for more information.

Required Courses
Agri 3000—International Seminar (1 cr)
4xxx internship, independent study project, or extensive review of literature (4 cr, must be a COAFES course)
3xxx-5xxx electives in language or culture (6-8 cr)
Electives in agricultural science (9-12 cr)

Nutrition
B.S.
The nutrition program is a collaborative partnership between COAFES and the College of Human Ecology. The major explores how nutrients and the foods from which they are derived aid the body in health, growth, and development. With major national and international concern for how food and nutrition affect health and disease, registered dietitians and nutritionists have many career opportunities. Students choose one of three options: nutrition, the Coordinated Program in Dietetics, or nutrition science.

Students expecting to apply to either the Coordinated Program in Dietetics, an internship, or a graduate school should maintain a GPA of at least 2.80. A cumulative GPA of at least 3.00 is highly recommended, and in the case of some graduate schools is required, for admission.

The Didactic Program in Dietetics (nutrition option) is currently granted approval status, and the Coordinated Program in Dietetics is currently granted accreditation status, by the Commission on Accreditation/Approval for Dietetics Education of the American Dietetic Association, 216 W. Jackson Blvd., Chicago, IL 60606-6995 (312-899-4876).

Degree Requirements
Students must complete at least 120 credits, including the University’s liberal education requirements, and must maintain an overall GPA of at least 2.00. All required courses must be taken A-F, and FScN courses must be completed with a grade of at least C-.

Required Courses for All Options
BioC 3021—Biochemistry (3 cr)
Biol 1009—General Biology (4 cr)
Chem 1021—Chemical Principles I (4 cr)
Chem 1022—Chemical Principles II (4 cr)
Chem 2301—Organic Chemistry I (3 cr)
FScN 1102—Food: Safety, Risks, and Technology (3 cr)
FScN 1112—Principles of Nutrition (3 cr)
FScN 3102—Introduction to Food Science (3 cr)
FScN 3612—Life Cycle Nutrition (3 cr)
FScN 4612—Human Nutrition (3 cr)
FScN 4613—Experimental Nutrition (2 cr)
FScN 5621—Nutrition and Metabolism (4 cr)
Phsl 3051—Human Physiology (4 cr)
Rhet 1101—Writing to Inform, Convince, and Persuade (4 cr)
Rhet 1223—Oral Presentations in Professional Settings (3 cr)
Rhet 3562W—Technical and Professional Writing (4 cr)
VPB 2032—General Microbiology with Laboratory (4 cr)
or MicB 2032—General Microbiology with Laboratory (4 cr)
or MicB 3301—Biology of Microorganisms (5 cr)

Nutrition
The nutrition option (also referred to as the Didactic Program in Dietetics) offers preparation in the basic sciences and liberal education, a background in food science, and a focus on human needs related to nutrition. Students identify several areas of interest and develop a varied portfolio of competence. Work experience in nutrition, elective courses, and extracurricular activities develop communication and leadership skills. Graduates of the program take positions in various food-related fields, including nutrition, industry, and community programs. Students who plan to become registered dietitians must meet the American Dietetic Association requirements. Graduates who have a cumulative GPA of 3.00, strong work experience in nutrition, demonstrated leadership skills, and who are highly recommended, may apply for a postbaccalaureate dietetic internship.
Additional Courses
FScN 3614—Nutrition Education (3 cr)
FScN 3615—Sociocultural Aspects of Food, Nutrition, and Health (3 cr)
FScN 3731—Food Service Operations Management Lab (2 cr)
FScN 3732—Food Service Operations Management (3 cr)
FScN 4614—Community Nutrition (3 cr)
FScN 4665—Medical Nutrition Therapy I (3 cr)
FScN 4666—Medical Nutrition Therapy II (3 cr)
FScN 4732—Food and Nutrition Management (3 cr)
Math 1031—College Algebra and Probability (3 cr)
Mgmt 3001—Fundamentals of Management (3 cr)
Stat 3011—Introduction to Statistical Analysis (4 cr)

Choose one of the following:
FScN 4111—Food Chemistry (3 cr)
FScN 4121—Food Microbiology and Fermentations (3 cr)

Coordinated Program in Dietetics
Students can apply, before their junior year, to the University’s Coordinated Program in Dietetics and complete both the academic and professional experience requirements within two years.

