This is the College of Agricultural, Food, and Environmental Sciences section of the 2000-2002 University of Minnesota Undergraduate Catalog.

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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 1998-99, more than 900 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.

COAFES is located on the St. Paul campus. The Minnesota Agricultural Experiment Station borders the campus and supports a comprehensive agricultural 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 Prospective Student Services, 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. (See High School Course Preparation on page 15.)

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 have

- passed intermediate algebra with a grade of at least C;
- have at least a C average in transfer coursework;
- demonstrated a solid foundation in math and science.

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 or Status 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 regular University admission deadlines.

Non-degree Seeking—Previously known as the “adult special” category, “non-degree seeking” admission is primarily for (1) students who are (a) pursuing coursework in COAFES departments, but not seeking a degree or (b) 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 (2) staff members in COAFES departments taking courses through the Regents Scholarship Program and (3) 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.
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<td><strong>Animals</strong></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><strong>Animal production (beef, dairy, poultry, swine)</strong></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><strong>Biotechnology</strong></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><strong>Business and financial management</strong></td>
<td>AIM, AgBu, ApEc, AgEd</td>
<td>Loan officer, Commodity merchandiser, 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><strong>Communication</strong></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><strong>Environmental horticulture (landscape, nursery, floriculture)</strong></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>
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<tr>
<td><strong>Environmental science</strong></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>
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<tr>
<td><strong>Field crop production (corn, soybeans, wheat, oats, barley, sunflowers, hay, flax)</strong></td>
<td>AIM, CSMR, 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; Agronomy &amp; Plant Genetics; Entomology; Plant Pathology; Soil, Water, and Climate</td>
</tr>
<tr>
<td><strong>Food</strong></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><strong>Food processing and food safety</strong></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><strong>Horticultural food crops (fruits, vegetables)</strong></td>
<td>AIM, CSMR, ScAg</td>
<td>Vegetable grower, Orchard manager, Greenhouse or garden center worker, Nursery stock producer, Plant breeder, Arborvitae assistant, Bedding plant grower</td>
<td>Agronomy &amp; Plant Genetics; Horticultural Science; Soil, Water, and Climate</td>
</tr>
<tr>
<td><strong>Human nutrition</strong></td>
<td>Nutr</td>
<td>Dietitian, Nutrition educator, Hospital consultant, Medical student</td>
<td>Food Science and Nutrition</td>
</tr>
<tr>
<td><strong>Insects</strong></td>
<td>AIM, CSMR, EH, ScAg</td>
<td>Crop/environmental consultant, Research biologist, Biological control specialist, Technical/commercial representative, Public health inspector, Commercial honey producer, Plant health care specialist</td>
<td>Entomology; Plant Pathology</td>
</tr>
<tr>
<td><strong>International agriculture</strong></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><strong>Landscape design</strong></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><strong>Plants</strong></td>
<td>AIM, CSMR, EH, ScAg</td>
<td>Plant breeder, Nursery/greenhouse manager, Plant health care specialist</td>
<td>Agronomy &amp; Plant Genetics; Entomology; Horticultural Science; Plant Pathology; Soil, Water, and Climate</td>
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<tr>
<td><strong>Sales and marketing</strong></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><strong>Soil and water resources</strong></td>
<td>BAE, CSMR, 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; Food Science and Nutrition; Rhetoric</td>
</tr>
<tr>
<td><strong>Teaching</strong></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 advisor, Environmental education teacher, Nature or environmental center educator</td>
<td>Agricultural Education</td>
</tr>
<tr>
<td><strong>Technical communication</strong></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><strong>Turfgrass</strong></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><strong>Veterinary medicine</strong></td>
<td>ScAg</td>
<td>Veterinarian</td>
<td>Animal Science</td>
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Degrees/Majors

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

In a limited number of programs, COAFES also offers a master of agriculture: a professional, non-research oriented degree designed for those who seek post baccalaureate education to further advance their professional competence. For more information, contact COAFES Student Services, 120 Biosystems and Agricultural Engineering, 1390 Eckles Avenue, St. Paul, MN 55108.

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. Interested students should contact the Department of Horticultural Science or COAFES Student Services.

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 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

**Crops and Soils Resources 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

**Food Science**
- Nutrition
  - Coordinated Program in Dietetics

**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 form before completing the required coursework for the second major.

Minors

To receive a minor, students must have a GPA of 2.00 or higher 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. The honors program 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 taken 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 Office of the Registrar–St. Paul, 130 Coffey Hall.

Use of Elective Credits—With the approval of an adviser and the Scholastic Standing Committee, students may request that some completed electives be omitted from the list of courses counted toward a degree. A maximum of 10 credits of electives may be withheld to raise a GPA, but only to satisfy the graduation requirement of a 2.00 GPA. When a course is withheld from the undergraduate record, it can be reinstated only by an examination for credit or by repeating the course.

COAFES students are not required to take courses in physical education or music.

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.

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.

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, 120 Biosystems and Agricultural Engineering, 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 APAS 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, 120 Biosystems and Agricultural Engineering, or at the Office of the Registrar–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 Undergraduate Research Opportunities Program 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 Career Services Office, 120 Biosystems and Agricultural Engineering (612-624-2710).

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 4 credits for satisfactory completion of a PEP program. Students may enroll in two different PEP programs, for a total of 8 credits. Salaries are paid by the cooperating businesses, industries, producers, and agencies participating in the program. For more information, students should consult their adviser or the COAFES Career Services Office, 120 Biosystems and Agricultural Engineering (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 120 Biosystems and Agricultural Engineering. 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, 120 Biosystems and Agricultural Engineering (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, 120 Biosystems and Agricultural Engineering, 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 120 Biosystems and Agricultural Engineering.
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, 120 Biosystems and Agricultural Engineering.

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 fall 2001. For relocation information, call 612-624-4636, email renovation@coffman.umn.edu, or visit the website 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 adviser or the COAFES Student Services Office, 120 Biosystems and Agricultural Engineering.
Directory
(area code 612)

Mailing address
120 Biosystems and Agricultural Engineering
1390 Eckles Avenue
St. Paul, MN 55108
<www.agri.umn.edu>

COAFES services listed below are in 120 Biosystems and Agricultural Engineering unless otherwise noted.

