

College of Agriculture

UNIVERSITY OF MINNESOTA

BULLETIN

1994-1996



College of Agriculture
A great place to...

College of Agriculture

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(students entering the College of Agriculture with fewer than 39 credits)

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A Message From the Dean

I am glad you have chosen to learn more about the College of Agriculture. Nowhere will you find a faculty, staff, or facilities better suited or more firmly dedicated to excellence in undergraduate education. We often boast of our past, of the more than 100 years over which we have grown into one of the world's most revered learning and research centers. But it is the future that really fuels our enthusiasm.

It is an exciting time to enter the world of agriculture. Demand is high for qualified graduates ready to tackle tough issues in the production of food, the assurance of its quality and safety, and the environmental consequences of meeting the world's ever increasing nutritional needs.

The College of Agriculture equips students with a comprehensive view of not only the world of agriculture, but the world beyond, as well. To meet the challenges of an industry that is so diverse, our students need to encounter the many aspects of food and fiber, from production to consumption, from marketing and storage to transportation and processing.



Of course, a full understanding of such intricate concepts requires the skill and expertise of practicing authorities. Here is the real strength of our program—experts respected worldwide for their skill in generating and transferring cutting-edge knowledge in all phases of our industry.

The curricula outlined in this bulletin add up to what we firmly believe is the finest program of

its kind available to motivated undergraduates. College of Agriculture programs cover the agricultural industries in detail: finance; communications; engineering; education; sales; marketing; and a host of basic and applied biologies, including plant and animal breeding, environmental science, production management, nutrition, food science, and biotechnology.

The College of Agriculture also affords students a number of opportunities to grow outside the classroom as they work closely with faculty advisers to tailor their educations to their personal interests and goals. Participation in department and professional clubs and judging teams is available, as are opportunities for enlightening internships and employment.

I think you will agree that the College of Agriculture is an outstanding place to grow: academically, personally, and professionally. You have the opportunity to share our strength, tradition, and vision.

Richard Jones
Dean, College of Agriculture

A great place to....

...Look Back

On March 10, 1858, a bill drafted for the Minnesota Legislature, establishing an agricultural college in Glencoe, Minnesota, became law. There were to be two terms: a long summer term, April to October, and a short winter term, December to February. The students were to do three to four hours of manual labor each day on the farm, and tuition was to be free. A contract to construct a college building in Glencoe would have been signed in February 1861, but Governor Ramsey was in Washington, D.C., meeting with President Lincoln offering the first Minnesota Infantry Regiment for the defense of the Union. Plans for the College at Glencoe lay dormant during the Civil War.

In 1866, after several disputes over the use of land granted to Minnesota through the terms of the Morrill Land Grant Act, it was agreed that Glencoe was too remote for an agricultural college. The Reorganization Act of February 18, 1868, provided that the regents of the University of Minnesota were to secure suitable land near the University's Minneapolis campus for an agricultural college and experimental farm.

Regent John Pillsbury, who held title to a piece of land east of the University, sold the land to the University for his cost. The land straddled University Avenue starting at Oak Street and continued east to the foot of the hill in Prospect Park. The land was sandy and swampy and little of it was suitable for farming. In 1873, President William Watts Folwell, the University's first president, reported, "So far as I am aware, not a single young man has come to the University desirous to learn the science of farming." Historian James Gray indicated that "on that arid soil of the University farm, nothing was sown but dissension and nothing reaped but problems."

In 1882, a new farm was purchased four miles east of the Minneapolis campus—155 acres for \$200 per acre. The old farm had cost \$8,500 and was sold for \$150,000. The proceeds were used to buy the new farm for \$59,000 and paid for at least four buildings: a farmhouse, a main barn, an experimental station building, and the home building for the School of Agriculture.*

More than 110 years later, thousands of students have come to study at the College of Agriculture (COA). In 1993-94, nearly 900 students were enrolled in undergraduate programs. The student body has a near equal split of women and men. And while some students come to learn the science of farming, 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.

The college is on the St. Paul campus. It shares the 700-acre campus with the colleges of Human Ecology, Natural Resources, Biological Sciences, and Veterinary Medicine. 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 campus also is home to the Minnesota Extension Service.

As a part of the University of Minnesota, COA is fully committed to its Land Grant mission of teaching, research and service to the citizens of Minnesota, the U.S. and the world. The college's reputation and influence stretch around the world through the work of both faculty and alumni.



...Look Forward

As a current or prospective undergraduate student, you will have access to the college's traditions and resources through the classroom and laboratory as well as through your faculty adviser. The college has a strong commitment to undergraduate education. In 1987, the faculty articulated that commitment in the following mission statement: "The goal of the College of Agriculture 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."

To help achieve this goal, the faculty of COA identified 14 objectives that students should accomplish while earning a degree in the college. These objectives are designated as learner outcomes. The establishment of the learner outcomes was the result of a joint effort by faculty, employers, and students. Employers were consulted to determine the skills they seek in recruiting COA graduates for positions in their companies or organizations. The curricula of the college have tried to ensure that students are able to meet these outcomes. Your COA education will provide you with skills needed to be an effective, responsible citizen in your workplace and community, because as a graduate of COA you should be able to:

- Demonstrate fundamental knowledge in the biological and physical sciences.

- Communicate effectively and use communication technologies.
- Evaluate and integrate diverse viewpoints or data.
- Make responsible judgments about management of natural resources and the environment.
- Make responsible judgments on ethical and policy issues in agriculture.
- Apply global perspectives to food and agricultural issues and decisions.
- Apply a historical perspective to the role of science and technology in agriculture.
- Retrieve, analyze, and use information.
- Manage human resources and provide leadership.
- Appreciate and interpret literature and the arts.
- Solve problems in a profession.
- Demonstrate specialized expertise in at least one collegiate major.
- Develop expertise in additional areas.
- Work effectively as a team member.

...Be Advised

COA is proud of the academic advising available to students. Perhaps no other relationship that students develop with faculty on the campus can be as positive as the advising relationship.

Advisers can provide guidance and insight, advice and counsel, as well as challenge and support for students. The faculty of COA is committed to providing quality advising support for students. To accomplish that goal, almost all advising is handled by the regular faculty. COA is unique in that advisers have all volunteered to advise undergraduates and have gone through training to familiarize themselves with the curriculum as well as University policies and resources.

New students in COA are assigned an academic adviser. Your adviser will be able to help guide you through your major curriculum requirements, assist you with course selection, provide references for scholarships and employment, supervise internships, provide advice and counsel, and listen to your questions and concerns during your stay in the college. While we are committed to helping you make your way through your program in the most efficient way possible, we know there are many other opportunities available at the University of Minnesota. Your adviser will be able to provide you with information about some of those opportunities. He or she can be a valuable link in making the connections you need to take full advantage of the resources available to you on the campus and in the community.

You may change advisers if your interests or career goals change. Most students prefer to have an adviser whose specialty matches their interests.

* Condensed from Ralph E. Miller, *The History of the School of Agriculture 1851-1960* (St. Paul: University of Minnesota Institute of Agriculture, Forestry & Home Economics, 1979).





You should consult your major coordinator or the college office for information or assistance in changing advisers.

What can you do to make your advising appointments more productive? Read this bulletin and become familiar with the basic requirements and core courses of your major.

Be aware of important dates on the academic calendar. The college office publishes a quarterly update of important deadlines and other pieces of information in a newsletter called *KIOSK*. Dates for changing your grade base, dropping and adding, late withdrawal and graduation application deadlines are important, and most require some assistance from your adviser. Know what they are and try to avoid waiting until the last minute to act on them.

Make an appointment in advance of your registration date. Most advisers don't do their best advising when they are in the hallway, rushing off to class being pursued by a student who just needs to have a signature on their course registration. Faculty are busy with teaching, research, outreach, and even have other advising responsibilities. Call a couple days ahead or stop by their office to set up an appointment. If you can't make your scheduled appointment, call to cancel and reschedule.

Go to sessions prepared. Make a list of courses that you know you need to take or are considering for the next quarter. Update your program sheet if you are keeping one to include all courses you have finished. Write down your questions ahead of time so you get them answered. Use your session to review your course list or to ask about other courses. Your adviser will be willing to suggest another course to meet your program requirements, but probably won't be excited about helping you look for "something I can fit in at 11 a.m."

Don't be afraid to ask for your adviser's opinion or advice on your program of study, internships, or career plans. Their knowledge of the curriculum, the campus, and world of work can be valuable to you. Tap that resource.

What can you expect from your adviser? Your adviser will have office hours. They will change quarterly as teaching schedules change. Some faculty post their office hours on their door or you can call to find out what they are.

Your adviser will know the curriculum of your major. She/he will also have a working knowledge of most of the courses that are required. Most advisers also know some of the basic requirements about other majors or programs and can help you consider other options if your interests change.

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

Your adviser will have a record of your work. Most advisers have advising files for the students assigned to them. They get regular transcript updates of your work from the COA office.

He or she will be familiar with services and resources around the campus. They are not likely to know every detail about every program or service, but most undergraduate advisers know how to find information or can make an appropriate referral.

Your adviser could be a source for a letter of recommendation for a scholarship, job or graduate school application.

...Find Committed Teachers

In June 1994, COA faculty adopted the following teaching philosophy: "The College of Agriculture at the University of Minnesota firmly believes that an educated public, constantly increasing its knowledge, is absolutely essential for sustaining a healthy environment and safe food supply.

To establish and foster excellent teaching, faculty in the COA make these commitments:

- Teaching is our primary responsibility.
- Quality research is essential for excellent teaching—just as quality teaching is essential for quality research.
- Undergraduate and graduate education are of equal importance.
- Excellence in teaching is recognized in performance evaluation.
- Interdisciplinary and interdepartmental teaching is encouraged.
- Personalized communication between students and faculty is essential.
- Creative and innovative teaching is valued.

...Succeed

What does it take to succeed? It takes hard work. You may feel that you have heard that comment so often that it has become cliché. However, academic programs in the COA are demanding. The University of Minnesota and the COA attract excellent students. Those students make for keen competition in classes. The combination of demanding course material and strong class competition will stretch your abilities. The faculty of the college and the University have high expectations of students in their classrooms. Professors expect that students are spending time outside of class reading and completing class assignments. The well-worn adage of spending two hours of study or preparation for every hour of class time is still valid.

Get to know your instructors or teaching assistants. All have office hours and are available to help outside of regular class hours. Some may ask that you call for an appointment, while others are available for walk-ins. Most professors will list their office hours or will provide information for reaching them outside of class on the course syllabus they distribute at the beginning of the quarter. If you are having trouble with a class, get help early.

Form a study group in your classes. It is a great way to make new friends and be more

efficient in studying and learning. Check with other students in your class, roommates, or acquaintances in your residence hall or where you live to see if they would be interested in forming a study group. Members of a study group can often help one another with problems or difficult concepts.

Learn about the resources available to you on the campus. The University is a big place, but that size brings with it resources. Several departments and service offices have tutors available for students who are seeking help. There are also service areas and offices that will help students with the development of study skills or time management skills. It is often some of the best students who figure out how to access that help.

Keep your priorities in order. Many students have jobs. Keeping jobs and school in balance is often a challenge. If you work more hours, you may have to cut back on the number of class hours you carry. If you want to carry a full class schedule, then you need to keep your number of work hours down. For most students carrying a full-time course load, 15-20 hours of work a week should be the maximum.

...Get Started

All new COA students, whether entering freshmen or transfer students, are mailed an invitation to an orientation-registration program. At this program, in addition to becoming acquainted with the campus, students receive general information about the college and the University, and have an opportunity to meet with a faculty adviser in the academic area they have chosen. Advisers help students select and register for courses.

Registration—Registration is done quarterly, and students have the option of early registration. Early registration normally begins about the eighth week of the quarter for the following quarter. Effective winter quarter 1995, all students will have the option of doing on-line registration from any computer that can be linked to the University's public access information system. That system is available through University student computer labs or can be accessed via modem from students' homes. Registration will also continue to be available in the Office of the Registrar, 130 Coffey Hall.

The *Class Schedule* is available each quarter in the COA office and in the Office of the Registrar, 130 Coffey Hall. The *Class Schedule* lists University day school courses throughout the University of Minnesota complete with hours, rooms, instructors, prerequisites, registration instructions, fees, maps, final exam schedules, grading definitions, and other valuable information. Students should also check with the COA office for other registration materials that are specific to the College of Agriculture.

Evening and summer courses are featured in the *Continuing Education and Extension Classes*



Bulletin and Summer Session Bulletin, respectively. Separate bulletins are also published for other University colleges. Most can be obtained from the Office of the Registrar, 130 Coffey Hall.

Majors—As you look at the list of majors for COA they may appear different from what you expected. They may not match the language or titles that you have heard from other sources. The college's 10 majors represent a bold new way of approaching education for agriculture. The majors, all of them interdisciplinary, incorporate teaching resources from many academic departments, and offer you the broad base of knowledge you will need for the dynamic future of agriculture. You will find a matrix listing general interests and occupations with corresponding majors and primary COA departments on the following page. Detailed information about each follows in the next sections of this bulletin.