The basic curriculum is similar to that specified under Required Courses for All Options, but also includes field experience courses in which didactic and clinical phases of instruction are coordinated. A detailed plan of the program may be obtained from the Department of Food Science and Nutrition. A limited number of students are admitted to the program each year. Minnesota law requires each student admitted to a supervised practice in dietetics to have a criminal background check conducted by the state of Minnesota. The dietetic program director arranges for the background check. Failure to pass the background check results in dismissal from the program.

Additional Courses
(Nutrition Option plus field experiences)
FScN 3614—Nutrition Education (3 cr)
FScN 3615—Sociocultural Aspects of Food, Nutrition, and Health (3 cr)
FScN 3662—Introduction to Dietetic Practice (2 cr)
FScN 3732—Food Service Operations Management (3 cr)
FScN 3796—Field Experience in Food Service Management (3 cr)
FScN 4596—Field Experience: Community Nutrition (3 cr)
FScN 4614—Community Nutrition (3 cr)
FScN 4665—Medical Nutrition Therapy I (3 cr)
FScN 4666—Medical Nutrition Therapy II (3 cr)
FScN 4696—Field Experience: Medical Nutrition Therapy I (6 cr)
FScN 4732—Food and Nutrition Management (3 cr)
FScN 4796—Field Experience in Food and Nutrition Management (3 cr)
FScN 4896—Field Experience: Medical Nutrition Therapy II (3 cr)
FScN 4996—Field Experience: Medical Nutrition Therapy III (3 cr)
Math 1031—College Algebra and Probability (3 cr)
Mgmt 3001—Fundamentals of Management (3 cr)
Stat 3011—Introduction to Statistical Analysis (4 cr)

Choose one of the following:
FScN 4111—Food Chemistry (3 cr)
FScN 4121—Food Microbiology and Fermentations (3 cr)

Nutrition Science
The nutrition science option is for students planning to do graduate work in nutrition, related sciences, or professional programs such as medicine or dentistry.

Additional Courses
Biol 2012—General Zoology (4 cr) or another advanced biology course
Chem 2302—Organic Chemistry II (3 cr)
Chem 2311—Organic Chemistry Lab (4 cr)
FScN 4111—Food Chemistry (3 cr) or an advanced chemistry course

FScN 5622—Vitamin and Mineral Biochemistry (3 cr)
FScN 5623—Regulation of Energy Balance (2 cr)
GCB 3022—Genetics (3 cr)
or Biol 4003—Genetics (3 cr)
Math 1142—Short Calculus (4 cr)
or Math 1271—Calculus I (4 cr)
and Math 1272—Calculus II (4 cr)
Phys 1201—General Physics I (5 cr)
Phys 1202—General Physics II (5 cr)
Stat 3011—Introduction to Statistical Analysis (4 cr)
or Stat 3021—Introduction to Probability and Statistics (3 cr)
or Stat 5021—Statistical Analysis (4 cr)

Nutrition Minor
For those having completed Biol 1009, Chem 1022, and Phil 3051:
FScN 1112—Principles of Nutrition (3 cr)
FScN 3612—Life Cycle Nutrition (3 cr)
FScN 4612—Human Nutrition (3 cr)
Select two courses from the following: FScN 3614, 3615, 4613, 4614, and 5621

Science in Agriculture
B.S.
The science in agriculture major is an interdisciplinary program that provides a thorough grounding of biological/physical science and mathematical principles and their applications to food and agriculture. Students select an area of emphasis within the major or construct an individualized program. Students also complete an undergraduate research thesis under the guidance of a faculty member in one of the host departments.