Admission to the College
General Information .................... 624-3045
Career Services ............................ 624-2710
Includes:
• Career decision-making, and resources
• Career Day
• Internship opportunities
• Full-time employment opportunities
• Mentor Program
Honors Program (COAFES) ...... 624-9299
International Study/Travel ........... 624-2710
Student Services ....................... 624-7254
Includes:
• Advising
• Change of major
• Course cancellation and late withdrawal
• Graduation clearance
• Petitions
Undergraduate Research Program (UROP) .................. 624-2710

COAFES Administrative Offices
Dean of the College and Vice President for Agricultural Policy
Charles C. Muscoplat, 277 Coffey Hall,
624-5387
Associate Dean for Curricular and Student Affairs
Alan G. Hunter, 120 Biosystems and Agricultural Engineering,
624-4212

Following is a list of COAFES departments. Several departments and units also have formal affiliations or administrative links to other colleges: Agricultural Education has links with the College of Education and Human Development (CEHD); 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 Eidiem, head
231 Classroom Office Building
1994 Buford Avenue
St. Paul, MN 55108
625-0231

Affiliated majors
• Agricultural Industries and Marketing
• Applied Economics
• Agricultural and Food Business Management

Biosystems and Agricultural Engineering
R. Vance Morey, head
213 Agricultural Engineering
1390 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
Gary Gardner, 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. Pfleger, 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
Billie J. Wahlstrom, head
202 Haecker Hall
1364 Eckles Avenue
St. Paul, MN 55108
624-7750
<www.rhetoric.umn.edu>

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

Soil, Water, and Climate
H. H. Cheng, head
439 Borlaug Hall
1991 Upper Buford Circle
St. Paul, MN 55108
625-9734
<www.soils.agri.umn.edu>

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

COAFES views each of its majors as a four-year program that integrates liberal education courses, preparation or foundation courses, and professional courses in areas of special expertise. The following section details the requirements for each major. Several courses listed under the designation of foundation and professional courses in each major will also meet the liberal education requirements. Students need to consult with their adviser and a copy of the Class Schedule to determine what University courses have been approved to meet the liberal education core and designated theme requirements.

Students who were enrolled in a degree program before 1994 at the University of Minnesota, Twin Cities and have been following the general education requirements designated as areas A-D, have the option of completing their COAFES degrees using those requirements. For a summary of the requirements and a complete list of courses to fulfill them, students should consult with their adviser or the COAFES Student Services Office.

All other transfer students will be held to the current liberal education requirements. The number of credits required for graduation is dictated by the liberal education program a student follows. Students in the environmental science major must complete the current liberal education requirements.

Program Requirements—Students are responsible for the program requirements that are in effect for their major the semester they enter the college. COAFES Student Services Office provides students with a current program sheet or Academic Progress Audit System (APAS) Report at orientation/registration.

Students can choose to move to newer program requirements as the program changes in subsequent years or semesters, but students must assume the new requirements in total. To move to a newer program, students file a Change of Major form, available in the COAFES Student Services Office. Upon processing the form, the Student Services Office provides students with an updated APAS report or program sheet. The student and his or her adviser should follow those requirements for graduation. The final degree clearance is processed using the student’s declared major.

Students who request a leave of absence, or who are not enrolled for more than two consecutive semesters but are without a leave of absence, should consult the Policies section of this catalog.

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 to the agricultural and food business management major, students must meet the following 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 or ApEc 1251
  —ApEc 1101, 1102 or Econ 1101, 1102
  —OMS 1550
  —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.

All 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, 331 Classroom Office Building, or from the COAFES Student Services Office, 120 Biosystems and Agricultural Engineering.
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, area of emphasis courses, and technical 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 (3 cr)
Rhet 1223—Oral Presentations in Professional Settings (3 cr)
Rhet 3257—Scientific and Technical Presentations (3 cr)
Math 1142—Short Calculus (3 cr)
or Math 1271—Calculus I (4 cr)
Note: Students contemplating graduate work are encouraged to take both Math 1271 (4 cr) and Math 1272 (4 cr).
Complete at least 8 credits of physical and biological sciences from courses listed below. The courses taken should be selected to provide the science background for the agricultural science courses listed below.
Biol 1009—General Biology (4 cr)
Biol 2012—General Zoology (4 cr)
Biol 2022—General Botany (3 cr)
Chem 1011—General Principles of Chemistry (4 cr)
Chem 1021—Chemical Principles I (4 cr)
Chem 1022—Chemical Principles II (4 cr)
Professional Requirements
Applied Economics
Core courses and electives required of all majors:
ApEc 1001—Orientation (1 cr)
ApEc 1101—Principles of Microeconomics (3 cr)
ApEc 1102—Principles of Macroeconomics (3 cr)
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)
6-8 credits from Applied Economics in an area of emphasis. An internship (ApEc 4096) or special project is encouraged.*
Carlson School of Management
Core courses and electives required of all majors:
Acct 2050—Introduction to Financial Reporting (4 cr)
Acct 3001—Introduction to Management Accounting (2 cr)
Mgmt 3001—Fundamentals of Management (2 cr)
Mktg 3001—Principles of Marketing (2 cr)
OMS 1550—Business Statistics: Data Sources, Presentation, and Analysis (4 cr)
6-8 credits from the Carlson School of Management in an area of emphasis.*
*Note: Electives in applied economics and from the Carlson School of Management are to be used to meet requirements in one of the following areas of emphasis.

Areas of Emphasis
12 credits in one of the following areas of emphasis:
Business Management
Acct 3201—Intermediate Management Accounting (2 cr)
ApEc 3401—Markets, Marketing and Prices (2 cr)
ApEc 3451—Food and Agricultural Sales (3 cr)
ApEc 3921—Agricultural Law (3 cr)
ApEc 4096—Professional Experience Program: Internship (1-3 cr)
ApEc 5811—Cooperative Organizations (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 (4 cr)
HRIR 3041—Individual in the Organization (2 cr)
Mgmt 4002—Managerial Psychology (4 cr)
Mgmt 4008—Entrepreneurial Management (4 cr)
OMS 3056—Production and Inventory Management (4 cr)
Marketing and Sales Management
ApEc 3401—Markets, Marketing and Prices (2 cr)
ApEc 3411—Grain Marketing Economics (3 cr)
ApEc 3421—Livestock and Meat Marketing Economics (2 cr)
ApEc 3451—Food and Agricultural Sales (3 cr)
ApEc 3921—Agricultural Law (3 cr)
ApEc 4096—Professional Experience Program: Internship (1-3 cr)
ApEc 4481—Futures and Options Markets (3 cr)
ApEc 5401—Price Analysis, Futures and Options Markets (3 cr)
ApEc 5751—Agricultural Trade and Trade Policy: Issues and Analysis (3 cr)
Mktg 4020—Advanced Logistics and Supply Chain (2 cr)
Mktg 4030—Selling and Sales Management (4 cr)
Mktg 4040—Buyer Behavior (4 cr)
Mktg 4060—Marketing and Distribution Channels (4 cr)
Mktg 4070—International Marketing (4 cr)
Mktg 4080—Marketing Strategy (4 cr)
Financial Management
Acct 3201—Intermediate Management Accounting (4 cr)
Acct 5100—Financial Statement Analysis (4 cr)
ApEc 3921—Agricultural Law (3 cr)
ApEc 4096—Professional Experience Program: Internship (1-3 cr)
ApEc 4481—Futures and Options Markets (3 cr)
ApEc 5811—Cooperative Organizations (3 cr)
BLaw 3058—The Law of Contracts and Agency (4 cr)
Fina 4121—Financial Markets and Interest Rates (2 cr)
Fina 4122—Banking Institutions (2 cr)
Fina 4241—Corporate Financing Decisions (4 cr)
Fina 4242—Corporate Investment Decisions (4 cr)
Fina 4322—Security Analysis (4 cr)
Fina 4541—Futures, Options, and Derivatives (4 cr)
Fina 4641—International Finance and Risk Management (4 cr)
Econ 4432—International Finance (3 cr)
Ins 5100—Corporate Risk Management (2 cr)
Food Processing, Wholesaling, and Retailing
ApEc 3401—Markets, Marketing and Prices (2 cr)
ApEc 3451—Food and Agricultural Sales (3 cr)
ApEc 4096—Professional Experience Program: Internship (1-3 cr)
ApEc 4451—Food Marketing Economics (3 cr)
ApEc 4481—Futures and Options Markets (3 cr)
ApEc 5751—Agricultural Trade and Trade Policy: Issues and Analysis (3 cr)
BLaw 3058—The Law of Contracts and Agency (4 cr)
Mktg 3010—Marketing Research (4 cr)
Mktg 4030—Selling and Sales Management (4 cr)
Mktg 4050—Integrated Marketing Communications (4 cr)
Mktg 4080—Marketing Strategy (4 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.