Key to Majors

AgBu Ag Business Management

AgEd Ag Education

AgEng ... Ag Engineering

AnPI Animal and Plant Systems

AIM Ag Industries & Marketing

ApEc Applied Economics

FdSc Food Science

ES Environmental Science

Nutr Nutrition

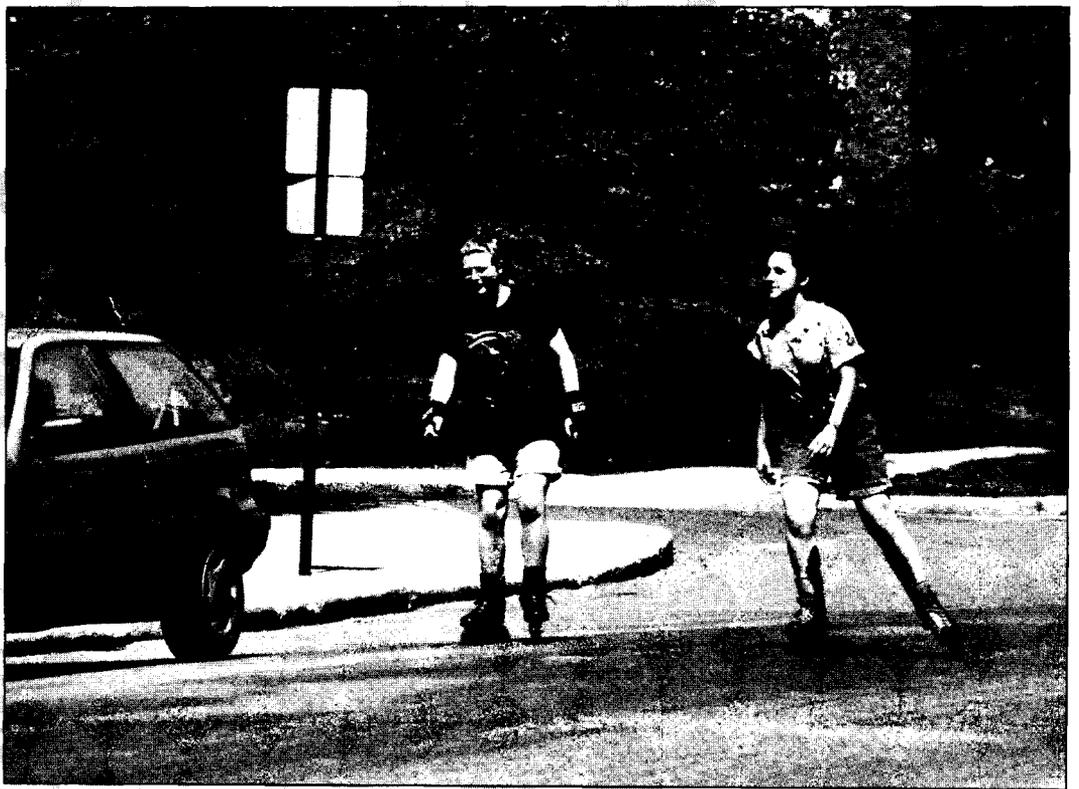
PreLA Pre-Landscape Architecture

ScAg Science in Agriculture

STC Scientific & Technical Communication

Finding your way around the College of Agriculture

Interests	COA majors	Occupations	Primary COA departments
Animals	AgEng, AnPI, ScAg	Animal breeder, Designer of animal housing, Animal nutritionist, Dairy inspector, Equipment designer	Animal Science, Agricultural Engineering
Animal production (beef, dairy, poultry, swine)	AIM, AnPI, ScAg, AgEd	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	Animal Science, Agricultural Education
Biotechnology	AgEng, FdSc, ES, ScAg	Lab technician, Scientist, Bioremediation specialist	Agronomy & Plant Genetics, Ag Engineering, Animal Science, Food Science & Nutrition, Horticulture, Soil Science
Business and financial management	AIM, AgBu, ApEc, AgEd	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	Agricultural and Applied Economics, Agricultural Education
Climate	ES, AgEng, ScAg	Climatologist, Meteorologist, Remote sensing systems designer, Weather historian	Agricultural Engineering, Soil Science
Communication	AgEd, AIM, STC	Group process facilitator, Interviewer, Extension specialist, Educator, State and county fair manager, Agricultural journalist, Public relations, Breed association and special interest groups promotion and public relations	Agricultural Education, Rhetoric
Field crop production (corn, soybeans, wheat, oats, barley, sunflowers, hay, flax)	AIM, AnP, ScAg, AgEd	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	Agricultural Engineering, Agronomy & Plant Genetics, Entomology, Plant Pathology Soil Science
Environmental horticulture (landscape, nursery, floriculture)	AnPI	Landscape design and management, Nursery/garden center management and production, Floral designer, Flower and foliage grower	Entomology, Horticultural Science, Plant Pathology, Soil Science
Environmental science	AgEd, AgEng, ES, ScAg	Soil scientist, Environmental protection analyst, Waste manager, Recycling specialist, Environmental scientist, Bioremediation specialist	Agricultural Education, Agricultural Engineering, Soil Science
Food	FdSc	Food product developer, Production manager, Quality control supervisor, Food inspector, Technical service representative	Food Science and Nutrition
Food processing and food safety	AgEn, FdSc	System designer for handling and preparing food, engineer for transporting and storing grain and feed, Packaging consultant, Plant manager	Agricultural Engineering, Food Science and Nutrition
Horticultural food crops (fruits, vegetables)	AIM, AnPI, ScAg	Vegetable grower, Orchard manager, Greenhouse or garden center worker, Nursery stock producer, Plant breeder, Arboretum assistant, Bedding plant grower	Agronomy & Plant Genetics, Horticultural Science, Soil Science
Human nutrition	Nutr	Dietitian, Nutrition educator, Hospital consultant, Medical student	Food Science and Nutrition
Insects	AIM, AnPI, ScAg	Crop/environmental consultant, Research biologist, Biological control specialist, Technical/sales representative, Public health inspector, Commercial honey producer, Plant health care specialist	Entomology, Plant Pathology
International agriculture	AgBu, AgEd, ApEc, FdSc, Nutr	Peace Corps volunteer, Agricultural development specialist, International trade economist	Agricultural & Applied Economics, Agricultural Education, Food Science and Nutrition
Landscape design	AnPI, PreLA	Landscape architect, Site planner, Urban planner, Recreation consultant, Landscape designer	Horticultural Science, Landscape Architecture (CALA)
Plants	AnPI, ScAg	Plant breeder, Nursery/greenhouse manager, Plant health care specialist	Agronomy & Plant Genetics, Entomology, Horticultural Science, Plant Pathology, Soil Science
Sales and marketing	AgBu, ApEc, AIM, AgEd, FdSc	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	Agricultural & Applied Economics, Agricultural Education, Food Science and Nutrition, Rhetoric
Soil and water resources	AgEng, AnPI, ES, ScAg	Pollution control agent, Land/water use planner, Waste manager, Fertilizer sales representative, Landscape designer, Irrigation and drainage system designer, Conservationist, Soil scientist	Agricultural & Applied Economics, Agricultural Education, Agricultural Engineering, Soil Science
Teaching	AgEd	Middle, high school or adult agriscience/agribusiness teacher, Natural resources, horticulture, agrimechanics teacher, Extension educator, Peace Corps volunteer, International development agent, IFFA and 4H adviser, Environmental education teacher, Nature or environmental center educator	Agricultural Education
Technical Communication	STC	Technical writer, Scientific illustrator, Educational video producer, Document designer, Manager of telecommunications, Training and development specialist	Rhetoric
Turfgrass	AnPI	Golf course superintendent, Grounds maintenance, Athletic facilities manager, Lawn service owner	Entomology, Horticultural Science, Plant Pathology, Soil Science
Veterinary medicine	ScAg	Veterinarian	Animal Science



New Entering Freshman Students

Beginning fall quarter 1994, students enrolling for the first time in the University of Minnesota with less than 39 quarter credits will be required to complete the University's new liberal education requirements. Those requirements are outlined on the following page. Students will need to consult with their adviser and the quarterly printed *Class Schedule* to determine which University courses have been approved to meet the liberal education core and designated theme requirements.

The College of Agriculture (COA) 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. *Note:* Several courses listed under the designation of foundation and professional courses in each major will also meet the liberal education requirements.

For each COA major, physical science, biological science, and mathematics courses required in the lower division will apply to the liberal education core categories of physical and biological sciences, mathematical thinking, and/or the designated theme requirements. Several of the majors also require specific courses that can be applied to the core categories of history and social sciences, the arts and humanities, and/or the designated theme requirements. Because of the high value placed on effective communication skills, all COA majors require courses in writing and speaking.

Students should work closely with their adviser to make efficient use of their time in meeting both major and liberal education requirements.

Transfer students, see transfer information on page 30.

Liberal Education Requirements

(effective fall 1994 and later for students enrolling with 38 or fewer credits)

A liberal education introduces you to the modes of inquiry and subject matter of the major branches of knowledge, including the factual information and theoretical or artistic constructs that form their foundations; the "ways of knowing"—the kinds of questions asked and how insight, knowledge, and data are acquired and used; the changes over time of their central ideas or expressive forms; and the interrelationships among them and with human society in general. To these ends, study by all undergraduate students on the Twin Cities campus is guided by a common framework.

The Diversified Core Curriculum

Physical and Biological Sciences. Comprehension of physical and biological principles; understanding of and ability to use the methods of scientific inquiry—the ways in which scientists investigate physical and biological phenomena; and appreciation of the importance of science and the value of a scientific perspective.

Requirement: A minimum of three courses totaling at least 12 credits, including one course with a laboratory or field experience in the physical sciences and one course with a laboratory or field experience in the biological sciences.

History and Social Sciences. Knowledge of how historians and social scientists describe and analyze human experiences and behavior; study of the interrelationships among individuals, institutions, structures, events, and ideas; understanding of the roles individuals play in their historical, cultural, social, economic, and political worlds.

Requirement: A minimum of three courses totaling at least 12 credits, including one course with historical perspective.

Arts and Humanities. Understanding of approaches to the human condition through works of art, literature, and philosophy; knowledge of how artists create and humanistic scholars think; ability to make aesthetic judgments.

Requirement: A minimum of three courses totaling at least 12 credits including courses in two of the following: literature, philosophical perspective, and visual or performing arts.

Mathematical Thinking. Acquisition of mathematical modes of thinking; ability to evaluate arguments, detect fallacious reasoning, and evaluate complex reasoning chains; appreciation of the breadth of applications of mathematics and its foundations.

Requirement: A minimum of one course totaling at least four credits.

The Designated Themes of Liberal Education

The designated themes of liberal education offer a dimension to liberal learning that complements the diversified core curriculum. Each of the themes focuses on an issue of compelling importance to the nation and the world, the understanding of which is informed by many disciplines and interdisciplinary fields of knowledge.

Requirement: A minimum of six courses (or five courses if one includes an approved practicum), including one course in each of the following:

Cultural Diversity. Understanding of the roles gender, ethnicity, and race play in structuring the human experience in and developing the social and cultural fabric of the United States.

International Perspectives. Comprehension of the ways in which you are part of a rapidly changing global environment dominated by the internationalization of most human endeavors.

Environment. Knowledge of the interaction and interdependence of the biophysical systems of the natural environment and human social and cultural systems.

Citizenship and Public Ethics. Reflection on and determination of a clearer sense of your present and future civic relationships and your obligations to the community.

Writing Skills (effective 1995)

The ability to communicate effectively is a hallmark of a liberally educated individual and a key to a successful and satisfying life. To encourage refining of writing skills, the liberal education curriculum includes both writing courses and writing across the curriculum.

Requirement: one writing course and four courses certified as writing intensive.

You may satisfy the liberal education requirements with a number of courses and credits different from those of other students because some courses serve multiple goals in the curriculum; e.g., some courses will satisfy a diversified core requirement and a designated theme requirement, and other courses will satisfy the requirements for each of two themes. Thus, you may satisfy the designated theme requirements with a smaller number of courses than is stated in the requirement. Each quarter, the *Class Schedule* will publish the requirements and list all courses that satisfy them. In addition, the *Class Schedule* will list which of these courses are offered that quarter and which are tentatively scheduled for the subsequent quarters during the academic year.

Agricultural Business Management

Dr. Vernon Eidman, Major Coordinator
 316 Classroom Office Building
 1994 Buford Avenue
 St. Paul, MN 55108
 612/625-5229

The Agricultural Business Management major is offered jointly by COA and the Carlson School of Management. The Agricultural Business Management curriculum emphasizes the use of concepts and methods from economics and business management in the identification, analysis, and solution of management problems related to food, agriculture, natural resources, and economic development. The program provides a balance between agricultural and applied economics and business administration studies, with a limited amount of agricultural science. Students may elect a variety of courses in their junior and senior years to accommodate special interests and career goals.

Graduates of this curriculum are prepared for a wide range of employment opportunities in agribusiness. Examples of employment areas include commodity trading and analysis, finance, management, marketing, sales management, administration, public and industrial relations, production management, economic and statistical analysis, managerial accounting, and transportation analysis.

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

Admission to the Major

Students are admitted to the major after satisfactory completion of a Pre-Agricultural Business Management program. Admission standards are developed in conjunction with the Carlson School of Management. Application deadlines are June 15 for fall quarter, October 15 for winter quarter, and January 15 for spring quarter.

To be considered for admission to the Agricultural Business Management major you must meet the following requirements:

- 1) Complete or have in progress coursework to total 85 credits by the time of admission.
- 2) Complete the following management "tool" courses on an A-F grading basis by the time you enter the program:
 - Acct 1050 or AgEc 1250
 - AgEc 1101, 1102 or Econ 1101, 1102
 - IDSc 1010 and OMS 1020
 - Math 1142 or 1251
- 3) Earn a minimum GPA of 2.80 in all coursework.
- 4) Earn a minimum GPA of 2.5 in the tool courses and at least a C in each course.

COA students planning to major in Agricultural Business Management who have not completed the Pre-agricultural Business Management program are assigned a faculty adviser but retain a 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 Business Management program in 316 Classroom Office Building, or from the College Office, 277 Coffey Hall.

Major Requirements

Agricultural Business Management students must complete the requirements listed below. Consult with your adviser to determine a suitable sequence for completing the required courses. Course substitutions in the professional requirements can be made only with the approval of your adviser and the Agricultural Business Management Major Coordinator.