The major is excellent preparation for employment in bachelor’s degree-level research positions as field or laboratory specialists in academia, government, or industry. The major also prepares students for graduate studies in the disciplines represented by the host departments (agronomy and plant genetics, animal science, entomology, food science and nutrition, horticultural science, plant pathology, and soil science) and related areas, as well as in veterinary or human medicine. Students considering veterinary medicine should consult the science in agriculture/doctor of veterinary medicine joint degree option.

The host departments for the major offer opportunities and facilities for doing scientific research. Students may offset some educational costs and gain experience by working part-time as undergraduate technicians on research projects of the Minnesota Agricultural Experiment Station. Experience may also be gained by working on a University, government, or industry internship through the Professional Experience Program.

Degree Requirements
Students must complete at least 120 credits to graduate, including required credits in the major. Faculty academic advisers help students select electives, an undergraduate thesis topic, and a thesis mentor.

Students must complete the University’s liberal education requirements; for more information, see page 31 of this catalog. Frequently, courses in the foundation requirements also apply toward completion of liberal education requirements. All required courses must be taken A-F, and a grade of at least C- is required in all professional courses and area of emphasis courses.

COAFES’ Mentor
Program matches students with alumni who are leaders in the student’s field of study and provides opportunities for students to learn, ask questions, and talk candidly with professionals.
**College of Agricultural, Food and Environmental Sciences**

**Required Courses**

**Foundation Requirements**
- BioC 3021—Biochemistry (3 cr)
- Biol 1009—General Biology (4 cr)
- Biol 4003—Genetics (3 cr)
- or GCB 3002—Genetics (3 cr)
- or Agro 4401—Plant Genetics and Breeding (4 cr)
- or Hort 4401—Plant Genetics and Breeding (4 cr)
- Chem 1021—Chemical Principles I (4 cr)
- Chem 1022—Chemical Principles II (4 cr)
- Chem 2301—Organic Chemistry I (3 cr)
- Chem 2302—Organic Chemistry II (3 cr)
- Chem 2311—Organic Chemistry Lab (3 cr)
- Math 1142—Short Calculus (3 cr)
- or Math 1271—Calculus I (4 cr)
- and Math 1272—Calculus II (4 cr)
- MicB 2032—General Microbiology (4 cr)
- or VPB 2032—General Microbiology (4 cr)
- Rhet 1101—Writing to Inform, Convince, and Persuade (4 cr)
- Rhet 1223—Oral Presentation (3 cr)
- Rhet 3562—Technical and Professional Writing (4 cr)
- Phys 1101—Fundamental Physics I (4 cr)
- or Phys 1301—Introductory Physics I (4 cr)
- Phys 1102—Fundamental Physics II (4 cr)
- or Phys 1302—Introductory Physics II (4 cr)
- Stat 3011—Introduction to Statistical Analysis (4 cr)
- or Stat 5021—Statistical Analysis (4 cr)
- or AnSc 2211—Biometrics for Livestock (3 cr)
- or Agro 4101—Experiment Design/Plot Techniques (3 cr)

**Professional Requirements**
- ScAg 1001—Orientation to Science in Agriculture (1 cr)
- ScAg 1501—Biotechnology, People, and the Environment (3 cr)
- ScAg 5009—Undergraduate Research Thesis (6 cr)

**Areas of Emphasis**

**Animal Science (24 cr)**
- AnSc 1101—Introductory Animal Science (4 cr)
- AnSc 2301—Systemic Physiology (4 cr)
- AnSc 2401—Animal Nutrition (3 cr)
- AnSc 3221—Animal Breeding (4 cr)
- Plus at least 9 additional credits from AnSc 1011, 1403, 3203, 3305, 3327, 3511, 4011, 4401, 4403, 4405, 4501

**Biotechnology (22-25 cr)**
- AnSc 2221—Animal Biotechnology (4 cr)
- BAE 3013—Engineering Principle of Molecular and Cellular Processes (3 cr)
- Hort 4071—Applications of Biotechnology to Plant Improvement (4 cr)
- Phil 3305—Medical Ethics (4 cr)
- or Biol 4501—Social Uses of Biology (3 cr)
- ScAg 1502—Biotechnology Laboratory (2 cr)