Technical Emphasis
An additional 9 credits are required in an area of technical emphasis. At least one course must be 3xxx or 4xxx. Courses in agricultural education, fisheries and wildlife, landscape architecture, rhetoric, or physical and biological sciences may not be used to meet the requirement. In agricultural engineering, only AgET 3025 and AgET 5410 may be used.
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 CEHD and the College of Agricultural, Food, and Environmental Sciences. Students may choose one of three specialization areas: agricultural science and technology education; agricultural leadership, training, and development; or natural and managed environmental education.

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. In addition, graduates of this specialization also are qualified for a broad array of agriculturally related positions in sales, management, finance, and production aspects of agriculture. The specialization allows students to have an emphasis area that includes a broad agricultural science and technology background.

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 (LE) requirements, including approved writing intensive (W) courses. For more information, see page 35 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)
Chem 1011—General Principles of Chemistry (4 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)
or
Agro 1103—Crops, Environment and Society (4 cr)
MicB 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)

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)
or
HSCI 1815—Introduction to History of Science: Modern Science (4 cr)
Psy 1001—Introduction to Psychology (4 cr)
or
GC 1281—General Psychology (4 cr)

Agricultural Sciences and Applied Economics (40 cr)

Plant Science (6 cr)
Agro 3003—Introduction to Integrated Weed Management (1 cr)
Ent 3001—Insects and Insect Management (1 cr)
PIPa 3001—Plant Disease Biology and Management (1 cr)

Plus 3-4 credits from the following:
Agro 1101—Biology of Plant Food Systems (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)
or
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 Carcass Evaluation (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)
FW 2001—Introduction to Fisheries, Wildlife, and Conservation Biology (3 cr)

Plus 3 credits from the following:
Agro/AnSc 3203—Environment, Global Food Production, and Citizens (3 cr)
EEB 3001—Ecology and Society (3 cr)
ES 1011—Issues in the Environment (3 cr)
NRES 1201—Conservation of Natural Resources (3 cr)

Soils (4 cr)
Soil 1125—The Soil Resource (4 cr)
or
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/BIE 2051—Current Technical Competencies (3 cr)
AFEE/BIE 3112—Technical Drawing and Production Technologies (3 cr)
AFEE/BIE 3121—Communication, Energy and Power, Transportation and Machineries Technologies (3 cr)

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

Professional Education (38-38.5 cr)

Foundations (15-15.5 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)
College of Agricultural, Food, and Environmental Sciences

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 (4 cr)
AFEE 5113—Adult Agricultural Education Program Development and Technology (3 cr)
AFEE 5114—Agricultural Education Teaching Seminar (1 cr)

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

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 transfer into the program any semester. They must have a GPA of 2.00 for admission.

Degree Requirements
Students must complete at least 124 credits, including required courses in the major. Students also must complete the University’s liberal education (LE) requirements, including approved writing intensive (W) courses. For more information, see page 35 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 1101—Writing to Inform, Convince, and Persuade (4 cr)
RhEt 1223—Oral Presentations in Professional Settings (3 cr)
RhEt 5562W—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)
Agro 1103W—General Biology (4 cr)
BioC 2011—Biotechnology for the Agricultural and Health Sciences (3 cr)
Chem 1101—General Principles of Chemistry (4 cr)
ScAg 1501—Biotechnology: People and the Environment (3 cr)

Social Science (8 cr)
Phil 1003—Introduction to Ethics (4 cr)
Psy 1001—Introduction to Psychology (4 cr)

Agricultural Sciences and Economics (52 cr)
Plant Science (9 cr)
Agro 3003—Introduction to Integrated Weed Management (1 cr)
Ent 3001—Insects and Insect Management (1 credit)
PhY 3001—Plant Disease Biology and Management (1 cr)

Plus at least 6 credits from the following:
Agro 1101—Biology of Plant Food Systems (4 cr)
Agro 2501—Weed Biology and Systematics (2 cr)
Agro 3005—Applied Crop Physiology and Development (2 cr)

Animal Science (10 cr)
AnSc 1101—Introductory Animal Science (4 cr)
AnSc 1403—Companion Animal Nutrition and Care (2 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)
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)

Agricultural Education and Extension (9 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 for Agricultural Professionals (1 cr)

Human Resource Development/Adult Education (15 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.
AdEd 5102—Perspectives of Adult Learning and Development (3 cr)

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)
PipPa 2002—Diseases of Field Crops (3 cr)
PipPa 3002—Air Pollution, People, and Plants: The Science and the Ethics (3 cr)

Agricultural Business and Management (10 cr)
ApEc 3041—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 1152W—Writing on Issues of Science and Technology (4 cr)
Rhet 3221W—Theories of Human Communication (4 cr)
Rhet 3257—Scientific and Technical Presentations (3 cr)
Rhet 1266—Group Process, Team Building, Leadership (3 cr)
Rhet 3401—Accessing Information Through Electronic Media (3 cr)

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. They must maintain an overall GPA of 2.00 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 (LE) requirements, including approved writing intensive (W) courses. For more information, see page 35 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 (9-10 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)
Biol 1051—Introduction to Environmental Science (3 cr)
Agro 1103—Crops, Environment and Society (4 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 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.