Liberal Education Diversified Core and Designated Themes (40 credits)—See the Liberal Education statement on page 8 and information at the beginning of this section.

Foundation Requirements

Communication

- Rhet 1101—Writing to Inform and Persuade (4)
- Rhet 1104—Library Research Methods (1)
- Rhet 1151—Writing in Your Major (4)
- Rhet 1222—Public Speaking (4)
- Rhet 3562—Writing in Your Profession (4)

Mathematics and Science

- Biol 1009—General Biology (5)
- Chem 1001—General Principles of Chemistry (4)
 or Chem 1051 Chemical Principles (4)
- Math 1142—Short Calculus (5)
 or Math 1251—One-Variable Differential and Integral Calculus (4)

Plus one from the following:

- BioC 1401—Elementary Biochemistry (4)
- Biol 1103—General Botany (5)
- Biol 1106—General Zoology (5)
- Chem 1002—Elementary Organic Chemistry (4)

Professional Requirements

From the College of Agriculture

- AgEc 1000—Orientation to Agricultural and Applied Economics (1)
- AgEc 1101*—Principles of Microeconomics (4)
- AgEc 1102*—Principles of Macroeconomics (4)
- AgEc 3001—Applied Microeconomics: Consumers and Markets (4)
- AgEc 3002—Applied Microeconomics: Managerial Economics (4)
- AgEc 3006—Applied Macroeconomics: Government (4)
- AgEc 3007—Applied Macroeconomics: Policy (4)
- AgEc 3240—Strategic Management of Farms and Agribusinesses(4)
- AgEc 3260—Operations Management of Farms and Agribusinesses(4)
- AgEc 3400—Markets, Marketing and Prices (4)
- AgEc 3500—Agribusiness Finance (4)
- Plus two elective courses in agricultural economics (an internship or special project is encouraged).

An additional 16 credits is required in agricultural science. At least one course must be 3xxx or 5xxx. Courses in agricultural education, fisheries and wildlife, landscape architecture, rhetoric or physical and biological sciences may not be used to meet this requirement. In agricultural engineering, only AgET 3603 and AgET 5400 may be used.

From the Carlson School of Management

- Acct 1050—Introduction to Financial Reporting (4)
- Acct 3001—Introduction to Managerial Accounting (4)
- IDSc 1010—Fundamentals of Informational Development and Use (4)
- OMS 1020—Data Analysis and Statistical Inference for Managers (4)
- Mgmt 3001—Fundamentals of Management (4)
- Mktg 3000—Principles of Marketing (4)

Plus three elective courses in the Carlson School of Management.

* For this major AgEc 1101 and 1102 cannot be counted as part of the liberal education requirement.

Emphasis Areas (16 credit minimum)**1. Business Management**

- BFin 3100—Financial Management (4)
- Choose additional credits from the following*
- Acct 3201—Intermediate Management Accounting (4)
- AgEc 3450—Agricultural Input Marketing Economics (4)
- AgEc 3920—Agricultural Law (4)
- AgEc 5440—Cooperatives and Agribusiness Organization (4)
- BLaw 3058—Introduction to Law, Law of Contracts and Sales Contracts (4)
- IR 3002—Personnel and Industrial Relations (4)
- IR 3010—The Individual and the Organization (4)
- Mgmt 3002—Psychology in Management (4)
- Mgmt 3008—Entrepreneurship and the Smaller Enterprise (4)
- OMS 3056—Production and Inventory Management (4)

2. Commodity and Farm Input Marketing

- AgEc 5480 Futures Markets and Prices (4)
- LM 3000 Introduction to Logistics Management (4)
- Choose additional credits from the following:*
- AgEc 3420—Grain Marketing Economics (4)
- AgEc 3430—Dairy Marketing Economics (4)
- AgEc 3440—Livestock and Meat Marketing Economics (3)
- AgEc 3450—Agricultural Input Marketing Economics (4)
- AgEc 5400—Intermediate Market and Price Analysis (4)
- AgEc 5750—Agricultural Trade and Commercial Policies (3)
- LM 5020—Advanced Logistics Management(4)

3. Finance and Banking

- AgEc 5500—Financial Markets and Agricultural Credit Institutions (4)
- BFin 3100—Financial Management (4)
- Choose additional credits from the following*
- Acct 3201—Intermediate Management Accounting (4)
- Acct 5160—Financial Statement Analysis (4)
- AgEc 3920—Agricultural Law (4)
- AgEc 5480—Futures Markets and Prices (4)
- BFin 3300—Investment Management and Financial Markets (4)
- BFin 3601—Bank Financial Management (4)
- Econ 5432—International Finance (4)
- Ins 5100—Risk Management and Insurance (4)

4. Food Marketing

- AgEc 5550—Food Marketing Economics (4)
- Mktg 3020—Marketing Operations Management (4)
- Choose additional credits from the following:*
- AgEc 5480—Futures Markets and Prices (4)
- AgEc 5580—Human Capital and Household Economics (3)
- AgEc 5750—Agricultural Trade and Commercial Policies (3)
- FScN 3400—Food Communication Techniques (3)
- FScN 3472—Food Selection Principles (4)
- FScN 5390—Introduction to Food Law (4)
- Mktg 3010—Buyer Behavior and Market Analysis (4)
- Mktg 3030—Sales and Distribution Management (4)
- Mktg 3050—Marketing Communications (4)
- Mktg 3065—Retail Management (4)

5. Individualized Area of Emphasis

Students preparing for career opportunities that emphasize skills such as communication, law, or information systems may use this alternative to design an area of emphasis. A program of study under this emphasis must be approved by the adviser and the major coordinator. At least 12 of the 16 credits must be completed after receiving approval.

Electives to reach 180 credits required for graduation with a bachelor of science degree.



Agricultural Education

*Dr. Roland Peterson, Major Coordinator
320 Vocational and Technical Education
1954 Buford Avenue
St. Paul, MN 55108
612/624-4736*

The undergraduate major in agricultural education, offered jointly by COA and the College of Education, is for students who plan to teach agriscience, agriculture, horticulture, agribusiness, food systems, or natural resource management education in public schools, technical colleges, or community colleges, and for those who plan to work in educational positions in agricultural development or in various agricultural-related organizations. The program provides comprehensive education for those preparing for teaching; extension work; local, national, and international development; other professional careers in sales and marketing; financial management; or production agriculture. The program requires a broad study of agriculture and permits emphasis in animal science, crop science, agricultural economics, agricultural business, horticulture, soils, natural resources, and agricultural engineering technology. The program's education specialization and natural and managed environmental systems specialization offer preparation in education necessary to qualify for licensure as a teacher of agriculture, horticultural science, agribusiness, agriscience education, and natural resources.

Admission Procedures

Students may enter a pre-agricultural education major in COA as freshmen or transfer students. Students must earn 90 credits in the pre-agricultural education major before transferring to the College of Education. Students should apply for admission to the College of Education in the final quarter of their sophomore year. This application may be completed with the faculty of Agricultural Education, 325 Vocational Technical Education Building. Students must complete the application requirements as directed by the Agricultural Education staff. Applications must be submitted within the first three weeks of the quarter preceding the desired quarter of admission.

The Natural and Managed Environmental Systems Specialization and the Agricultural Education Specialization—Students in these specializations will be eligible to teach agriculture, horticulture, natural resources, forestry, agribusiness, agriscience, food systems, and agricultural mechanics at the secondary or post-secondary levels and adult farm business management education with the agricultural education specialization provided they have the appropriate work experience to accompany their degree. In addition, graduates from this specialization may seek employment in all of the other areas listed in the general features section.

To be eligible for admission to the natural and managed environmental systems or the agricultural education specializations in the College of Education, students must have a minimum overall GPA of at least 2.50. Prior to admission, students will be required to complete the Pre-Professional Skills Test (PPST) which is a test of basic reading, writing, and mathematics knowledge.

The Agricultural Development

Specialization—Students in this specialization will be eligible for a wide range of positions in agricultural development. They will guide the process of change for improving an individual, organization, community, or society within the context of agriculture. They may seek employment in all fields listed in the general features section except teaching. This specialization provides an emphasis in experiential education in both the production and agribusiness phases of agriculture.

To be eligible for admission to the Agricultural Development Specialization in the College of Education, you must have a minimum overall GPA of at least 2.30.

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

Transfer students who have completed two or more years of college work apply for admission to the College of Agriculture, Office of Admission and Records, University of Minnesota, 130 Coffey Hall, 1420 Eckles Avenue, St. Paul, MN 55108. The COA will review the application and evaluate the credits earned. During the first quarter of enrollment in COA, students will apply for admission to the College of Education.

Clinical Experience—In the natural and managed environmental systems and the agricultural education specializations, students must have an overall GPA of 2.50 to be eligible for clinical experience.

Graduation Requirements—Students must have an overall GPA of 2.50 to meet graduation requirements in the natural and managed environmental systems and agricultural Education specializations. They must have an overall GPA of 2.30 to graduate from the agricultural development specialization.

Work Experience—Students applying for licensure must have satisfactory work experience in agriculture production and agribusiness. In general, students will be expected to verify at least 2,000 hours of work experience in production and agribusiness agriculture.

Major Requirements—Students majoring in agricultural education must complete the liberal education requirements listed below. Changes in the education categories require the approval of

the adviser and the College of Education. Changes in the agriculture and natural resources categories may be made with the adviser's recommendation and approval of the agricultural education coordinator.

Liberal Education Diversified Core and Designated Themes—See the Liberal Education statement on page 8 and information at the beginning of this section.

Foundation Requirements

- Writing two courses (8)
- Oral Communication two courses (8)
- One mathematics course—check specialization
- Psy 1001—Introduction to Psychology (4)
- Biol 1009—General Biology (5)
- Phys 1041—General Physics (5)
- Chem 1001, 1002—General Principles of Chemistry (4,4)
or Chem 1051, 1052 Chemical Principles I, II (4,4)
- Biol 1103—General Botany (5)
or Biol 1106—General Zoology (5)
- BioC 1401—Elementary Biochemistry (4)
or Chem 3301—Organic Chemistry I (4)

Professional Requirements

- AgEd 1001—Introduction to Agricultural Education (1)
- AgEd 1002—Principles of Career Planning in Agriculture (1)
- AgEd 3029—Directed Experience in Agricultural Education (1)

Emphasis Areas

1. **Agricultural Education** (Teacher Licensure Program)
Math 1031—College Algebra and Probability (4)

General Education

- EPsy 5119—Learning and Cognitive Foundations of Education (4)
- EPsy 5139—Interpersonal and Personality Effects on Learning (4)
- EPsy 5229—Classroom Assessment Methods (2)
- EdPA 5090—School and Society (3)
- Kin 5530—Biological Foundations of Education (2)
- PubH 3004—Basic Concepts in Personal and Community Health (5)
or PubH 3001—Personal and Community Health (3)
and PubH 3003—Fundamental of Alcohol and Drug Abuse (2)

Agricultural Education

- AgEd 5028—Teaching Methods in Agricultural Education (5)
- AgEd 5049—Agricultural Education for Adults (3)
- AgEd 5061—Program Planning and Evaluation (3)
- AgEd 5072—Practicum: Agricultural Business and Industry (3)
- VoEd 5100—Clinical Experience (2,2,8)
- VoEd 5300—Philosophy and Practice of Vocational Education (3)
- VoEd 5330—Coordination Techniques in Cooperative Education (3)

Animal Science (14 credits)

Applied Economics/Business (20 credits)

- AgEc 1101—Principles of Microeconomics (4)
- BIE 3060—Professional Sales Management (3)
or GC 1537—Professional Selling (3)
plus 13 additional credits in Marketing, Management (1 course), and Accounting (1 course)

Mechanical Technology and Environment (6 credits)

- AgEd 1042—Current Technical Competencies (3)
- AgEd 5042—Agricultural Mechanics (3)

Natural Resources (9 credits)

Plant Science/Plant Pathology or Entomology (12 credits)

- Soil 1020—The Soil Resource (5)
or Soil 3125—Basic Soil Science (5)

Electives to complete the 198 credits required for a bachelor of science degree.

2. **Agricultural Development**

- Math 1031—College Algebra and Probability (4)

General Education

- AdEd 5401—Adult Learning and Development Through the Life Span (3)

Agricultural Education

- AgEd 5010—Rural Development Leadership (3)
- AgEd 5021—Education Through Extension Methods (3)
- AgEd 5023—Extension Methods for Developing Countries (3)
- AgEd 5025—Extension Program Development (3)
- AgEd 5055—Methods in Farming Systems Research and Extension (3)

Plus 10 credits from the following:

- AgEd 3001—Experiential Learning: Production Agriculture (0-10)
- AgEd 3002—Experiential Learning: Agricultural Business (0-10)

Development

Two from the following:

- AgEc 3070—Agriculture and Economic Growth in Developing Countries (4)
- AgEc 5790—World Food Problems (3)
- Econ 5401—International Economics (4)
- Pol 3477—Political Development (4)
- Pol 3835—The International System (4)

Two from the following:

- AgEc 3006—Applied Macroeconomics: Government and the Economy (4)
- AgEc 3007—Applied Microeconomics: Trade, Policy and Development (4)
- AgEc 3040—Economic Development of American Agriculture (4)
- AgEc 3610—Resource Development and Environmental Economics (4)
- Econ 5301—Economic Development (4)
- Econ 5307—Comparative Economic Systems (4)
- F&ScN 1102—Technology of Food Processing (4)
- F&ScN 1612—Principles of Nutrition (4)

Animal Science (7 credits)

Agricultural Economics (18 credits)

- BIE 3060—Professional Sales Management (3)
or GC 1537—Professional Selling (4)
- AgEc 1250—Principles of Accounting (4)
or Acct 1050—Principles of Accounting (4)
- AgEc 3810—Principles of Farm Management (4)

Plus select two courses from the following:

- AgEc 3420—Grain Marketing Economics (4)
- AgEc 3430—Dairy Marketing Economics (4)
- AgEc 3440—Livestock and Meat Marketing Economics (3)
- AgEc 3450—Agricultural Input Marketing Economics (4)
- AgEc 5440—Cooperatives and Agribusiness Organizations (4)
- AgEc 5480—Futures Markets and Prices (4)

Mechanical Technology and Environment (5 credits)

Natural Resource Management (6 credits)

Plant Science or Plant Pathology or Entomology (12 credits)

Soil Science (5 credits)

- Soil 1020—The Soil Resource (5)
or Soil 3125—Basic Soil Science (5)

Electives to complete the 198 credits required for a bachelor of science degree.