**One of the following:**
- Agro 1102—Crops, Environment, and Society (4 cr)
- AnSc 1101—Introductory Animal Science (4 cr)
- FScN 1102—Food: Safety, Risks, and Technology (3 cr)
- Soil 2125—Basic Soil Science (4 cr)

**One of the following:**
- AnSc 2301—Systemic Physiology (4 cr)
- FScN 4121—Food Microbiology and Fermentation (3 cr)
- PBio 5414—Plant Cell and Molecular Biology (3 cr)
- Soil 4601—Soils and Pollution (3 cr)

**Food Science (21 cr)**
- FScN 1112—Principles of Nutrition (3 cr)
- FScN 3102—Introduction to Food Science (3 cr)
- FScN 4121—Food Microbiology and Fermentation (3 cr)
- Plus at least 12 credits from FScN 4111, 4122, 4131, 4312, 4331, 4332

**Nutrition (22 cr)**
- FScN 1112—Principles of Nutrition (3 cr)
- FScN 3612—Lifecyle Nutrition (3 cr)
- FScN 4612—Human Nutrition (3 cr)
- FScN 5621—Nutrition and Metabolism (4 cr)
- Plus at least 9 additional credits from AnSc 4401, 4403, 4405, FScN 2103, 4103, 4613, 5622, 5623.

**Plant Science (26-27 cr)**
- Agro 1101—Biology of Plant Food Systems (3 cr)
- or Hort 1001—Plant Propagation (4 cr)
- Agro 2501—Plant Identification for Urban and Rural Landscapes (2 cr)
- Agro 3005—Applied Crop Physiology and Development (2 cr)
- and Biol 3005—Plant Function Laboratory (2 cr) (concurrent registration required)
- or Hort 3005—Environmental Effects on Horticultural Crops (2 cr)
- and Biol 3005—Plant Function Laboratory (2 cr) (concurrent registration required)
- Agro 4401—Plant Genetics and Breeding (4 cr)
- or Hort 4401—Plant Genetics and Breeding (4 cr)
- Biol 2022—General Botany (3 cr)
- Ent 3001—Insects and Insect Management (1 cr)
- Ent 3005—Insect Biology (concurrent with Ent 3001) (2 cr)
- PIta 2001—Introductory Plant Pathology for Horticulturists (3 cr)
- or PIta 2002—Diseases of Field Crops (3 cr)
- Soil 2125—Basic Soil Science (4 cr)

**Soil Science (20 cr)**
- Soil 2125—Basic Soils (4 cr)
- Soil 3221—Soil Conservation (3 cr)
- Soil 3416—Plant Nutrients (3 cr)
- Soil 3612—Soil and Environmental Biology (3 cr)
- Soil 4511—Field Study of Soils (2 cr)
- Plus at least 6 credits from Soil 4601, 4121, 5211, 5232, 5515, 5555

**Individualized Area of Emphasis**
- Students wishing to design a program with an individualized area of emphasis should consult with their adviser. Individualized programs must be approved by the major coordinating committee and have at least 21 credits, plus electives, to reach 120 credits required for graduation.

**Final Project**
- Students must complete 6 credits of ScAg 5009—Undergraduate Research Thesis.

**Science in Agriculture/Doctor of Veterinary Medicine Joint Degree**

The science in agriculture/doctor of veterinary medicine joint degree is a cooperative program between COAFES and the College of Veterinary Medicine (CVM). Students who satisfy the specified curriculum requirements earn a B.S. in science in agriculture and, later, a doctor of veterinary medicine from CVM.

New freshmen enrolling in the science in agriculture major may complete three years of undergraduate coursework and then apply to CVM. Upon being accepted into CVM and successfully completing the courses specified in the first semester of the veterinary medicine curriculum, students earn the B.S. degree from COAFES.