**Admission Requirements** — Admission to COAFES.

**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 (calculus, accounting, and statistics) and science (biology and chemistry) and (2) professional courses with three major clusters (communications, business, and agricultural sciences). Students must complete at least 13 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 1142 —Short Calculus (3 cr)

or Math 1271 Calculus I (4 cr)

**Plus one of the following:**

Agro 4101 —Experimental Design/Plot Techniques (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 (3 cr)

or Biol 1009 —General Biology (4 cr)

BioC 1012 —General Principles of Biochemistry (3 cr)

Chem 1011 —General Principles of Chemistry (4 cr)

**Professional Requirements**

**Experiential**

AFEE 1002 —Principles of Career Planning for Agricultural Professionals (1 cr)

xxx 4096 —Professional Experience Program (3 cr)

or AIM 4011 —Student Project/Field Investigation (3 cr)
One of the following:
- ApEc 3451—Food and Agricultural Sales (3 cr)
- BFE 3061—Professional Sales Management (3 cr)

**Communications**
- Rhet 1101—Writing to Inform, Convince and Persuade (4 cr)
- Rhet 1152—Writing on Issues in Science and Technology (3 cr)
- Rhet 1223—Oral Presentations in Professional Settings (3 cr)
- Rhet 3562—Technical and Professional Writing (4 cr)
- Rhet 3572—Scientific and Technical Presentations (3 cr)

Plus one of the following:
- Rhet 3266—Team Building and Leadership (3 cr)
- Rhet 3258—Information Gathering Techniques in Scientific and Technical Communications (3 cr)

**Business**
- ApEc 1101—Principles of Microeconomics (3 cr)
- ApEc 1102—Principles of Macroeconomics (3 cr)
- ApEc 3001—Applied Microeconomics: Consumers and Markets (4 cr)
- ApEc 3002—Applied Microeconomics: Managerial Economics (3 cr)
- ApEc 3402—Markets, Marketing and Prices (2 cr)

One of the following:
- ApEc 3411—Grain Marketing Economics (2 cr)
- ApEc 3421—Livestock and Meat Marketing Economics (2 cr)
- ApEc 3821—Retail Center Management (3 cr)
- ApEc 4451—Food Marketing Economics (3 cr)

Plus one of the following:

**Agriculture**
- AgET 3213—Engineering Principles and Applications (3 cr)
- Agro 1103—Crops, Environment, and Society (4 cr)
- Hort 1101—Plant Propagation (4 cr)
- AnSc 1011—Domestic Animals and Society (3 cr)
- Soil 2125—Basic Soil Science (4 cr)
- or
- FScN 1112—Principles of Nutrition (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**
- Agro 3005—Introduction to Integrated Weed Management (1 cr)
- Agro 3005—Applied Crop Physiology and Development (2 cr)
- Biol 3002—Plant Biology: Function (2 cr)
- PlPa 3001—Plant Disease Biology and Management (1 cr)
- Soil 3416—Plant Nutrients in the Environment (3 cr)

Plus at least 4 credits from the following: Agro 2103, Agro 3203, Agro 4305, Agro 4401, Agro 4505, Agro 4603, Agro 4605, Ext 4005, PlPa 2002, Soil 3221, Soil 3612, Soil 4511

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

**Horticultural Industries**
- Biol 3002—Plant Biology: Function (2 cr)
- Hort 1012—Woody Landscape Plants (3 cr)
- Hort 1011—Herbaceous Landscape Plants (3 cr)

Plus at least 7 credits from the following:
- Hort 4061, Hort 3002, Hort 4021, Hort 4041, Hort 4051, Hort 4071, Hort 4072, Hort 4401, Hort 5023, Hort 5031, Hort 5071, Hort 5183, PlPa 2001

**Food Industries**
- ApEc 4451—Food Marketing Economics (3 cr)
- FScN 3102—Introductory Microbiology (4 cr)
- FScN 3102—Introduction to Food Science (3 cr)

Plus at least 3 credits from the following:
- FScN 1511—Food Animal Products for Consumers (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 according to student’s interests, in consultation with an advisor and with approval of the AIM major committee.

**Final Project**
- Professional Experience Program (xxx 4096) or AIM 4011 required.

### 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 3451—Food and Agricultural Sales (3 cr)
- BioC 1012—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—Plant and Crop Science (4 cr)
- AnSc 1101—Introductory 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 2522—Animal Breeding (4 cr)
- AnSc 4096—Livestock Systems Analysis (2 cr)
- AnSc 4096—Professional Experience Program: Internship (3 cr)
- Soil 2125—Basic Soil Science (4 cr)
- VPB 3103—General Microbiology (4 cr)

Choose at least 11 credits from the following (courses from this list cannot be applied to an area of emphasis):
- AnSc 1011 (3 cr), ApEc 1251 (3 cr), Ext 3001 (1 cr), AnSc 3203 (3 cr), AgET 3213 (3 cr), AnSc 3305 (4 cr), ApEc 3421 (2 cr), ApEc 3451 (3 cr), AnSc 3511 (3 cr), ApEc 3811 (3 cr), Ext 4281 (2 cr), AnSc 4501 (3 cr), AnSc 4601 (4 cr), AnSc 4602 (4 cr), AnSc 4603 (4 cr), AnSc 4604 (4 cr), AnSc 4605 (4 cr), AnSc 4611 (2 cr), AnSc 4613 (2 cr), AnSc 4614 (2 cr)
Areas of Emphasis

**Beef**
- AnSc 2012—Livestock and Carcass Evaluation (3 cr)
- AnSc 4403—Ruminant Nutrition (3 cr)
- AnSc 4603—Beef 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 2012—Horse Production (ITV from Crookston) (2 cr)
- AnSc 3102—Equine Management (ITV from Crookston) (2 cr)

Students must complete at least 2 credits of selected equine lab courses offered during summer sessions at Crookston.

**Sheep**
- AnSc 2012—Livestock and Carcass Evaluation (3 cr)
- AnSc 4403—Ruminant Nutrition (3 cr)
- AnSc 4602—Sheep Production Systems Management (4 cr)

**Swine**
- AnSc 2012—Livestock and Carcass Evaluation (3 cr)
- AnSc 4401—Swine Nutrition (3 cr)
- AnSc 4601—Pork Production Systems Management (4 cr)
- AnSc 4611—Advanced Pork Production Systems Management (2 cr)

**Poultry**
- AnSc 4602—Poultry Production Systems Management (4 cr)
- At least 3 poultry courses from the Midwest Poultry Consortium Summer Program at Madison, WI.

**Individualized Emphasis (12 cr min)**
Courses may be selected according to students’ 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.