3. **Natural and Managed Environmental Systems**

(Teacher Licensure Program)

- Math 1142—Short Calculus (5)
or Math 1251 and 1252 One-Variable Differential and Integral Calculus I, II (4,4)

Stat 3011—Statistical Analysis (4)

or Agro 3060—Field Plot Design in Agronomy (4)

Geol 1001—The Dynamic Earth: An Introduction to Geology (4)

or Geol 1111—Introductory Physical Geology (5)

EEB 3001—Introduction to Ecology (4)

General Education

- EPsy 5119—Learning and Cognitive Foundations of Education (4)
- EPsy 5139—Interpersonal and Personality Effects on Learning (4)
- EPsy 5229—Classroom Assessment Methods (2)
- EdPA 5090—School and Society (3)
- Kin 5530—Biological Foundations of Education (2)
- PubH 3004—Basic Concepts in Personal and Community Health (5)
or PubH 3001—Personal and Community Health (3)
and PubH 3003—Fundamental of Alcohol and Drug Abuse (2)

Agricultural Education

- AgEd 5028—Teaching Methods in Agricultural Education (5)
- AgEd 5061—Program Planning and Evaluation (3)
- AgEd 5072—Practicum: Agricultural Business and Industry (3)
- VoEd 5100—Clinical Experience (2,2,8)
- VoEd 5300—Philosophy and Practice of Vocational Education (3)
- VoEd 5330—Coordination Techniques in Cooperative Education (3)

Animal Science (6 credits)

- AnSc 3401—Principles of Animal Nutrition (4)
- Select two from the following:
- AnSc 1301—Management Technique: Swine (1)
- AnSc 1302—Management Technique: Sheep (1)
- AnSc 1303—Management Technique: Beef (1)
- AnSc 1304—Management Technique: Dairy (1)
- AnSc 1305—Management Technique: Poultry (1)

Soil and Plant Science (25 credits)

- Soil 1020—The Soil Resource (5)
- or Soil 3125—Basic Soil Science (5)
- Soil 3220—Soil Conservation and Land Use Management (4)
- or Soil 3416—Soil Fertility (4)
- Soil 1425—Introduction to Meteorology (4)
- or Geog 1425—Introduction to Meteorology (4)
- AnPl 3010—Environment and World Food Production (4)
- or AnPl 5060—Integrated Management of Cropping Systems (4)
- Agro 1010—Principles of Agronomy (5)
- or Hort 1021—Woody Plant Materials (5)
- or FR 1100—Dendrology (4)

Agro 3020—Growth and Development of Field Crops (4)

or Hort 3001—Growth Regulation of Horticultural Plants (5)

Natural Resources and Environment Studies (15 credits)

One from the following:

- NRES 1010—Issues in the Environment (3)
- or FR 1201—Conservation of Natural Resources (3)
- or FW 1002—Wildlife: Ecology Values, and Human Impact (3)
- or FW 1101—Ethics and Values in Research Management (3)
- or FW 3052—Introduction to Fisheries and Wildlife (3)
- or PIPa 3004—Air Pollution, People and Plants (3)

Each of the following:

- NRES 3001—Colloquium in Natural Resources and Environmental Studies (1)
- NRES 3060—Water Quality in Natural Resource Management (3)
- or AgET 5410—Hydrology and Water Quality (5)
- NRES 5100—Problem Solving in Natural Resources and Environmental Studies (5)
- NRES 5210—Survey, Measurement, and Modeling Methods for Natural Resource Analysis (3)

Mechanical Technology and Environment (6 credits)

- AgEd 1042—Current Technical Competencies (3)
- AgEd 5042—Agricultural Mechanics (3)

Agricultural Economics/Business (8 credits)

- AgEc 1250—Principles of Accounting (4)
- or AgEc 3810—Principles of Farm Management (4)
- AgEc 3610—Resource Development and Environmental Economics (4)

Electives to reach 198 credits required for graduation with a bachelor of science degree.

Agricultural Industries and Marketing

Dr. Delane Welsch
130 Classroom Office Building
1994 Buford Avenue
St. Paul, MN 55108
612/625-3713

Industries related to modern agriculture include the manufacturers and distributors of farm production inputs (such as equipment, structures, animal feed, health products, seeds, and agricultural chemicals), and the assemblers, processors, manufacturers, and distributors of products originating in farming (such as meat, milk, eggs, wool, grains, fruits, vegetables, nursery crops, flowers, and turf) and the finance and insurance industries providing agricultural credit. These agribusiness industries employed about 18 million workers in 1988 and created nearly 16 percent of the U.S. Gross National Product that year. "Agribusinesses," such as these, regularly search for individuals who have a broad education in the scientific aspects of agriculture, effective work and communication skills, and the ability to competently use quantitative methods to solve business problems.

All departments in COA contribute to and are represented by the Agricultural Industries and Marketing (AIM) major. This educational program achieves two objectives:

- 1) it provides a broad-based educational program reflecting the academic strengths of COA and the University at large, and
- 2) it 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 an Area of Emphasis in one of five areas: animal industries, horticultural industries, crops/soils industries, food industries, or an individualized emphasis. Certified advisers assist students with course selection in their area of emphasis, identify appropriate internships or practicum experiences, and select electives to develop breadth and depth in their undergraduate programs.

In addition, this major emphasizes development of oral and written communication skills in various interactive settings. Courses in business methods and economic analysis help students recognize and solve problems in the modern agribusiness world.

The cross-disciplinary AIM major requires that students become involved in "real-world" experiences (industry internships) and/or in marketing problem-solving (marketing practicum). As students progress through the program, regular meetings with faculty, agribusiness leaders, student organizations, alumni, and fellow students are a part of the educational experience.

Major Requirements

All students in the AIM major must complete 180 credits, including the requirements listed below. Faculty advisers assist students in selecting required courses, the use of electives, and the professional project (internship or practicum).

Liberal Education Diversified Core and Designated Themes—See the Liberal Education statement on page 8 and information at the beginning of this section.

Foundation Requirements

Quantitative Foundations

Math 1142—Short Calculus (5)
or Math 1251—One-Variable Differential and Integral Calculus (4)

AgEc 1250—Principles of Accounting (4)
or Acct 1050—Introduction to Financial Reporting (5)

Plus one from the following

Stat 3011—Statistical Analysis (4)

IDSc 1010—Fundamentals of Information Development and Use (4)

Agro 3060—Field Plot Design in Agronomy (4)

Science Foundations

Biol 1009—General Biology (5)

Chem 1001—General Principles of Chemistry (4) and

Chem 1002—Elementary Organic Chemistry (4)

or Chem 1051—Chemical Principles (4) and

BioC 1401—Elementary Biochemistry (4)

Professional Requirements

Experiential

AIM 1001—Orientation: AIM (1)

xxxx5000* —Professional Experience Program (4)

or AIM 5001,5002—Marketing Practicum I, II (2,2)

One from the following:

GC 1537—Professional Selling (4)

or BIE 3260—Professional Sales Ed. (3)

* For Professional Experience Program (PEP) registration, use the four-character designator (xxxx) that represents the department in which your PEP adviser resides (i.e., AgEc 5000, Agro 5000, etc.).

Communication

Rhet 1101—Writing to Inform and Persuade (4)

Rhet 1104—Library Research Methods (1)

Rhet 1151—Writing in Your Major (4)

Rhet 1222—Public Speaking (4)

Rhet 3562—Writing in Your Profession (4)

Two from the following:

Rhet 3254—Advanced Public Speaking (4)

Rhet 3266—Communication, Discussion in Small Groups (4)

or Spch 3411—Small Group Communication Process (4)

Rhet 5258—Interviewing (4)

Business

AgEc 1101—Principles of Microeconomics (4)

AgEc 3001—Applied Microeconomics: Consumers and Markets (4)

AgEc 3002—Applied Microeconomics: Managerial Economics (4)

AgEc 3920—Agricultural Law (4)

AgEc 3400—Markets, Marketing, and Prices (4)

One from the following:

AgEc 3420—Grain Marketing Economics (4)

AgEc 3430—Dairy Marketing Economics (4)

AgEc 3440—Livestock and Meat Marketing Economics (3)

AgEc 3450—Agricultural Input Marketing Economics (4)

AgEc 5480—Futures Markets and Prices (4)

AgEc 5550—Food Marketing Economics (4)

FscN 5474—Food Marketing Economics (4)

One from the following:

AgEc 3500—Agribusiness Finance (4)

AgEc 5440—Cooperative/Ag-Bus Organization (4)

GC 1513—Small Business Fundamentals (4)

Spch 3441—Communicating Organizations (4)

Jour 3201—Principles of Advertising (4)

Agriculture

- AnSc 1100—Introduction to Animal Science (5)
- AgET 3025—Engineering Principles and Applications (4)
 - or FScN 1102—Technology of Food Processing (4)
- Agro 1010—Principles of Agronomy (5)
 - or Hort 1036—Plant Propagation (5)
- One from the following:
 - Soil 1020—The Soil Resource (5)
 - Soil 3125—Basic Soil Science (5)
 - FScN 1612—Principles of Nutrition (4)

Emphasis Areas (20-33 credits)

Contact: Leslie Hansen, Animal Science, 130 Haecker Hall

1. Animal Industries (23 credits required)

- Biol 1106—General Zoology (5)
 - or Biol 3011—Animal Biology (5)
- AnSc 3220—Principles of Animal Breeding (5)
- AnSc 3301—Systemic Physiology (6)
- AnSc 3401—Principles of Animal Nutrition (4)

One from the following:

- AnSc 5401—Swine Nutrition and Feeding (4)
- AnSc 5403—Ruminant Nutrition (4)
- AnSc 5405—Poultry Nutrition (3)

2. Crops/Soils Industries (21 credits required)

Contact: Vernon B. Cardwell, Crops/Soils, 309 Agronomy

- Biol 1103—General Botany (5)
 - or Biol 3012—Plant Biology (5)
- Agro 3020—Growth and Development of Field Crops (4)
- Soil 3416—Plant Nutrients in the Environment (4)

Plus at least 7 credits from the following:

- Agro 3030—Harvest, Storage and Utilization of Field Crops (4)
- Agro 3060—Field Plot Design in Agronomy (4)
- Agro 3130—Seed Technology (2)
- Agro 3150—Advanced Seed and Grain Evaluation (4)
- Agro 3200—Seminar (1)
- Agro 5010—Forage Production and Utilization (4)
- Agro 5020—Introduction to Plant Breeding (4)
- Agro 5030—Weed Control (5)
- Agro 5040—Corn and Soybean Management (3)
- AnPI 3010—Environment and World Food Production (4)
- AnPI 5060—Integrated Management of Cropping Systems (4)
- Ent 1005—Economic Entomology (4)
- PIPa 3001—Management and Control of Field Crop Diseases (4)
- Soil 3220—Soil Conservation and Land-Use Management (4)
- Soil 3417—Soil Fertility Laboratory (1)
- Soil 5104—Computer Applications in Soils (2)
- Soil 5510—Field Study of Soils for Environmental Assessment (4)
- Soil 5240—Microclimatology (3)
- Soil 5560—Interpretation of Land Resources (3)
- Soil 5610—Soil Biology (4)

3. Horticultural Industries (33 credits required)

Contact: Bert Swanson, Horticulture, 164 Alderman Hall

- Biol 1103—General Botany (5)
 - or Biol 3012—Plant Biology (5)
- Hort 1021—Woody Plant Materials (5)
- Hort 3001—Growth Regulation of Horticultural Plants (5)
- Hort 3002—Horticultural Cropping Systems (5)

Plus at least 13 credits from the following:

- Hort 3003—Plant Genetics and Improvement (4)
- Hort 3004—Applications of Plant Biotechnology (4)
- Hort 3030—Landscape Design of Residential and Small Commercial Sites (4)
- Hort 3040—Landscape Design and Implementation (5)
- Hort 3072—Turf Management (4)
- Hort 5026—Landscape Management (5)
- Hort 5031—Temperate Fruit Production (4)
- Hort 5034—Commercial Vegetable Agriculture (5)
- Hort 5042—Turf Grass Science (5)
- Hort 5046—Nursery Management (4)
- Hort 5047—Nursery Scheduling and Enterprise Development (2)
- Hort 5048—Nursery Management II (4)
- Hort 5054—Commercial Floriculture Crop Production (4)

- Hort 5055—Commercial Glasshouse Systems, Practices and Problems (5)

4. Food Industries (20 credits required)

Contact: Elaine Asp, Food Science and Nutrition, 261 Food Science and Nutrition

- FScN 1020—Introductory Microbiology (4)
- FScN 3102—Introduction to Food Science (4)
- AgEc 5550—Food Marketing Economics (4)
 - or FScN 5474—Food Marketing Economics (4)

Plus at least 8 credits from the following:

- FScN 3112—Food Analysis (4)
- FScN 3400—Food Communication Techniques (3)
- FScN 3472—Food Selection Principles (4)
- FScN 3730—Quantity Food Production Management (3)
- FScN 3732—Lecture in Quantity Food Production Management (2)
- FScN 5643—World Food Problems (3)
- FScN 5524—Sensory Evaluation of Dairy Products (1)

5. Individualized Emphasis (20 credits minimum)

Courses may be selected according to the student's interests in consultation with the student's adviser and with approval of the AIM major committee. Electives to reach 180 credits required for graduation with a bachelor of science degree.