The program gives highly qualified students the opportunity to earn both a B.S. degree and a D.V.M. degree in seven years. It also allows integration of a significant set of animal science courses in the student’s preparation for veterinary education.

The program is only available to students who enter COAFES with no previous coursework and start in fall semester. The science in agriculture/D.V.M. curriculum is very structured, and the COAFES portion must be completed in three academic years. COAFES students enrolled in the program must meet CVM application standards; admission is competitive. COAFES students applying under the agreement receive special consideration because of the animal knowledge and experience gained in the animal science courses required in the curriculum.
Application to CVM must be made in the junior year. Students not admitted to CVM are expected to complete the normal science in agriculture requirements for the B.S. degree. Students can also reapply to CVM or any other college of their choice at a later date.

AnSc 1101—Introductory Animal Science (4 cr)
AnSc 2301—Systemic Physiology (4 cr)
AnSc 2401—Animal Nutrition (3 cr)
AnSc 3305—Reproductive Biology in Health and Disease (4 cr)
AnSc 3221—Animal Breeding (4 cr)
Plus two from AnSc 4401, 4403, 4405, 4501
Plus one from AnSc 4601, 4603, 4604, 4605
Plus fall semester, first-year veterinary courses

Note: Successful completion of the first semester in CVM constitutes the fourth year of the science in agriculture/D.V.M. joint program and leads to a bachelor’s degree.

**Scientific and Technical Communication**

**B.S.**

Scientific and technical communicators apply modern techniques and technologies to the distribution of knowledge in industry, business, education, and government. They write and design information for audiences ranging from scientists to management to consumers of technical products and services. To accomplish their objectives, scientific and technical communicators apply principles of audience analysis, writing and editing, usability and testing, visual communication, communication technology, communication research and theory, and oral communication. The program offers an interdisciplinary curriculum that combines theory and practice in a program flexible enough to allow students to plan a course of study appropriate to their career goals.

**Steps for Admission**—Students who wish to major in scientific and technical communication should take the following steps:

- **Step 1.** Apply for admission to COAFES.
- **Step 2.** Make an appointment to meet with the assistant major coordinator at rhetmac@umn.edu or 612-624-4710 for suggestions on coursework for the first year in the program.
- **Step 3.** Complete liberal education requirements and introductory Rhetoric classes. The assistant major coordinator helps tailor the program up to this point.
- **Step 4.** Complete upper division coursework, including an internship.

After the first year in the program (Step 3), students are assigned a faculty advisor who helps them meet educational and career objectives and plan upper division coursework (Step 4). Students should meet with their advisor at least once per term to discuss the courses they plan to take the next term, as well as to discuss personal and professional development as a technical communicator.

**Degree Requirements**

Students must complete at least 120 credits to graduate, including 66 credits in the major. Students must also complete the University’s liberal education requirements. All required courses must be taken A-F, and a grade of at least C- is required in all major degree requirements.

**Required Courses**

Equivalent transfer courses are accepted in all areas (except for required rhetoric courses). At least 30 credits must be completed in the Department of Rhetoric, as follows.

**Entrance to Major (2 cr)**

Rhet 1001—Introduction to Scientific and Technical Communication (2 cr)

**Written Communication (10 cr)**

Rhet 3562W—Technical and Professional Writing (4 cr)
Rhet 4561—Editing and Style for Technical Communicators (3 cr)

**Choose one from the following:**

Rhet 1152W—Writing on Issues of Science and Technology (4 cr)
Rhet 5664W—Science Writing for Popular Audiences (3 cr)

**Oral Communication (6 cr)**

Rhet 1223—Oral Presentations in Professional Settings (3 cr)
Rhet 3257—Scientific and Technical Presentations (3 cr)

**Professional Practice (9 cr)**

Rhet 4196—Internship in Scientific and Technical Communication (3-6 cr)
Rhet 3266—Group Process, Team Building, and Leadership (3 cr)