**Admission Requirements—**Admission to COAFES.

Degree Requirements

Students must complete at least 120 credits to graduate, including 52 credits in the major. Besides completing the liberal education requirements of the University, 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. According to their interests, students select the remainder of their courses from the categories of professional application (specialization), technical emphasis, and electives. All required courses must be taken A-F, and a grade of at least C- is required in all professional courses, area of emphasis courses, and technical emphasis courses.

**Required Courses**

**Foundation Requirements**

**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**
Students in ApEc must complete 6 credits in social sciences beyond the 6 credits required for liberal education.
- Math 1142—Short Calculus
- or Math 1271—Calculus (4 cr)

**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 Microeconomics: Policy, Trade, and Development (3 cr)
- OMS 1550—Business Statistics (4 cr)

**A. Professional Application Cluster (12 cr min)**
At least two ApEc courses plus one or two more courses from ApEc, Econ, or Carlson School of Mgmt. Students are encouraged to take 9 or more of these 12 credits in one of the following areas:

- Food Retailing: ApEc 4821, ApEc 4451, DHA 4241, Mktg 3001, HRIR 3041
- Individualized Professional Cluster: To develop such a program, consult with adviser.

**Technical Emphases (12 cr min)**
With the help of an adviser, students select at least three courses from at least two departments. At least one course should be 3xxx or above.

**Electives—**Several courses in the Carlson School and in the Economics Department are optional in meeting the professional requirement and the professional application cluster chosen.
Internships
Internships are recommended for all students in the major.

Minor Requirements
For students who want to include a basic core of 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)
Electives (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 Atmosphere Laboratory (1 cr)
Soil 5211—Biometeorology (3 cr)
Electives (13 credits)
EEB 5008—Forest Response to Quaternary Climate Change (2 cr)
EEB 5009—Quaternary Vegetation History and Climate (2 cr)
Geog 340—Geography of Environmental Systems (3 cr)
Geog 5423—Climate Models and Modeling (3 cr)
Geog 5426—Climatic Variations (3 cr)
Soil 5401—Introduction to Atmospheric Science (3 cr)
Soil 5402—The Atmospheric Boundary Layer (3 cr)

Crops and Soils Resources Management

B.S.
The crops and soils resources management major is for students who are interested in becoming proficient in those 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 production as a part of managed ecosystems with local and global connections.

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 support staff. Quality performance in the major prepares students to pursue crops and environmental science related graduate degrees.

Admission Requirements—Admission to COAFES.

Degree Requirements
Students must complete at least 120 credits to graduate, including 66 credits in the major. 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.

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
BioC 1012—General Principles of Biochemistry (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
AFEE 1002—Principles of Career Planning for Agricultural Professions (1 cr)
AgET 3213—Engineering Principles and Applications (3 cr)
Agro 1103—Crops, Environment, and Society (4 cr)
Agro 2501—Weed Biology, Ecology, and Systematics (2 cr)
Agro 3005—Applied Crop Physiology and Development (2 cr)
and Bio 3002—Plant Biology: Function (2 cr)
or Hort 3005—Applied Crop Physiology and Development (2 cr)
and Bio 3002—Plant Biology: Function (2 cr)
Agro 4096—Professional Experience Program: Internship (3 cr)
Agro 4305—Crop Harvest, Storage, Processing, Utilization (3 cr)
or FScN 5551—Grains: Introduction to Cereal Chemistry and Technology (2 cr)
Agro 4401/Hort 4401—Plant Genetics and Breeding (4 cr)
Agro 4505—Integrated Weed Management (4 cr)
Agro 4603—Field Crop Scouting and Problem Diagnosis (2 cr)
Agro 4605—Crop Management Technologies (3 cr)
or Hort 5030—Sustainable Horticultural Food Production (4 cr)
Agro 4660—Senior Capstone (2 cr)
AnSc 1101—Introductory Animal Science (4 cr)
ApEc 1101—Principles of Microeconomics (3 cr)
ApEc 3451—Food and Agricultural Sales (3 cr)
or BIE 3061—Professional Sales Management (3 cr)
ApEc 3811—Principles of Farm Management (3 cr)
Ent 4005—Economic Entomology (3 cr)
Pipa 2002—Diseases of Field Crops (3 cr)
or Pipa 2001—Introductory Plant Pathology for Horticulturists (3 cr)
Soil 2125—Basic Soil Science (4 cr)
Soil 3221—Soil Conservation and the Land Use Management (3 cr)
or Soil 3612—Soil and Environmental Biology (3 cr)
Soil 3416—Plant Nutrients in the Environment (3 cr)

One of the following:
AgET 5203—Environmental Impacts of Food Production (3 cr)
Agro 5203—Environment, Global Food Production, and the Citizen (3 cr)
NRES 3021—Plant Resource Management and the Environment (3 cr)
Electives

Final Project
Agro 4096—Professional Experience Program.

Note: The major in Crops and Soils Resources Management 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.
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.

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 4005—Field Crops Entomology (2 cr)
  - Ent 4015—Ornamental and Turf Entomology (2 cr)
  - Ent 4251—Forest and Shade Tree Entomology (2 cr)
  - Ent 4281—Livestock 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 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 to 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 1012—General Principles of Biochemistry (3 cr)
- Biol 1009—General Biology (4 cr)
- Biol 2022—General Botany (3 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 4251—Forest and Shade Tree Entomology (3 cr)
- 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)
- Hort 3002—Greenhouse Management (3 cr)
- Hort 3005—Environmental Effects on Horticultural Crops (2 cr)
  - and Biol 3002—Plant Biology: Function (2 cr)
- Hort 4096—Professional Experience Program (3 cr)
- Hort 4401—Plant Genetics and Breeding (4 cr)
- PIPa 2001—Introductory Plant Pathology for Horticulturists (3 cr)
- PIPa 4000—Plant Pathology Practicum (1 cr)
- Soil 2125—Basic Soil Science (4 cr)

Areas of Emphasis

- Landscape Design, Implementation, and Management (18 cr min)
  - Hort 4021—Landscape Design, Implementation, and Management I (4 cr)
  - Hort 4061—Turf and Landscape Management (4 cr)
  - Hort 5021—Landscape Design II (3 cr)
  - Hort 5024—Landscape Development (1 cr)
  - At least two additional horticultural science courses (6-8 cr)

- Nursery Production and Garden Center Management (18 cr min)
  - ApEc 3821—Retail Center Management (3 cr)
  - Hort 4041—Nursery Production and Management I (4 cr)
  - Hort 5041—Nursery Production and Management II (3 cr)
  - Hort 5042—Nursery Operations (1 cr)

  - At least two additional horticultural science courses (7-8 cr)

- Greenhouse Production and Retail Floriculture (18 cr min)
  - ApEc 3821—Retail Center Management (3 cr)
  - Hort 4041—Nursery Production and Management I (4 cr)
  - Hort 5051—Floriculture Production and Management II (4 cr)
  - At least two additional horticultural science courses (7-8 cr)

- Turfgrass Management (18 cr min)
  - Hort 4021—Landscape Design, Implementation, and Management I (4 cr)
  - Hort 4061—Turf and Landscape Management (4 cr)
  - Hort 5061—Turfgrass Science (3 cr)
  - Soil 3416—Plant Nutrients in the Environment (3 cr)

  - At least one additional horticultural science course (3-4 cr)

Individualized Program of Study (18 cr min)
Seven courses (21-23 cr) chosen in consultation with adviser. Students must submit a course of study to the Department of Horticultural Science Undergraduate Affairs Committee at least three semesters before graduation.