Animal and Plant Systems

Dr. Bert Swanson, Major Coordinator
164 Alderman Hall
1970 Folwell Avenue
St. Paul, MN 55108
612/624-7432

The Animal and Plant Systems major prepares students to work as managers and technical advisers for animal and plant production systems, maintenance and sales. This curriculum provides a science-based agricultural education with an applied principle emphasis. Students majoring in animal and plant systems are prepared to pursue careers in animal, plant, and environmental industries through a curriculum that increases their understanding of agriculture, science, mathematics, business, and social science. Quality performance in this curriculum also allows students to pursue graduate studies in animal- and plant-related specializations.

Students majoring in Animal and Plant Systems select an area of emphasis based on their interests and career goals. The four areas available are outlined below.

Animal Production prepares students for careers in farm animal and poultry production. Career opportunities include farming, farm management, county extension work, dairy production, meat packing, farm supply, genetic and nutritional consulting, appropriate government positions, and artificial insemination.

Crops and Soils/Horticultural Food Production prepares students for careers in the production and improvement of field crops, vegetables, and fruits. Career opportunities include positions as technical representatives of agricultural chemical and seed companies, field specialists for crops, environmental protection specialists, state and federal crop regulatory agents, grain buyers and merchandisers, storage elevator operators, farm managers, field agronomists and horticulturists for production consulting firms, soil and water specialists, conservationists, and many others.

Environmental Horticulture prepares students for professional positions requiring a thorough understanding of the technical and managerial aspects of environmental horticulture. Career opportunities include floriculture; landscape design, installation, and management; nursery management and production; turf management; and urban horticulture. Students learn environmental enhancement process and management techniques required in state, city, and county agencies as well as in private industry.

Integrated Pest Management (IPM) prepares students to identify and control major insect, weed, and disease problems on principal agronomic and horticultural crops. Students emphasizing IPM learn how the environment and various cropping systems affect pests. Students learn selection and application of the most

comprehensive, cost-efficient, and environmentally safe IPM procedures. This integrated approach considers such factors as soil fertility, cultivar selection, economics, and ethical concerns. This emphasis prepares students for the following career opportunities: agricultural crop protection products sales representative, crop management consultant, plant pest regulatory official for state or federal agencies, research assistant, and applicator of agricultural crop protection materials.

Major Requirements

All students in Animal and Plant Systems must complete the requirements listed below. All course substitutions in the foundation and professional requirements must have the approval of the student's adviser and the Coordinating Committee for Animal and Plant Systems and the COA Office.

Liberal Education Diversified Core and Designated Theme Requirements—See the Liberal Education statement on page 8 and information at the beginning of this section.

Foundation Requirements

AgEc 1101—Principles of Microeconomics (4)
Biol 1009—General Biology (5)
BioC 1401—Elementary Biochemistry (4)
Chem 1051—Chemical Principles I (4)
 or Cham 1001—General Principles of Chemistry (4)
 and Chem 1002—Elementary Organic Chemistry (4)
Phys 1041—Introductory Physics (5)
 or Phys 1001,1005—The Physical World, Lab (4,1)
Rhet 1101—Writing to Inform and Persuade (4)
Rhet 1104—Library Research Methods (1)
Rhet 1151—Writing in Your Major (4)
Rhet 3562—Writing in Your Profession (4)
Rhet 1222—Public Speaking (4)
 or Spch 3431—The Role of Persuasion in the Modern World (4)
Math 1031—College Algebra and Probability (4)

Professional Requirements

AnPI 1001—Orientation to Animal and Plant Systems (1)
AnPI 5000—Professional Experience Program (4)
Soil 1020—The Soil Resource (5)
 or Soil 3125—Basic Soil Science (5)
AgET 3025—Engineering Principles and Applications (4)
 or NRES 3060—Water Quality in Natural Resource Management (3)
One from the following:
Ent 1005—Economic Entomology (4)
Ent 3005—Insect Biology (3)
Ent 5250—Forest Entomology (4)
Ent 5280—Livestock Entomology (4)

Emphasis Areas

Students must complete at least one area of emphasis.

1. Animal Production

Agro 1010—Principles of Agronomy (5)
AnSc 1100—Introductory Animal Science (5)
AnSc 1510—Consumer Meat Science (2)
AnSc 3220—Principles of Animal Breeding (5)
AnSc 3301—Systemic Physiology (6)
AnSc 3401—Principles of Animal Nutrition (4)
Biol 1105—General Zoology (5)
 or Biol 3011—Animal Biology (5)
CAPS 3502—Animal Health and Disease (5)

One from the following:

AnSc 5401—Swine Nutrition and Feeding (4)
AnSc 5403—Ruminant Nutrition (4)
AnSc 5405—Poultry Nutrition (3)

One from the following:

- AnSc 5601—Swine Production (4)
- AnSc 5602—Sheep Production (4)
- AnSc 5603—Beef Cattle Production (4)
- AnSc 5604—Dairy Farm Management (4)
- AnSc 5605—Poultry Production (4)

One from the following:

- Biol 5003—Genetics (4)
- GCB 3022—Genetics (4)
- Hort 3003—Plant Genetics and Improvement (4)

One from the following:

- Agro 3060—Field Plot Design in Agronomy (4)
- IDSC 1010—Fundamentals of Information Development and Use (4)
- Stat 3011—Statistical Analysis (4)

Two from the following:

- AgEc 3001—Applied Microeconomics: Consumers and Markets (4)
- AgEc 3002—Applied Microeconomics: Managerial Economics (4)
- AgEc 3430—Dairy Marketing Economics (4)
- AgEc 3440—Livestock and Meat Marketing Economics (3)
- AgEc 3810—Principles of Farm Management (4)
- AnPI 3010—Environment and World Food Production (4)
- GC 1513—Small Business Fundamentals (4)
- GC 1537—Professional Selling (4)

2. Crops and Soils/Horticultural Food Production

- Agro 5030—Weed Control (5)
- AnPI 5060—Integrated Management of Cropping Systems (4)
- Biol 1103—General Botany (5)
 - or Biol 3012—Plant Biology (5)
- Hort 1036—Plant Propagation (5)
 - or Agro 3130—Seed Technology (2)
- Soil 3416,3417—Plant Nutrients in the Environment and Lab (4,1)

One from the following:

- Agro 3020—Growth and Culture of Field Crops (4)
- Hort 3001—Growth Regulation of Horticultural Plants (5)
- PBio 3131—Survey of Plant Physiology (4)

One from the following:

- Agro 3030—Harvest, Storage and Utilization of Field Crops (4)
- Agro 5020—Introduction to Plant Breeding (4)
- Hort 5001—Harvest to Market of Horticultural Crops (3)

One from the following:

- Biol 5003—Genetics (4)
- GCB 3022—Genetics (4)
- Hort 3003—Plant Genetics and Improvement (4)

One from the following:

- Agro 3060—Field Plot Design in Agronomy (4)
- IDSC 1010—Fundamentals of Information and Use (4)
- Stat 3011—Statistical Analysis (4)

One from the following:

- AgEc 3420—Grain Marketing Economics (4)
- AgEc 3810—Principles of Farm Management (4)
- GC 1513—Small Business Fundamentals (4)
- GC 1537—Professional Selling (4)

Select either sequence below: a.) Crops and Soils or b.) Horticultural Food Production

Horticultural Food Production

a. Crops and Soils

- Agro 3200—Seminar (1)
- PIPa 3001—Management and Control of Field Crop Diseases (4)
 - or PIPa 3002—Management of Horticultural Crop Diseases (4)
- Soil 3220—Soil Conservation and Land Use Management (4)
 - or Soil 5510—Field Study of Soils for Environmental Assessment (4)

One course in animal science

Three from the following:

- Agro 3030—Harvest, Storage and Utilization of Field Crops (4)
- Agro 3150—Advanced Seed and Grain Evaluation (4)
- Agro 5020—Introduction to Plant Breeding (4)
- Agro 5050—Management Techniques for Crop Production in Minnesota (4)

- Agro 5070—Ecology of Field Crops (3)
- AnPI 3010—Environment and World Food Production (4)
- NRES 3020—Plant Resource Management and the Environment (4)
- Soil 5240—Microclimatology (3)
- Soil 5610—Soil Biology (4)

b. Horticultural Food Production

- Hort 3002—Horticultural Cropping Systems (5)
- Hort 3099—Seminar (1)
- Hort 5001—Harvest to Market of Horticultural Crops (3)
- Hort 5031—Temperate Fruit Production (4)
- Hort 5034—Commercial Vegetable Agriculture (5)
- PIPa 3002—Management of Horticultural Crop Diseases (4)

3. Integrated Pest Management

- AgEc 3450—Agricultural Input Marketing Economics (4)
 - or AgEc 3810—Principles of Farm Management (4)
- Agro 3020—Growth and Development of Field Crops (4)
 - or Hort 3001—Growth Regulation of Horticultural Plants (5)
- Agro 5030—Weed Control (5)
- AnPI 5060—Integrated Management of Cropping Systems (4)
- Biol 1103—General Botany (5)
 - or Biol 3012—Plant Biology (5)
- PBio 3131—Survey of Plant Physiology (4)
- PIPa 3001—Management and Control of Field Crop Diseases (4)
 - or PIPa 3002—Management of Horticultural Crop Diseases (4)

- PIPa 5205—Plant Disease Diagnosis (2)

One course in animal science

One from the following:

- Agro 3060—Field Plot Design in Agronomy (4)
- IDSC 1010—Fundamentals of Information Development and Use (4)
- Stat 3011—Statistical Analysis (4)

One from the following:

- Biol 5003—Genetics (4)
- GCB 3022—Genetics (4)
- Hort 3003—Plant Genetics and Improvement (4)

Three from the following:

- Agro 3020—Growth and Development of Field Crops (4)
- Agro 3030—Harvest, Storage and Utilization of Field Crops (4)
- Agro 5050—Management Techniques for Crop Production in Minnesota (4)
- AnPI 3010—Environment and World Food Production (4)
- Hort 1036—Plant Propagation (5)
- Hort 3001—Growth Regulation of Horticultural Plants (4)
- Hort 3002—Horticultural Cropping Systems (5)
- Hort 3003—Plant Genetics and Improvement (4)
- Hort 3072—Turf Management (4)
- Hort 5026—Landscape Management (4)
- Hort 5031—Temperate Fruit Production (4)
- Hort 5034—Commercial Vegetable Agriculture (5)
- Hort 5042—Turfgrass Science (5)
- Hort 5046—Nursery Management I (4)
- Hort 5047—Nursery Scheduling and Enterprise Development (2)
- Hort 5048—Nursery Management II (4)
- Hort 5054—Commercial Floriculture Production Practices (4)
- Hort 5055—Commercial Floriculture Production Systems (5)

One from the following:

- Ent 5020—Insect Taxonomy (5)
- Ent 5040—Insect Ecology (4)
- Ent 5215—Insects in Relation to Plant Diseases (3)
- Ent 5250—Forest Entomology (4)
- Ent 5280—Livestock Entomology (4)

One from the following:

- PIPa 5201—Biology of Plant Diseases (3)
- PIPa 5202—Biology of Plant Diseases Laboratory (2)
- PIPa 5203—Phys. and Molecular Plant-Microbe Interactions (3)
- PIPa 5204—Plant Pathology (2)

- PIPa 5206—Biology of Fungi (4)
- PIPa 5209—Biochemistry of Plant Disease (3)
- PIPa 5211—Fungal Genetics (4)
- PIPa 5212—Diseases of Forest and Shade Trees (4)
- PIPa 5213—Plant Nematology (4)
- PIPa 5214—Plant Virology (4)
- Soil 3416,3417—Plant Nutrients in the Environment and Lab (4,1)
- Soil 5610—Soil Biology (4)

4. Environmental Horticulture

- Biol 1103—General Botany (5)
- or Biol 3012—Plant Biology (5)
- Hort 1021—Woody Plant Materials (5)
- Hort 1022—Herbaceous Plants (5)
- Hort 1036—Plant Propagation (5)
- Hort 3001—Growth Regulation of Horticultural Plants (5)
- Hort 3002—Horticultural Cropping Systems (5)
- Hort 3099—Seminar (1)
- PIPa 3002—Management of Horticultural Crop Diseases (4)
- or PIPa 5212—Diseases of Forest and Shade Trees (4)
- Soil 3416,3417—Plant Nutrients in the Environment and Lab (4,1)

Three from the following:

- Acct 1050—Introduction to Financial Accounting (5)
- or AgEc 1250—Principles of Accounting (4)
- Acct 3001—Introduction to Management Accounting (4)
- AgEc 1102—Principles of Macroeconomics (4)
- AgEc 3001—Applied Microeconomics: Consumers and Markets (4)
- AgEc 3002—Applied Microeconomics: Managerial Economics (4)
- AgEc 3006—Applied Macroeconomics: Government and the Economy (4)
- AgEc 3007—Applied Macroeconomics: Policy, Trade, and Development (4)
- AgEc 3240—Strategic Management of Farms and Agribusinesses(4)
- AgEc 3260—Operations Management of Farms and Agribusinesses(4)
- AgEc 3400—Markets, Marketing, and Prices (4)
- BFin 3000—Finance Fundamentals (4)
- or AgEc 3500—Agribusiness Finance (4)
- BLaw 3058—Introduction to Law, Law of Contracts and Sales Contracts (4)
- or AgEc 3920—Agricultural Law (4)
- GC 1513—Small Business Fundamentals (4)
- IDSC 1010—Fundamentals of Information Development and Use (4)
- IDSC 3030—Information Systems and Information Management (4)
- Ins 5100—Risk Management and Insurance (4)
- IR 3002—Personnel and Industrial Relations (4)
- IR 3010—Individual in the Organization (4)
- IR 3032—Governing in the Work Place (4)
- IR 5002—Systems of Conflict and Dispute Resolution (4)
- Jour 3201—Principles of Advertising (4)
- Mgmt 3001—Fundamentals of Management (4)
- Mgmt 3004—Business Policy (5)
- Mgmt 5101—Advanced Topics in Management: Small Business Management (4)
- Mktg 3000—Principles of Marketing (4)
- Mktg 3010—Buyer Behavior and Marketing Analysis (4)
- NRES 3010—Ethics and Values in Resource Management (3)
- OMS 1020—Data Analysis and Statistical Inference for Managers (4)
- OMS 3000—Introduction to Operations Management (4)
- Rhet 1200—Information Technology in Scientific and Technical Professions (3)
- or GC 1571—Introduction to Microcomputer Applications (5)
- or GC 1572—Introduction to Computer Programming (5)
- or GC 1575—Introduction to Computers (4)
- Rhet 3266—Communication, Discussion in Small Group Decision Making(4)
- Rhet 5170—Managerial Communication (4)
- Stat 3011—Statistical Analysis (4)

Select either sequence below: a.) Landscape, Nursery, and Turf or b.) Floriculture

a. Landscape, Nursery, and Turf

- Hort 3030—Landscape Design of Residential and Small Commercial Sites (4)
- Hort 3040—Landscape Design and Implementation (5)

Six courses from the following:

- Hort 3072—Turf Management (4)
- Hort 5026—Landscape Management (4)
- Hort 5042—Turf Grass Science (5)
- Hort 5046—Nursery Management I (4)
- Hort 5047—Nursery Scheduling and Enterprise Development (2)
- Hort 5048—Nursery Management II (4)
- Hort 5054—Commercial Floriculture Production Practices (4)

b. Floriculture

- GC 1513—Small Business Fundamentals (4)
 - Hort 3004—Applications of Plant Biotechnology (4)
 - or Hort 5001—Harvest to Market of Horticultural Crops (3)
 - Hort 5054—Commercial Floriculture Production Practices (4)
 - Hort 5055—Commercial Floriculture Production Systems (5)
- Electives to reach 180 credits required for graduation with a bachelor of science degree.

Applied Economics

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The Applied Economics major prepares students for careers in private industry, government agencies, agribusinesses, or for graduate work. Areas of emphasis include: management and finance; marketing; trade and development; resources and environment; and regional and public economics as well as individualized areas of emphasis that students may design in consultation with their adviser. This curriculum emphasizes fundamental written and oral communication skills as well as development of a strong foundation in economic principles and their applications.

This curriculum offers flexibility while providing a strong fundamental core of knowledge. The core group of professional courses includes basic economic principles, applied micro/macroeconomic theory, accounting, and statistics. Students may select the remainder of their courses according to their interests.

Liberal Education Diversified Core and Designated Themes—See the Liberal Education statement on page 8 and information at the beginning of this section.

Foundation Requirements

Writing performance courses:

- Rhet 1101—Writing to Inform (4)
- Rhet 1104—Library Research Methods (1)
- Rhet 1151—Writing in Your Major (4)
- Rhet 3562—Writing in Your Profession (4)

Speech performance courses:

- Rhet 1222—Public Speaking (4)
- Rhet 3254—Advanced Public Speaking (4)
 - or Rhet 3266—Communication, Discussion in Small Group Decision Making (4)

- Math 1142—Short Calculus (5)
 - or Math 1251—One Variable Differential and Integral Calculus I (4)

Note: Students contemplating graduate study are encouraged to take Math 1251, 1252 (4,4)

Professional Requirements

- AgEc 1000—Orientation to Agricultural and Applied Economics (1)
- AgEc 1101—Principles of Microeconomics (4)
- AgEc 1102—Principles of Macroeconomics (4)
 - Note:* For this major AgEc 1101 and 1102 cannot be counted as part of the Liberal Education, SSci requirements.
- AgEc 1250—Principles of Accounting (4)
 - or Acct 1050—Introduction to Financial Reporting (4)
- IDSc 1010—Fundamentals of Information Development and Use (4)
- OMS 1020—Data Analysis and Statistical Inference for Managers (4)
- AgEc 3001—Applied Microeconomics: Consumers and Markets (4)
- AgEc 3002—Applied Microeconomics: Managerial Economics (4)
- AgEc 3006—Applied Macroeconomics: Government and the Economy (4)
- AgEc 3007—Applied Macroeconomics: Policy, Trade, and Development (4)
- AgEc 3400—Agricultural Markets, Marketing and Prices (4)

A. Professional Application Cluster (16 credits minimum)

At least 2 AgEc courses plus two more courses from AgEc, Econ, or Carlson School of Mgmt. Students are encouraged, but not required, to take 12 or more of these 16 additional credits in one of the following areas:

1. **Management and Finance**
 - AgEc 3240—Strategic Management of Farms and Agribusinesses (4)
 - AgEc 3260—Operations Management of Farms and Agribusinesses (4)
 - AgEc 3500—Agribusiness Finance (4)
 - AgEc 5020—Applied Linear Programming (4)
 - AgEc 5440—Cooperatives and Agribusiness Organization (4)
 - AgEc 5500—Financial Markets and Agricultural Credit Institutions (4)
2. **Marketing**
 - AgEc 3420—Grain Marketing Economics (4)
 - AgEc 3430—Dairy Marketing Economics (4)
 - AgEc 3440—Livestock and Meat Marketing Economics (3)
 - AgEc 3450—Agricultural Input Marketing Economics (4)
 - AgEc 5400—Intermediate Market and Price Analysis (4)
 - AgEc 5440—Cooperatives and Agribusiness Organization (4)
 - AgEc 5480—Futures Markets and Prices (4)
 - AgEc 5550—Food Marketing Economics (4)
3. **Trade and Development**
 - AgEc 3040—Economic Development of American Agriculture (4)
 - AgEc 3070—Agriculture and Economic Growth in Developing Countries (4)
 - AgEc 5710—US Agriculture: Farm, Food, and Environmental Policy (3)
 - AgEc 5720—Economics of World Agriculture (3)
 - AgEc 5730—European Agriculture: Farm, Food, and Environmental Policy (4)
 - AgEc 5750—Agricultural Trade and Commercial Policies (3)
 - AgEc 5790—World Food Problems (3)
4. **Resources and Environment**
 - AgEc 3610—Resource Developing and Environmental Economics (4)
 - AgEc 5600—Land and Water Economics (3)
 - AgEc 5630—Regional Development Systems (3)
 - AgEc 5640—Financing State and Local Governments (4)
 - AgEc 5650—Economics of Natural Resource Policy (4)
 - Econ 5611—Resource and Environmental Economics (4)
 - Econ 5831—Cost-benefit Analysis (4)
5. **Regional and Public Economics**
 - AgEc 5620—Regional Economic Analysis (3)
 - AgEc 5630—Regional Development Systems (3)
 - AgEc 5640—Financing State and Local Government (3)
 - Econ 3801—Elements of Public Finance (4)
 - Econ 5621—Urban Economics (4)
 - Econ 5623—Housing Markets and Public Policy (4)
6. **Individualized Professional Cluster**
Consult with adviser to develop such a program.

B. Technical Emphasis (16 credits minimum)

Applied economists need both knowledge of economics and expertise in scientific or technical areas. With the help of an adviser, students select at least four courses in two departments. At least 1 course should be 3xxx or above. The areas should be selected according to the future job interests of the student. For example, students aiming at the food industry may want to take food science courses; those interested in grain marketing could take grain handling and storage classes; resource students may want water, forestry, or ecology courses.

Electives to reach 180 credits required for graduation with a bachelor of science degree.

Environmental Science

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The Environmental Science (ES) curriculum 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 will become knowledgeable about environmental issues and the science behind policy decisions. Students will gain an appreciation of the important role of managed and natural systems in managing the environment in a sustaining way at the local, regional, national and international levels.

As concern for the environment grows, opportunities for ES graduates increase in agencies and firms involved in control technology, regulation of environmental contamination, and remediation of contaminated sites. Recent ES graduates have found employment in areas such as: environmental consulting firms; state and local agencies such as the Minnesota Pollution Control Agency, Minnesota Office of Waste Management, Minnesota Department of Natural Resources, Minnesota Department of Health, Minnesota Department of Agriculture, and Metropolitan Council; federal agencies such as the Environmental Protection Agency, Soil Conservation Service, U.S. Forest Service, and Bureau of Land Management; waste management firms; environmental engineering firms; environmental education; and extension service-resource management.

Graduates would also be prepared to go on to professional school (law or public policy) or graduate school in selected disciplines.

All students require training in math and science, social science, humanities, communication and applied technical aspects of environmental problems. Resolving environmental problems involves working with people and therefore emphasis in oral and written communication is required. The environmental science core draws courses from atmospheric science, soil science, hydrology, and plant science.

Students in University of Minnesota's Environmental Science program:

- Have analytical skills and a broad understanding of environmental problems;
- Have demonstrated their abilities in scientific courses;
- Have worked with computers in courses and can use many current software tools;

- Have developed skills to communicate effectively with technical and non-technical audiences;
- Have practiced the necessary problem solving skills to develop creative solutions to environmental problems;
- Are highly motivated and committed to solving environmental problems.

Liberal Education Diversified Core and Designated Themes—See the Liberal Education statement on page 8 and information at the beginning of this section.

Foundation Requirements

Basic Sciences

- Biol 1009—General Biology (5)
- Chem 1051, 1052—Chemical Principles I, II (4,4)
- Phys 1041, 1042—Introductory Physics I, II (5,5)
- Biol 1103—General Botany (5)
or Biol 1106—General Zoology (5)
- BioC 1401—Elementary Biochemistry (4)
or Chem 3301—Elementary Organic Chemistry I (4)

Math and Statistics

- Math 1251, 1252—One-Variable Differential and Integral Calculus I, II (4,4)

One from the following:

- Stat 3011—Statistical Analysis (4)
- Stat 3091—Introduction to Probability and Statistics (4)
- Agro 3060—Field Plot Design in Agronomy (4)

Computer competency

Computer skills are necessary for today's student. As a student in COA, you will use computer applications in your coursework no matter which major you choose. You will be expected to have basic computer competency in word processing, spreadsheets, database management, and telecommunications. Your level of computer competency will be assessed in the advising process. If you lack needed skills, you will be given advice on which courses you will be required to take in order to learn those skills.

Writing and Speaking

- Rhet 1101—Writing to Inform and Persuade (4)
- Rhet 1151—Writing in Your Major (4)
- Rhet 3562—Writing in Your Profession (4)
- Rhet 1222—Public Speaking (4)
or Rhet 3266—Communication, Discussion in Small Group Decision Making (4)

plus 2 other writing intensive courses (8)

History and Social Sciences

- AgEc 1101—Principles of Microeconomics (4)
- AgEc 1102—Principles of Macroeconomics (4)
- AgEc 3610—Resource Developing and Environmental Economics (4)

Professional Requirements

Environmental Courses

- ES 1001—Orientation to Environmental Science (1)
- NRES 3001—Colloquium in Natural Resources and Environmental Studies (1)
- ES 3050—Experience and Training in a Field Setting (1-4)
- ES 1050—Introductory Environmental Science (4)
or Biol 3051—Environmental Studies (4)
- NRES 1010—Issues in the Environment (3)
or NRES 3010—Ethics and Values in Resource Management (3)
- Soil 5020—Environmental Impact Assessment (3)
- NRES 5100—Problem Solving in Natural Resources (5)

Land, Water, Atmosphere and Ecology Courses

- Soil 1020—The Soil Resource (5)
or Soil 3125—Basic Soil Science (5)
- Soil 3416—Plant Nutrients in the Environment (4)
- AgET 5410—Hydrology and Water Quality (5)
or FR 5114—Forest Hydrology (3) and NRES 3060—
Water Quality in Natural Resource Mgmt (3)
- EEB 3001—Introduction to Ecology (4)
or EEB 3101—Ecology for Engineers and Physical
Scientists (4)
- Soil 1425—Introduction to Meteorology (4)
- Geo 1001—Introduction to Geology (4)
or Geo 1111—Introductory Physical Geology (5)

Soil, Plant and Animal Courses

- Soil—select one from the following:*
- Soil 3220—Soil Conservation and Land Use
Management (4)
- Soil 5210—Environmental Biophysics (4)
- Soil 5510—Field Study of Soil for Environmental
Assessment (4)
- Soil 5555—Wetland Soils (4)
- Plant—select one from the following:*
- NRES 3020—Plant Resource Management and the
Environment (4)
- Agro 3020—Growth and Development of Field
Crops (4)
- Hort 3001—Growth Regulation of Horticultural
Plants (5)

- PIPa 3001—Management and Control of Field Crop
Diseases (4)
- PIPa 3002—Management of Horticultural
Crop Diseases (4)
- PIPa 5212—Diseases of Forest and Shade Trees (4)
- Animal—select one from the following:*
- FW 3052—Introduction to Fisheries and Wildlife (3)
- Ent 1005—Economic Entomology (4)
- AnSc 1100—Introduction to Animal Science (5)
- AnSc 3113—Animal Welfare (4)

Emphasis Areas (24 credits)

There are no required courses. See major coordinator for suggested course lists. Specific courses are chosen with an adviser in such areas as:

Land and Water Resources: Land Use Management, Soil Resources, Sustainable Agriculture, and Water Resources (Hydrology and Climatology)

Environmental Management: Bioremediation, Environmental Measurement, and Waste Management

Environmental Education: Natural and Managed Environmental Systems Education

Electives to reach 180 credits required for graduation with a bachelor of science degree.