**Choose one from the following:**

Rhet 4165—Managerial and Organizational Communication, Planning, and Change (3 cr)
Rhet 4573—Writing Proposals and Grant Management (3 cr)
Rhet 5534—Designing Technical Training for Intercultural Audiences (3 cr)
Rhet 5562—Theory and Practice in International Business Communication (3 cr)

**Research (6 cr)**

Choose two from the following:

Rhet 4501—Usability and Human Factors in Technical Communication (3 cr)
Rhet 5258—Information-Gathering Techniques in Scientific and Technical Communication (3 cr)
Rhet 5511—Research in Scientific and Technical Communication (3 cr)

**Theory (8 cr)**

Rhet 3221W—Theories of Human Communication (4 cr)
Rhet 3701W—Rhetorical Theory and Scientific and Technical Communication (4 cr)

**Science, Technology, and Society (9 cr)**

Rhet 3371—Technology, Self, and Society (3 cr)

**Choose two from the following:**

Rhet 3108W—Gender and the Rhetoric of Science and Technology (4 cr)
Rhet 1302—Science, Religion, and the Search for Human Nature (3 cr)
Rhet 3577W—Rhetoric, Technology, and the Internet (3 cr)

**Print and Media Design (10 cr)**

Rhet 3671—Project Design and Development I (3 cr)
Rhet 3672—Project Design and Development II (3 cr)

**Scientific or Technical Emphasis (6 cr)**

Choose one from the following:

Rhet 4662W—Emerging Technology in Technical Communication (4 cr)
Rhet 4105W—Corporate Video for Technical Communicators (4 cr)

**Scientific or Technical Emphasis (6 cr)**

2xxx or above course in science or technology (3 cr)
3xxx or above course in science or technology (3 cr)

The scientific or technical emphasis area helps students develop familiarity with a science or technology, and helps students develop in order to communicate with professionals in that field. Students may meet courses in a scientific or technical area in consultation with their adviser. Courses may be from multiple departments, but should combine to form a single, cohesive emphasis.

**Final Project**

All students must participate in an internship, Rhet 4196—Internship in Scientific and Technical Communication (3-6 cr), as a requirement for the professional practice area.
Department of Rhetoric Minors

The Department of Rhetoric offers four minors:

- Designing documents with new and emerging technologies
- Internet, science, and society
- Land, nature, and environmental values
- Technical communication

A description of each minor is given below. Note that some of the required courses for these minors have prerequisite courses; for example, a prerequisite to taking Rhet 3257—Scientific and Technical Presentations is Rhet 1223—Oral Presentations in Professional Settings. Request a copy of the Minors Brochure from the Department of Rhetoric or contact the Department of Rhetoric program secretary at 612-624-3445 for more information.

Designing Documents With New and Emerging Technologies

Minor Only

The minor focuses on designing effective documents using both traditional and emerging technologies. Students learn to design written messages using computer technologies (such as PowerPoint); visual messages using photography, digital imaging, and video; and online and Web messages using multimedia, World Wide Web technologies, and streaming audio and video. Message design components include audience analysis and rigorous evaluation of document effectiveness. This minor differs from the technical communication minor by its focus on emerging technologies and the requirement that students take a design project in which they work collaboratively on educational technology projects with faculty mentors.

For more information, contact the major coordinator of the Scientific and Technical Communication Program, Department of Rhetoric.

Students must have a GPA of at least 2.00 in the required courses and a minimum of 15 credits to receive the minor.

Required Courses

Rhet 3671—Project Design and Development I (3 cr)
Rhet 3672—Project Design and Development II (3 cr)
Rhet 4501—Usability and Human Factors in Technical Communication (3 cr)
Rhet 4662W—Emerging Technologies in Scientific and Technical Communication (4 cr)

Plus one of the following:

Rhet 3101—Functional Photography (3 cr)
Rhet 3257—Scientific and Technical Presentations (3 cr)
Rhet 3401—Internet Communication: Tools and Issues (3 cr)
Rhet 4105W—Corporate Video for Technical Communicators (4 cr)

Internet, Science, and Society

Minor Only

This minor introduces students to the fields of Internet studies/technology studies then allows students to select from elective courses that focus on an area of interest. Areas of study might include legal or social issues, such as intellectual property on the Internet or ways in which gender stereotypes are both reinforced and modified online; how scientific and technical information is conveyed on the Internet and how the Internet is playing an important role in our ability to share cutting-edge information; or how controversies, such as current debates over genetically modified foods, are played out in cyberspace.