Final Project
All students are required to do an internship. After arranging an internship and getting approval from an adviser, students register for Hort 4096.

Minor Requirements
- Hort 1001—Plant Propagation (4 cr)
- Hort 3005—Environmental Effects on Horticultural Crops (2 cr)
- At least 12 credits of horticultural science electives of which one course from a related area may be used. A maximum of 3 credits of Hort 5090—Directed Studies may be applied to the minor.
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).

Admission Requirements—Acceptance to COAFES.

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 area. 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)
ApEc 1102—Principles of Macroeconomics (3 cr)
BioC 1012—General Principles Biochemistry (3 cr)
or
Chem 2301—Organic Chemistry I (3 cr)
Biol 1001—Introductory Biology I: Evolutionary and Ecological Perspectives (4 cr)
Biol 1002—Introductory Biology II: Molecular, Cellular, and Developmental Perspectives (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
Phys 1201—General Physics (5 cr)
and Phys 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)
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)
Geo 1001—Introduction to Geology (4 cr)
NRES 3001—Water Quality Management (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)

Areas of Emphasis (15 cr)

Land and Water Resources

Land Use Management Required Courses
FR 3601—Elements of Surveying (1 cr)
FR 4131—GIS for Natural Resource Analysis (3 cr)
or
Geog 3561—Principles of Geographic Information Science (4 cr)
Soil 5511—Field Study of Soils (2 cr)
Soil 5555—Wetland Soils (3 cr)

Select 6 credits 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 3355—Environmental Quality (3 cr)
Geog 3361—Land Use, Landscapes and the Law (3 cr)
Geog 3401—Geography of Environmental Systems (3 cr)
Hort 5071—Landscape and Reclamation Ecology (3 cr)
NRES 3575—Wetlands Conservation (3 cr)
PA 5013—Law and Urban Land Use (3 cr)

Soil Science Required Courses
(for soil science license, students must complete required courses)
Soil 4511—Field Study of Soils (2 cr)
Soil 5232—Soil Physics (3 cr)
Soil 5515—Soil Genesis and Landscape Relations (3 cr)

Choose one from the following:
Agro 1101—Biology of Plant Food Systems (4 cr)
Agro 1103—Crops, Environment, and Society (3 cr)
NRES 3021—Plant Resource Management and the Environment (3 cr)
**Student teams in nutrition and food science have won three consecutive national championships in product development competitions.**

**Environmental Measurement Required Courses**
- PIPa 3002—Air Pollution, People and Plants (3 cr)
- PubH 5190—Environmental Chemistry (3 cr)
- Soil 5211—Biometeorology (3 cr)

**Select 6 credits from the following:**
- CE 4541—Environmental Water Chemistry (3 cr)
- PubH 5103—Exposure to Environmental Hazards (2 cr)
- PubH 5112—Risk Analysis: Application to Risk-Based Decision Making (3 cr)
- PubH 5171—Properties, Behavior and Measurement of Environmental Airborne Contaminants (4 cr)
- PubH 5180—Environmental Microbiology (4 cr)
- PubH 5200—Environmental Health (2 cr)

**Waste Management Required Courses**
- PubH 5111—Preventing Pollution (3 cr)
- Soil 5001—Principles of Waste Management (3 cr)

**Select 9 credits from the following:**
- CE 4561—Solid and Hazardous Wastes (3 cr)
- CE 4562—Remediation Technology (3 cr)
- PubH 5103—Exposure to Environmental Hazards (2 cr)
- PubH 5112—Risk Analysis: Application to Risk-Based Decision Making (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 5611—Soil Biology and Fertility (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 Department. Program requirements are detailed on page 49.

**General Environmental Education Required Courses**
- FR 5403—Fundamentals of Natural Resource Education (3 cr)
- NRES 3202—Leadership, Planning, and Conflict Management in Natural Resources (3 cr)
- NRES 3011—Ethics and Leadership in Natural Resource Management (3 cr)
- NRES 4811—Natural Resources Interpretation (3 cr)

**Select 6 credits from the following:**
- Agro 4103—World Food Problems (3 cr)
- CI 5140—Reflective Teaching and Professional Ethics (3 cr)
- CI 5502—Special Topics: Outdoor Science Education (1-8 cr)
- CI 5533—Studies in Science Education (4 cr)
- CI 5537—Special Topics: 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 3251—Role of Renewable Natural Resources in Developing Countries (1 cr)
- Hort 5071—Restoration and Reclamation Ecology (3 cr)
- NRES 1041—Natural Resources as Raw Materials (3 cr)
- NRES 3202—Leadership, Planning, and Conflict Management in Natural Resources (3 cr)
- NRES 4811—Natural Resources Interpretation (3 cr)

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**Environmental Management**

**Bioremediation Required Courses**
- Chem 2301—Organic Chemistry I (3 cr)
- Chem 2302—Organic Chemistry II (3 cr)
- Soil 5601—Principles of Waste Management (3 cr)
- Soil 5611—Soil Biology and Fertility (3 cr)
- Soil 4121—Microbial Ecology and Applied Microbiology (3 cr)

**Select 6 credits from the following:**
- CE 4551—Environmental Microbiology/Lab (4 cr)
- CE 4562—Remediation Technology (3 cr)
- PubH 5111—Preventing Pollution (3 cr)
- PubH 5180—Environmental Microbiology (4 cr)
Food Science

B.S.

Food scientists apply principles of chemistry, physics, and microbiology to food processing, preservation, and product development. The food science program provides students with a foundation in calculus, chemistry, physics, communications, statistics, and biology. Professional courses center around food engineering/processing, food chemistry, food microbiology, and food quality.

Degree Requirements

Students must complete at least 120 credits to graduate, including 92 credits in the major. Students must also complete 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 a grade of at least C- is required in all professional courses.