Food Science

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Food Science applies scientific principles to the manufacture, distribution, marketing, and consumer aspects of food. Food scientists apply the basic principles and techniques of many disciplines including chemistry, physics, economics, microbiology, nutrition, management, and marketing to food processing and preservation, new product development, and food marketing. Food scientists are concerned with the theoretical and practical aspects of the food chain from the production of raw materials to the use of food products by consumers.

This curriculum balances fundamental principles and practical applications of theory within a flexible program that permits you to tailor your studies to fit personal career goals. You can develop proficiency in a related discipline through an optional area of specialization such as consumer emphasis, process/technology, chemistry, or microbiology. Graduates of the program work in a variety of technical, marketing, and promotional positions in the consumer food industry.

The program is open to students registered in either COA or the College of Human Ecology. Faculty advisers are from the Department of Food Science and Nutrition, which is jointly administered by the two colleges.

Many graduates of the program seek employment after earning the bachelor of science degree, while others continue on to graduate study. Career areas include production management, product and process research and development, public health and regulatory agency service, education, marketing, management, technical sales and promotion, and quality control supervision. Admission to the Food Science program requires a GPA of at least 2.50.

Liberal Education Diversified Core and Designated Themes—See the Liberal Education statement on page 8 and information at the beginning of this section.

Foundation Requirements

AgEc 1101—Microeconomic Principles (4)
Biol 1009—General Biology (5)
Chem 1051, 1052—Chemical Principles I, II (4,4)
Chem 3301, 3305—Elementary Organic Chemistry I and Lab (4,2)
Chem 3302, 3306—Elementary Organic Chemistry II and Lab (4,2)
BioC 3021—Introduction to Biochemistry (4)
Math 1142—Short Calculus (5)
or Math 1251, 1252—One Variable Differential and Integral Calculus (4,4)
Phys 1041, 1042—Introductory Physics (5,5)
Rhet 1101—Writing to Inform and Persuade (4)
Rhet 1104—Library Research Methods (1)
Rhet 1222—Public Speaking (4)
Rhet 3562—Writing in Your Profession (4)

Stat 3011, 3012—Statistical Analysis (4,4)
or Stat 5021—Statistical Analysis (5)
VPB 3103—General Microbiology (5)
or MicB 5105—Biology of Microorganisms (5)

Professional Requirements

FScN 1102—Technology of Food Processing (4)
FScN 1612—Principles of Nutrition (4)
FScN 3102—Introduction to Food Science (4)
FScN 3112—Food Analysis (4)
FScN 3135—Food Processing I (4)
FScN 3136—Food Processing II (4)
FScN 5100—General Seminar (1)
FScN 5110—Food Chemistry (4)
FScN 5120—Food Microbiology (5)
FScN 5122—Control Systems in Food Microbiology (2)
FScN 5123—Food Fermentation and Biotechnology (3)
FScN 5135—Food Engineering Unit Operations (5)
FScN 5312—Instrumental Analysis of Foods (3)
Plus a minimum of 16 credits from the following:
FScN 3400—Food Communication Techniques (3)
FScN 3472—Food Selection Principles (4)
FScN 5000—Professional Experience Program (4)
FScN 5111—Independent Study in Food Science and Nutrition (1-5)
FScN 5314—Physiochemistry of Foods (4)
FScN 5320—Food Biotechnology (3)
FScN 5350—Application of Experimental Design in the Food Industry (4)
FScN 5360—Sensory Evaluation of Food Quality (4)
FScN 5380—Food Packaging (3)
FScN 5390—Introduction to Food Law (4)
FScN 5403—Experimental Study of Foods (5)
FScN 5414—Ingredient Interactions (3)
FScN 5474—Food Marketing Economics (4)
FScN 5512—Meat Technology (4)
FScN 5522—Technology of Fluid and Concentrated Milk Products (4)
FScN 5523—Technology of Fermented Dairy Products (4)
FScN 5524—Sensory Evaluation of Dairy Products (1)
FScN 5530—Industrial Processing of Fruits and Vegetables (4)
FScN 5540—Fats and Oils Chemistry and Technology (4)
FScN 5555—Freezing and Dehydration of Foods (5)
FScN 5562—Flavor Technology (4)
FScN 5620—Nutrition and Metabolism (5)

Electives to complete the 180 credits required to graduate with a bachelor of science degree.

Nutrition

Linda Brady, Coordinator
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Nutrition explores how nutrients and the foods from which they are derived aid the body in health, growth, and development. With the major national and international concern for how nutrition affects health and disease, there are many career opportunities for registered dietitians and nutritionists.

The Nutrition option is for students planning to become registered dietitians by meeting the American Dietetic Association requirements. These include completion of an approved baccalaureate program, an approved or accredited professional experience, and a national registration examination. Students transferring to the program must have a minimum GPA of at least 2.50. Students complete the degree program and apply for a postbaccalaureate dietetic internship, or apply, before their junior year, to the University of Minnesota's Coordinated Program in Dietetics and complete both the academic and professional experience requirements in a two-year program. Students expecting to apply to the Coordinated Program in Dietetics, an internship, or graduate school should maintain a GPA of 2.80 or better (a cumulative GPA of 3.0 or better is highly recommended). Registered dietitians work in a wide variety of health care, community, educational, and corporate positions relating to food and health. Nutrition graduates choosing not to become registered dietitians may pursue a variety of career options based on their preparation in the sciences, liberal education and nutrition.

The Nutritional Science option is for students planning to do graduate work in nutrition, related sciences, or professional programs such as medicine or dentistry. Students should be aware of the entrance requirements for the graduate or professional program of their choice and maintain a cumulative GPA of 3.00 or higher.

Computer Competency—As a nutrition student you will use computer applications in your coursework and will be expected to have basic computer competency in word processing, spreadsheets, database management, and telecommunications. Computer competency will be assessed in the advising process, and students lacking the needed skills may seek advice on courses required to learn those skills.

Liberal Education Diversified Core and Designated Themes—See the Liberal Education statement on page 8 and information at the beginning of this section.

Foundation Requirements

Biol 1009—General Biology (5) Biol/L
Chem 1051, 1052—Chemical Principles I, II (4,4)
Chem 3301, 3305—Elementary Organic Chemistry I and Lab (4,2)
Chem 3302, 3306—Elementary Organic Chemistry II and Lab (4,2)
Rhet 1101—Writing to Inform and Persuade (4)
Rhet 1104—Library Research Methods (1)
Rhet 1151—Writing in Your Major (4)
Rhet 1222—Public Speaking (4)
Rhet 3562—Writing in Your Profession (4)

One from the following:

EPsy 5260—Introductory Statistical Methods (4)
PubH 5404—Introduction to Biostatistics and Statistical Decision (4)
PubH 5450—Biostatistics I (4)
Soc 3801—Sociological Methods I: Descriptive Statistics (5)
Stat 1001—Introduction to Ideas of Statistics (4)
Stat 3011—Statistical Analysis (4)
Stat 3091—Introduction to Probability and Statistics (4)
Stat 5021—Statistical Analysis I (5)

Professional Requirements

BioC 3021—Biochemistry (4)
FScN 1612—Principles of Nutrition (4)
FScN 3102—Introduction to Food Science (4)
FScN 3612—Biological Aspects of Nutrition (4)
FScN 5100—General Seminar (1)
FScN 5612—Experimental Nutrition (2)
VPB 3103—General Microbiology (5)
or Micro 5105—Biology of Microorganisms (5)

Emphasis Areas

1. Nutrition

CBN 3001—Elementary Anatomy (4-5)
FScN 3112—Food Analysis (4)
FScN 3472—Food Selection Principles (4)
FScN 3610—Community Nutrition (3)
FScN 3730—Quantity Food Production Management [Lab] (3)
FScN 3732—Lecture in Quantity Food Production Management (2)
FScN 5620—Nutrition and Metabolism (5)
FScN 5665—Applied Clinical Nutrition I (3)
FScN 5666—Applied Clinical Nutrition II (3)
FScN 5667—Applied Clinical Nutrition III (3)
FScN 5750—Principles of Food Service Management
LAMP 5177—Pathology for Allied Health Students: General and System Pathology (4)
or LAMP 5172—Pathology for Allied Health Students (4)
Math 1031—College Algebra and Probability (4)
Mgmt 3001—Fundamentals of Management (4)
Phsl 1001—Physiology: Introductory Survey for Allied Health Sciences (4)
or Phsl 3051—Human Physiology (5)

One from the following:

FScN 5110—Food Chemistry (4)
FScN 5120—Food Microbiology (5)
FScN 5360—Sensory Evaluation of Food Quality (4)
FScN 5643—World Food Problems (3)

One from the following:

HSU 5011—The Teaching-Learning Process in the Health Care Setting (3)
EPsy 5114—Psychology of Student Learning (3)
EPsy 5115—Adult Learning and Educational Practice (3)

2. Coordinated Program in Dietetics

A special subset of the curriculum specified for Nutrition. Requires special application procedures and acceptance. Includes additional field experiences in which didactic and clinical phases of instruction are coordinated.

3. Nutritional Science

Students considering applying to medical school should check the Social Science and Humanities requirements of the specific schools of interest. For example, the U of MN Medical School requires 27 credits (non-specified courses) in Social Science and Humanities. Thus a student in Nutritional Science would need to take an 9 extra credits in these categories.

Biol 1106—General Zoology (5)
or Biol 3011—Animal Biology (5)

Biol 5003—Genetics (4)
 or GCB 3022—Genetics (4)
 BioC 5025—Biochemistry Lab (2)
 FScN 3610—Community Nutrition (3)
 or FScN 5665—Applied Clinic Nutrition I (3)
 FScN 5110—Food Chemistry (4)
 or another advanced chemistry course (4)
 FScN 5622—Macro-Nutrient Metabolism (4)
 FScN 5623—Vitamin and Mineral Biochemistry (4)
 FScN 5624—Human Protein and Energy Utilization (4)
 Math 1142—Short Calculus (5)
 or Math 1251, 1252—One Variable Differential and
 Integral Calculus I, II (4,4)
 Physics 1104,5,6—General Physics (4,4,4)
 Physics 1107,8,9—General Physics Lab (1,1,1)
 One from the following:
 Phsl 1001—Physiology : Introductory Survey for Allied
 Health Sciences (4)
 Phsl 3051—Human Physiology (5)
 AnSc 3301—Systemic Physiology (6)
 Electives to complete the 180 credits required to graduate
 with a bachelor of science degree with any of the three
 emphasis areas in nutrition.

Science in Agriculture

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Science is the basis for progress in modern agriculture. Advances in the agricultural sciences are responsible for the unprecedented growth in quantity and quality of human food, animals, feeds, plant fibers, industrial products and aesthetic plants. Science in agriculture will be critical in addressing the environmental, resource, and technological issues facing humankind into the 21st century. Students completing the Science in Agriculture major in COA will be well prepared for scientific careers of the future.

The Science in Agriculture (ScAg) major is an interdisciplinary program of seven departments in COA. Students in this major obtain a thorough understanding of biological/physical science and mathematics principles and their applications to food and agriculture. Students may elect an area of emphasis within the major or they may choose to construct an individualized program combining courses from several disciplines. Host departments for this major are Agronomy and Plant Genetics, Animal Science, Entomology, Food Science and Nutrition, Horticultural Science, Plant Pathology, and Soil Science. Students in this major complete an undergraduate research thesis under the guidance of a faculty member in one of the host departments.

Students pursuing the Science in Agriculture major should be well prepared to undertake graduate studies in the disciplines represented by the host departments 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 major is also excellent preparation for employment in bachelor's degree-level research positions as field or laboratory specialists in academia, government, or industry.

The host departments for the Science in Agriculture major offer excellent opportunities and facilities for gaining experience in scientific research. Students may offset some costs of their education and gain valuable 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 (PEP).

Major Requirements

All students in the Science in Agriculture major must complete the requirements listed below. A minimum of 180 credits is required for completion of the degree. Faculty academic advisers will assist students in selecting suitable courses for completion of electives. Students planning to seek

admission for particular graduate programs should consult the specific admissions requirements for those programs as guidance in selecting coursework options. The academic advisers also assist students in selecting an undergraduate thesis topic and thesis mentor.

Liberal Education Diversified Core and Designated Themes—See the Liberal Education statement on page 8 and information at the beginning of this section.

Foundation Requirements

Basic Sciences

- Biol 1009—General Biology (5)
- Chem 1051,1052—Chemical Principles I, II (4,4)
- Chem 3301,3305—Elementary Organic Chemistry I and Lab (4,2)
- Chem 3302,3306—Elementary Organic Chemistry II and Lab (4,2)
- Phys 1041, 1042—Introductory Physics (5,5)
or Phys 1251, 1252, 1253—General Physics I, II, and III, and Lab (5,5,5)
- BioC 3021—Biochemistry (4)
- One from the following:*
- Biol 1103—General Botany (4)
- Biol 1106—General Zoology (5)
- Biol 3012—Plant Biology (5)
- Biol 3011—Animal Biology (5)

Math and Statistics

- Math 1142—Short Calculus (5)
or Math 1251,1252—One-Variable Differential and Integral Calculus I, II (4,4)
- Computer competency
or Rhet 1200—Information Technology in Scientific and Technical Professions
- Stat 5021—Statistical Analysis (5)
or Stat 3011,3012—Statistical Analysis I, II (4,4)

Writing and Speaking

- Rhet 1101—Writing to Inform and Persuade (4)
- Rhet 1104—Library Research Methods (1)
- Rhet 1151—Writing in Your Major (4)
- Rhet 1222—Public Speaking (4)
- Rhet 3562—Writing in your Profession (4)

Arts and Humanities

One course from the approved list of CLE courses in Arts and Humanities (4-5) beyond the three courses required to meet the Core Curriculum Requirement.