Several courses in the minor include guest speakers from the affiliated faculty of the Internet Studies Center, such as Internet law experts or soil scientists with expertise in making scientific information available on the Internet. Students have the opportunity to publish their work on the Internet Studies Center Web site and to attend guest lectures by internationally known Internet studies scholars.

Students work with an adviser in their home department and an adviser in Rhetoric. Students must complete at least 18 credits to complete the minor.

Required Courses

Rhet 3371—Technology, Self, and Society (3 cr)
Rhet 3401—Internet Communication: Tools and Issues (3 cr)
Rhet 3577W—Rhetoric, Technology, and the Internet (3 cr)

Electives (3 cr)

Rhet 4108W—Gender and the Rhetoric of Science and Technology (4 cr)
Rhet 3291—Independent Study (3 cr)
Rhet 4105W—Corporate Video for Technical Communicators (4 cr)
Rhet 4196—Internship in Scientific and Technical Communication (3-6 cr)

Outside electives (6 cr)

Students should work with their minor adviser to select 6 credits of approved coursework outside the Department of Rhetoric. The selected courses should complement the minor.

Land, Nature, and Environmental Values

Minor Only

This is a multidisciplinary minor based in the humanities. The minor complements professional and scientific degree programs in COAFES and serves students from other colleges who have an interest in cultural issues relating to the environment. Students are introduced to the historical development, philosophical assumptions, and imaginative expression of the human relationship to nature and are asked to consider implications of issues involving our use of nature. Students write a senior integrative paper relating some aspect of their major field to social, cultural, or historical trends in the larger society.

For assistance in planning a minor in land, nature, and environmental values, see the humanities course coordinator in the Department of Rhetoric.

Students must complete at least 18 credits to complete the minor.

Required Courses

Rhet 3291—Independent Study (3 cr) (The integrative paper; see adviser for approval)

At least five of the following:

Rhet 1152W—Writing on Issues of Science and Technology (4 cr)
Rhet 1302—Science, Religion, and the Search for Human Nature (3 cr)
Rhet 1315—The Land in American Experience (3 cr)
Rhet 3270—Special Topics (1-3 cr)
Rhet 3371—Technology, Self, and Society (3 cr)
Rhet 3383—in Search of Nature (3 cr)

Technical Communication

Minor Only

The minor provides theoretical and practical information about how to communicate complex technical information to various audiences. Students take required courses in oral and written communication and in communication technologies. Additional courses (e.g., visual communication, project management, international communication) are selected to complement students’ career plans. For help in planning the minor, contact the major coordinator of the Scientific and Technical Communication Program in the Department of Rhetoric.

To complete the minor, students must complete at least 15 credits.

Required Courses

Rhet 3562W—Technical and Professional Writing (4 cr)
Rhet 3257—Scientific and Technical Presentations (3 cr)
Rhet 4561—Editing and Style for Technical Communicators (3 cr)

Plus two additional Rhet courses at 3xxx or higher.
Soil Science

Minor Only
The minor allows students to complete coursework required for the Professional Soil Science Examination for geoscientists. To complete the minor, students must complete at least 20 credits.