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)
- 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)
- Stat 3011—Introduction to Statistical Analysis (4 cr)

Choose one of the following lab courses: BioC 4025, Chem 2111, Chem 2311, FScN 4613

Choose one of the following microbiology courses: MicB 2032, MicB 3301, VPB 2032

Choose one of the following physics series: Phys 1101/1102, Phys 1201/1202, Phys 1301/1302

**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—Lab 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 courses with a Capstone component: FScN 4341, FScN 4342, FScN 4343, FScN 4344, FScN 4345, FScN 4346

**Minor Requirements**

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

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—Weed Biology Systematics (2 cr)
- Agro 4505—Integrated Weed Management (4 cr)
- Ent 5211—Insect Pest Management (3 cr)
- PIPs 5204—Epidemiology and Plant Disease Resistance (4 cr)

Choose one of the following management courses:
- Agro 4605—Management Technologies 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 (2 cr)
- Agro 4888—Issues in Sustainable Agriculture (2 cr)
- PIPs 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)
College of Agricultural, Food, and Environmental Sciences

Nutrition
B.S.
The nutrition major explores how nutrients and the foods from which they are derived aid the body in health, growth, and development. Given national and international concern for how food and nutrition affect health and disease, there are many career opportunities for registered dietitians and nutritionists. Students choose one of three options: nutrition, 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 to graduate, including required credits in the major. Students must also complete 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 a grade of at least C- is required in all professional courses.

Required Courses for All Options
BioC 3021—Biochemistry (3 cr)
Biol 1005—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 3562—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, electives, 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, and demonstrated leadership skills, and who are highly recommended, may apply for a postbaccalaureate dietetic internship.

Additional Courses
FScN 3614—Nutrition Education (2 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 (2 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 (2 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 (2 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 (2 cr)
Math 1031—College Algebra and Probability (3 cr)
Mgmt 3001—Fundamentals of Management (2 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
Chen 2302—Organic Chemistry II (3 cr)
Chen 2311—Organic Chemistry Lab (3 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)
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.

Admission Requirements—See COAFES policy.

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 liberal education diversified core and designated themes. See the University’s liberal education statement on page 35 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.
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)

University rhetoric students participated with nine other schools worldwide on an international team dealing with technology and community building sponsored by Apple, Inc.

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, Artificial Insemination, and Lactation (4 cr)
AnSc 3221—Animal Breeding (4 cr)

Plus two from AnSc 4401, AnSc 4603, AnSc 4604, AnSc 4605
Plus two from AnSc 4601, AnSc 4603, AnSc 4604, AnSc 4605

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, Artificial Insemination, and Lactation (4 cr)

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.
Admissions Requirements—Students who wish to major in scientific and technical communication should take the following steps.

1. Declare the major with COAFES.
2. Make an appointment with the scientific and technical communication assistant major coordinator. Students should bring samples of writing, computer work, graphics, Web pages, or any other form of communication they created. If a student doesn’t have samples, he or she should bring a short essay (2-3 pages) that describes their interest in scientific and technical communication. These materials are a way for advisers to get to know more about the student’s interests and are not part of any formal admissions procedure. The student should also bring a recent copy of their APAS report.

At the first meeting, the assistant major coordinator discusses the student’s interest in the major, reviews the requirements for completing the major, and has the student complete the Major Program Form. The form provides official notice that the student is a scientific and technical communication major.

The assistant major coordinator serves as the student’s academic adviser during the first stages of the program. The student is assigned a faculty adviser after completing the following requirements:

- At least 30 credit hours (including accepted transfer credits)
- At least the following three courses taken in the Department of Rhetoric or as accepted transfer credits:
  - Rhet 1223—Oral Presentations in Professional Settings (3 cr)
  - Rhet 3221—Theories of Human Communication (4 cr)
  - Rhet 3562—Technical and Professional Writing (4 cr)

Degree Requirements

Students must complete at least 120 credits to graduate, including 85 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). However, at least 30 credits in areas A, B, C, D, and E must be completed in the Department of Rhetoric, as follows.

Area A. Communication Design (30 cr)

- A-1. Written Communication (15 cr)
  - Rhet 1152—Writing on Issues of Science and Technology (4 cr)
  - Rhet 3562—Technical and Professional Writing (4 cr)
  - Rhet 4561—Editing and Style for Technical Communicators (3 cr)
  - Rhet 5662—Advanced Technical Communication (4 cr)

- A-2. Oral Communication (9 cr)
  - 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)

  - Rhet 4671—Principles and Application of Project Management and Design I (3 cr)
  - Rhet 4672—Principles and Application of Project Management and Design II (3 cr)

Area B. Communication Expertise (9 cr)

Students work with their adviser to select courses in one area of communication in which they would like to develop expertise. Possible areas include written communication, multimedia, training and development, public relations and management, information management systems, sales and marketing, oral communication, visual communication, business communication, and international communication.

Area C. Information Management and Theory (23 cr)

- C-1 Information Management (9 cr)
  - Rhet 4501—Usability and Human Factors in Technical Communication (3 cr)
  - Plus at least 6 credits from Rhet 3401, Rhet 4165, Rhet 4573, Rhet 5111/5112, Rhet 5258, Rhet 5562

- C-2 Theory (11 cr)
  - Rhet 3221—Theories of Human Communication (4 cr)
  - Rhet 3701—Rhetorical Theory and Scientific and Technical Communication (4 cr)
  - Rhet 5511—Research in and Scientific and Technical Communication (3 cr)

- C-3 Internship (3 cr)
  - Rhet 4196—Internship in Scientific and Technical Communication (3-6 cr)

Area D. Science, Technology, and Society (10 cr)

- Rhet 1302—Science, Religion, and the Search for Human Nature (3 cr)
- Rhet 3108—Gender and the Rhetoric of Science and Technology (4 cr)
- Rhet 3371—Technology, Society, and Self (3 cr)

Area E. Scientific or Technical Competency (15 cr)

Students develop expertise in a specific scientific or technical area, in consultation with their adviser. Courses are limited to science and technology fields. The courses may be from multiple departments but cannot be taken from the Department of Rhetoric. At least two courses in the area must be upper division.

Scientific areas include, but are not limited to, agricultural science (including plant science and horticulture), animal science, astronomy, biology, chemistry, climatology, ecology, environmental science, food science/nutrition, health science, natural resources, and physics.

Engineering and technical areas include aerospace engineering, biomedicine, civil engineering, cognitive psychology (including human factors and ergonomics), computer science, electrical engineering, mathematics, and mechanical engineering.

To discuss non-rhetoric courses required as part of the major, contact the Department of Rhetoric assistant major coordinator.

Electives—The program accepts equivalent courses in all areas (except for required rhetoric courses as listed under Required Courses). Students are also expected to take courses outside of rhetoric in areas listed under Required Courses such as area B and area E.