Required Courses (18 cr)
- Soil 1125 — The Soil Resource (4 cr)
- Soil 2125 — Basic Soil Science (4 cr)
- Soil 3221 — Soil Conservation and Water Quality Impacts (3 cr)
- Soil 3416 — Plant Nutrients in the Environment (3 cr)
- Soil 3612 — Soil and Environmental Biology (3 cr)
- Soil 4601 — Soils and Pollution (3 cr)
- Soil 4511 — Field Study of Soils (2 cr)

Electives (2 cr)
- Soil 4021 — Environmental Impact Statements (3 cr)
- Soil 4216 — Contaminant Hydrology (2 cr)
- Soil 5515 — Soil Genesis and Landscape Relations (3 cr)
- Soil 5555 — Wetland Soils (3 cr)

Sustainable Agriculture

Minor Only
This minor allows students to study the sustainability of agricultural food systems from an integrated perspective, including coursework, practical experience, and community reflection. Required courses and courses from the foundational clusters—land and public policy; agriculture, environment, and natural resources; and citizens, science, and society—define the students’ minor curriculum. In addition, each student works with a minor adviser to design an individualized practical experience in some aspect of sustainable agriculture (i.e., an internship, experiential learning opportunity, etc.). In the unique format of community reflection through the What’s Up in Sustainable Agriculture (WUSA) student-led seminar series and the senior capstone, students synthesize their learning about sustainability for local, national, and global agricultural food systems. For this minor, students must complete 8-10 credits of required courses and a minimum of 9 credits of foundational coursework, for a total of at least 17 credits.

For more information, contact Dr. Craig Sheaffer, minor coordinator, 612-625-2724 or the Minnesota Institute for Sustainable Agriculture (MISA), 612-625-2738, misamail@umn.edu.

Required Courses (8-10 cr)
- Agro 4888 — Issues in Sustainable Agriculture (2 cr)
- AnSc/Agro 3203 — Environment, Global Food Production and the Citizen (3 cr)
- xxxx 4096 — Internship/Professional Experience Program (1-3 cr)
- Agro 4660 — Senior Capstone: Leadership, Decision Making and Problem Solving (2 cr)

(To be taken concurrently with or after completion of xxxx 4096)

Foundational Course Clusters (9 cr min)
Select one course from each of the following clusters. Other courses may be substituted with approval of the minor adviser and coordinator.

Land and Public Policy
- Agro/ApEc/FScN 4103 — World Food Problems (3 cr)
- ApEc 3041 — Economic Development of U.S. Agriculture (3 cr)
- Geog 3361 — Land Use, Landscapes and the Law (3 cr)
- PA 5002 — Introduction to Policy Analysis (1.5 cr)
- Rhet 1315 — The Land in American Experience (3 cr)

Agriculture/Environment and Natural Resources
- Agri 3001 — Pests and Crop Protection (3 cr)
- Agro 1103 — Crops, Environment, and Society (4 cr)

Water Science

Minor Only
The minor provides students the opportunity to broaden their expertise in the area of water science. Students interested in qualifying as a hydrologist should determine the exact requirements for the Minnesota civil service position by checking the Hydrologist I (Hydrogeology) and Hydrologist I (Water Resources) position descriptions. Students in environmental science in the water resources emphasis are not eligible for a water science minor.

To complete the minor, students must complete at least 20 credits.

Required Courses
- EEB 4601 — Linnology (3 cr)
- or Geo 5701 — General Hydrogeology (4 cr)
- FR 4114 — Forest Hydrology and Watershed Management (3 cr)
- Soil 5232 — Vadose Zone Hydrology (3 cr)
- or Soil 5555 — Wetland Soils (3 cr)

Electives
- CE 4541 — Environmental Water Chemistry (4 cr)
- EEB 4605 — Linnology Lab (1 cr)
- NRES 4061W — Water Quality: Management of a Natural Resource (3 cr)
- FR 5153 — Forest and Wetland Hydrology (3 cr)
- or Geo 5701 — General Hydrogeology (4 cr)
- Soil 4216 — Contaminant Hydrology (2 cr)
- Soil 5555 — Wetland Soils (3 cr)
- or Soil 5232 — Vadose Zone Hydrology (3 cr)
- Soil 5211 — Environmental Biophysics and Ecology (3 cr)
- GeoE 4351 — Ground Water Mechanics (3 cr)
- WRS 5001 — Field Methods in Water Resources (3 cr)