Language Requirements

Scientific and technical communication majors are encouraged to take a foreign language. In addition, students may choose international communication as their area of emphasis under area B.

Final Project

All students must participate in an internship, under area C: Rhet 4196—Internship in Scientific and Technical Communication (3-6 cr).
Minors
The Department of Rhetoric offers three minors

- Designing with New and Emerging Technologies
- 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 612-624-4761 for more information.

Designing Documents with New and Emerging Technologies

**Minor Only**

The minor focuses on designing effective documents with both traditional and emerging technologies. Students learn to design oral 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. Components of designing messages include audience analysis and rigorous evaluation of document effectiveness. The minor differs from the minor in technical communication 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 21 credits to receive the minor.

**Required Courses**

Rhet 3101—Functional Photography (3 cr)

Rhet 3108—Corporate Video for Technical Communicators (4 cr)

Rhet 3257—Scientific and Technical Presentations (3 cr)

Rhet 3401—Accessing Information Through Electronic Media (3 cr)

Rhet 4501—Usability and Human Factors in Technical Communication (3 cr)

Rhet 5111—Message Design: Theory and Practice I (3 cr)

Rhet 5112—Message Design: Theory and Practice II (3 cr)

Rhet 5291—Independent Study (2-3 cr)

**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. (Students writing the integrative paper register in the Department of Rhetoric for approval.)

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 21 credits to complete the minor.

**Required Courses**

Rhet 3291—Independent Study (3 cr) (The integrative paper)

At least four of the following:

- Rhet 1152—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 (3 cr)
- Rhet 3371—Technology, Self, and Society (3 cr)
- Rhet 3383—In Search of Nature (3 cr)

At least two courses outside of the Department of Rhetoric:

Courses should be appropriate to the student’s interests and have the approval of the Rhetoric humanities course coordinator. The following list of courses would qualify for the minor: other courses may be substituted with the approval of the Rhetoric humanities course coordinator. Please observe prerequisites carefully when selecting upper division courses.

- AFEE 4221—Rural Leadership Development (3 cr)
- Agro 3203—Environment, Global Food Production and the Citizen (3 cr)
- Agro 4103—World Food Problems (3 cr)
- AnSc 3113—Animal Welfare (4 cr)
- ApEc 3041—Economic Development of U.S. Agriculture (3 cr)
- ApEc 3921—Agricultural Law (3 cr)
- ApEc 4611—Resource Development and Environmental Economics (3 cr)
- ApEc 5631—Economics of Natural Resource Policy (4 cr)
- ApEc 5711—Agriculture: Farm, Food, and Environmental Policy (3 cr)
- ES 1011—Issues in the Environment (3 cr)
- ES 1051—Introduction to Environmental Science (3 cr)
- FSChN 1102—Food: Safety, Risks, and Technology (3 cr)
- NRES 1201—Conservation of Natural Resources (3 cr)
- ScAg 1501—Biotechnology, People, and the Environment (3 cr)
- Soil 1125—The Soil Resource (4 cr)
- Soil 3221—Soil Conservation and Land Use Management (3 cr)

**Technical Communication**

**Minor Only**

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 21 credits.

**Prerequisite Courses**

Rhet 1101 (or 1152), 1223, and 3562 (do not count toward credits required for the minor)

**Required Courses**

Rhet 3257—Scientific and Technical Presentations (3 cr)

Rhet 3401—Accessing Information Through Electronic Media (3 cr)

Rhet 4511—Editing and Style for Technical Communicators (3 cr)

Rhet 5626—Advanced Technical Communication (4 cr)

Three 3xxx or higher courses

Courses should be selected in consultation with the student’s academic adviser and the major coordinator of the Scientific and Technical Communication Program.
### 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 Land-Use Management (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)
- Soil 5711—Forest Soils (2 cr)

### Sustainable Agriculture

**Minor Only**

The minor emphasizes a holistic perspective in understanding farming and food systems and solving problems in agriculture. The importance of yield and profitability are balanced by consideration of the environment and of the health and social well being of producers, consumers, and communities. The minor provides for flexibility and individuality through several electives. Students should develop their program in consultation with an adviser in one of the COAFES major programs. To complete the minor, students must complete at least 20 credits.

**Required Courses**

- Agro 4888—Issues in Sustainable Agriculture (2 cr)
- AnSc 3203 or Agro 3203—Environment, Global Food Production, and the Citizen (3 cr)
- Rhet 1315—The Land in American Experience (3 cr)

**Electives**

Courses to fulfill the remaining credit requirements of the minor may be selected from the following list; other courses may be substituted.

- AgEt 5203—Environmental Impacts of Food Production (3 cr)
- Agro 3003—Introduction to Integrated Weed Management (1 cr)
- Agro 4103 or ApEc 4103—World Food Problems (3 cr)
- ApEc 3041—Economic Development of U.S. Agriculture (3 cr)
- Ent 3001—Insects and Insect Management (1 cr)
- FScN 3615—Socio-Cultural Aspects of Food, Nutrition, and Health (3 cr)
- Hort 4072—Growing Plants Organically: What It Means to Be Green (3 cr)
- Hort 5031—Sustainable Fruit and Vegetable Production Systems (4 cr)
- Soil 3221—Soil Conservation and Land-Use Management (3 cr)
- Soil 3612—Soil and Environmental Biology (3 cr)
- PlPa 1001—Microbes, Plants, and People: The Social and Economic Impact of Plant Disease (3 cr)
- PlPa 3001—Plant Disease Biology and Management (1 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**

- CE 4541—Environmental Water Chemistry (4 cr)
- EEB 4601—Limnology (3 cr)
- Geo 5701—General Hydrogeology (4 cr)
- FR 4114—Forest Hydrology and Watershed Management (3 cr)
- Soil 5232—Soil Physics (3 cr)
- Soil 5555—Wetland Soils (3 cr)

**Electives**

- EEB 4605—Limnology Lab (1 cr)
- NRES 3061—Water Quality: Management of a Natural Resource (3 cr)
- FR 5153—Forest and Wetland Hydrology (3 cr)
- EEB 4601—Limnology (3 cr)
- Geo 5701—General Hydrogeology (4 cr)
- Soil 4216—Contaminant Hydrology (2 cr)
- Soil 5555—Wetland Soils (3 cr)
- Soil 5232—Soil Physics (3 cr)
- Soil 5211—Biometeorology (3 cr)
- GeoE 4351—Ground Water Mechanics (3 cr)
- WRS 5001—Field Methods in Water Resources (3 cr)

### Internship Opportunities

Students are encouraged to gain knowledge and practical experience in sustainable agriculture through enrollment in a professional experience course or, less formally, through an internship with a sustainable agriculture producer or organization.