Professional Requirements

- ScAg 1001—Orientation to Science in Agriculture (1)
or AgEd 1002—Principles of Career Planning in Agriculture (1)
- ScAg 5009—Undergraduate Research Thesis (9)
- One from the following:*
- Biol 5013—Microbiology (5)
- VPB 3103—General Microbiology (5)
- MicB 5105—Biology of Microorganisms (5)
- One from the following:*
- GCB 3022—Genetics (4)
- Biol 5003—Genetics (4)
- Hort 3003—Plant Genetics and Improvement (4)
- A minimum of 8 credits from the following:*
- AnPl 3010—Environment and World Food Production (4)
- AnSc 5609—Principles of Farm Animal Environment (4)
- Biol 1103—General Botany (5)
- Biol 1106—General Zoology (5)
- Biol 3011—Animal Biology (5)
- Biol 3012—Plant Biology (5)
- Chem 1133—Elementary Quantitative Analysis (3)
- Chem 5520—Elementary Physical Chemistry (3)
- EBB 3001—Introduction to Ecology (4)
- FScN 1102—Technology of Food Processing (4)
- Hort 3004—Applications of Plant Biotechnology (4)
- Math 3066—Elementary Differential Equations (4)
- PBio 3109—Plant Anatomy (5)
- PBio 3201—Introductory Plant Taxonomy (4)
- PIPa 5206—Biology of Fungi (4)
- Soil 1020—The Soil Resource (5)

- Soil 1425—Introduction to Meteorology (4)
- ScAg 1500—Biotechnology (3)
- (Students may substitute other basic science courses with the approval of their adviser.)

Emphasis Areas

1. Animal Science (32 credits)

- AnSc 1100—Introductory Animal Science (5)
- AnSc 3220—Principles of Animal Breeding (5)
- AnSc 3301—Systemic Physiology (6)
- AnSc 3401—Principles of Animal Nutrition (4)
- Plus a minimum of 12 additional credits from:*
- AnSc 3111—Introduction to Animal Behavior (4)
- AnSc 3305—Reproductive Physiology, AI, and Lactation (5)
- AnSc 3510—Growth and Development of Animal Tissues (3)
- AnSc 5327,5328—General Endocrine Physiology, Lab (4)
- AnSc 5330—Current Topics in Endocrinology (1)
- AnSc 5401—Swine Nutrition and Feeding (4)
- AnSc 5403—Ruminant Nutrition (4)
- AnSc 5405—Poultry Nutrition (3)
- AnSc 5609—Principles of Farm Animal Environment (4)

2. Climatology (35 credits)

- AgET 5410—Hydrology and Water Quality (5)
- Agro 3020—Growth and Development of Field Crops (4)
- Geol 1601—Oceanography (4)
- Geog 3421—Climatology (4)
- PIPa 3004—Air Pollution, People and Plants (3)
- Soil 3125—Basic Soil Science (5)
- Soil 5240—Microclimatology (3)
- Soil 5424—Applied Climatology (3)
- Hort 5041—Environmental Physiology of Horticultural Plants (3)

3. Food Science (31 credits)

- FScN 1612—Principles of Nutrition (4)
- FScN 3102—Introduction to Food Science (4)
- FScN 5120—Food Microbiology (5)
- A minimum of 18 additional credits from:*
- FScN 3112—Food Analysis (4)
- FScN 5110—Food Chemistry (4)
- FScN 5122—Control Systems in Food Microbiology (2)
- FScN 5123—Food Fermentations and Biotechnology (3)
- FScN 5135—Food Engineering Unit Operations (5)
- FScN 5312—Instrumental Analysis of Foods (3)
- FScN 5360—Sensory Evaluation of Food Quality (4)
- FScN 5403—Experimental Study of Foods (5)
- FScN 5414—Ingredient Interactions (3)
- FScN 5512—Meat Technology (4)
- FScN 5522—Technology of Fluid and Concentrated Milk Products (4)
- FScN 5530—Industrial Processing of Fruits and Vegetables (4)
- FScN 5540—Fats and Oils Chemistry and Technology (4)
- FScN 5555—Freezing and Dehydration of Foods (5)
- FScN 5562—Flavor Technology (4)

4. Nutrition (31 credits)

- FScN 1612—Principles of Nutrition (4)
- FScN 3612—Biological Aspects of Nutrition (4)
- FScN 5622—Macro-Nutrient Metabolism (4)
- FScN 5623—Vitamin and Mineral Biochemistry (4)
- BioC 5025—Biochemistry Laboratory (2)
- A minimum of 12 additional credits from:*
- FScN 3102—Introduction to Food Science (4)
- FScN 5612—Experimental Nutrition (2)
- FScN 5624—Human Protein and Energy Utilization (4)
- FScN 5643—World Food Problems (3)
- AnSc 3401—Principles of Animal Nutrition (3)
- AnSc 5401—Swine Nutrition and Feeding (4)
- AnSc 5403—Ruminant Nutrition (4)
- AnSc 5405—Poultry Nutrition (3)
- Chem 3100—Quantitative Analysis (3)

5. Plant Sciences (27-41 credits, depending upon specialization)

Soil 3125—Basic Soil Science (5)
 Agro 5030—Weed Control (5)

One from the following:

- Agro 3020—Growth and Development of Field Crops (4)
- Hort 3001—Growth Regulation of Horticultural Crops (5)
- Hort 3002—Horticultural Cropping Systems (5)
- Ent 1005—Economic Entomology (4)
 or Ent 3005—Insect Biology (3)
- PIPa 3001—Management and Control of Field Crop Diseases (4)
 or PIPa 3002—Management of Horticultural Crop Diseases (4)

In addition, choose one plant science specialization:

a. Agronomy

Agro 5020—Introduction to Plant Breeding (4)
 Soil 3416, 3417—Plant Nutrients in the Environment and Lab (4,1)

One from the following:

- Agro 5010—Forage Production and Utilization (4)
- Agro 5050—Management Techniques for Crop Production in Minnesota
- AnPI 5060—Integrated Management of Cropping Systems (4)

b. Entomology

Ent 5020—Insect Taxonomy (5)

Two from the following:

- Ent 5030—Insect Physiology (3)
- Ent 5040—Insect Ecology (4)
- Ent 5210—Insect Pest Management (4)
- Ent 5215—Insects in Relation to Plant Disease (3)
- Ent 5280—Livestock Entomology (3)
- Ent 5310—Sampling Biological Populations (4)
- Ent 5350—Insect Pathology (3)

c. Horticultural Science

Hort 1036—Plant Propagation (5)
 Hort 3001—Growth Regulation of Horticultural Plants (5)

At least one from the following:

- Hort 3002—Horticulture of Cropping Systems (5)
- Hort 3004—Applications of Plant Biotechnology (4)
- Hort 3072—Turf Management (4)
- Hort 5001—Harvest to Market of Horticultural Crops (3)
- Hort 5031—Temperate Fruit Production (4)
- Hort 5034—Commercial Vegetable Agriculture (5)
- Hort 5046—Nursery Management I (4)
- Hort 5047—Nursery Scheduling and Enterprise Development (2)
- Hort 5048—Nursery Management II (4)
- Hort 5054—Commercial Floriculture Production Practices (4)
- Hort 5055—Commercial Floriculture Production Systems (5)

d. Plant Pathology

PIPa 5201, 5202—Biology of Plant Diseases and Lab (3,2)

Plus three from the following:

- PIPa 5203—Physics and Molecular Plant-Microbe Interactions (3)
- PIPa 5204—Field Plant Pathology (2)
- PIPa 5205—Plant Disease Diagnosis (2)
- PIPa 5206—Biology of Fungi (4)
- PIPa 5209—Biochemistry of Plant Disease (3)
- PIPa 5211—Fungal Genetics (4)
- PIPa 5212—Diseases of Forest and Shade Trees (4)
- PIPa 5213—Plant Nematology (4)
- PIPa 5214—Plant Virology (4)
- PIPa 5500—Epidemiology and Ecology of Plant Disease (3)

6. Soil Science (31 credits)

Agro 3020—Growth and Development of Field Crops (4)
 Soil 3125—Basic Soil Science (5)
 Soil 3220—Soil Conservation and Land Use Management (4)
 Soil 3416, 3417—Plant Nutrients in the Environment, Lab (4,1)
 Soil 5240—Microclimatology (3)
 Soil 5510—Field Study of Soils for Environmental Assessment (4)

Remaining credits selected from:

- Soil 5210—Soil Physical Properties and the Environment (4)
- Soil 5232—Soil Physics (4)
- Soil 5310—Soil Chemistry (3)
- Soil 5515—Soil Development, Classification, and Geography (4)

Soil 5560—Interpretation of Land Resources (3)
 Soil 5610—Soil Biology (4)
 Soil 5710—Forest Soils (3)

7. Science in Agriculture/Doctor of Veterinary Medicine Joint Degree (64 credits)

The Science in Agriculture/Doctor of Veterinary Medicine joint degree is a cooperative program between COA and the University College of Veterinary Medicine (CVM). Students satisfying the specified curriculum requirements will earn a Bachelor of Science Degree in Science in Agriculture from COA and, later, a Doctor of Veterinary Medicine from CVM.

Effective fall 1994, new entering freshmen students enrolling in COA's Science in Agriculture major will have the option of completing 3 years of undergraduate coursework and then applying to CVM. Upon being accepted into CVM and successfully completing the courses specified in the first quarter of the veterinary medicine curriculum, students will earn the BS degree from COA.

This program gives highly qualified students the opportunity to earn both a BS degree and a DVM degree in seven years. It also allows integration of a significant set of animal science courses into the student's preparation for veterinary education.

This program is only available to students who enter COA with no previous coursework and start in fall quarter. The Science in Ag/DVM curriculum is very structured and the COA portion must be completed in 3 academic years. COA students enrolled in this program will be obligated to meet the application standards of CVM and admission will be competitive. COA students applying under this agreement will 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 will be expected to complete the normal Science in Agriculture requirements for the bachelor of science degree. Students can also re-apply to CVM or any other college of their choice at a later date.

AnSc 1100—Introductory Animal Science (5)
 AnSc 3220—Principles of Animal Breeding (5)
 AnSc 3301—Systemic Physiology (6)
 AnSc 3401—Principles of Animal Nutrition (4)
 AnSc 3305—Reproductive Physiology, AI, and Lactation (5)
 AnSc 5401—Swine Nutrition and Feeding (4)
 AnSc 5403—Ruminant Nutrition (4)
 AnSc 5405—Poultry Nutrition (3)
 AnSc 5609—Principles of Farm Animal Environment (4)

Plus one from the following:

- AnSc 5601—Swine Production (4)
- AnSc 5603—Beef Production (4)
- AnSc 5604—Dairy Farm Management (4)
- AnSc 5605—Poultry Production (4)

Plus fall quarter, first year Vet classes (20)

Note: Successful completion of the first quarter of the University's College of Veterinary Medicine will constitute the fourth year of the Animal Science/ DVM joint program and will lead to Bachelors Degree in Science in Agriculture from COA.

8. Individualized area of emphasis

Students wanting to design a program with an emphasis different from these options should consult their adviser. Individualized programs must be approved by the major coordinating committee and have a minimum of 31 credits.

Electives to reach 180 credits required for graduation with a bachelor of science degree.

Scientific and Technical Communication

Dr. Alan Gross, Major Coordinator
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Scientific and technical communicators apply modern techniques and technologies to the distribution of knowledge in industry, business, education, and government. They write for audiences ranging from scientists to management to the consumer of technological products and services. To accomplish their objectives, scientific and technical communicators must first be generalists, well acquainted with the basic principles of science, engineering, the social sciences, and management practices. In addition, they must be familiar with and able to apply the principles of writing and editing, visual communication, communication technology, communication research and theory, and oral communication. The interdisciplinary curriculum combines the necessary theory and practical experience in a program flexible enough to allow you to plan a course of study appropriate to your career goals.

As a graduate of the program, you may be employed in government, education, and organizations in such fields as agriculture, communication, computer science, health sciences, research and development, and natural resources. You may pursue a career as a writer-editor, extension specialist, a corporate trainer or media specialist.

If you plan to pursue a graduate program in scientific and technical communication, you should consult with your adviser about selection of appropriate coursework early in your program.

Admission Requirements—Admission to COA does not automatically admit you to full-major status in the Scientific and Technical Communication (STC) program; students enter at pre-major status. To move from pre-major to major status, students must meet the following prerequisites:

Completion of the following coursework (with a minimum GPA of 2.50):

- 8 credits in basic rhetoric, English, or composition
- 8 credits in physical and biological sciences
- 8 credits in social science
- 8 credits in math, computer science, or engineering

For suggested course lists, contact the Department of Rhetoric.

To apply for major status, students must submit the following information to the STC Program:

- application form—available in 201 Haecker Hall

- pre-major checklist—available in 201 Haecker Hall
- college transcripts
- letter of intent
- portfolio

A portfolio consists of documents showing written work, examples of graphic display and design (e.g., projects from art, drafting, or design classes, or photographs, slides, or videos), and a résumé.

Deadlines for submitting applications are: fall quarter admission, April 15; winter quarter admission, October 15; spring quarter admission, January 15.

Note: Although you only need a 2.00 GPA to be admitted to COA, a 2.50 GPA is required in the 32 required credit hours for acceptance to the major.

Students will retain pre-major status until they are formally accepted into the major program. Keep in mind that you cannot graduate from COA unless you are officially enrolled in a major in the college. In addition to meeting COA residency requirements, as a degree candidate in Scientific and Technical Communication, you must earn at least 30 of your last 45 credits in the major following the quarter you are accepted into the major. For more information, contact the STC Program major coordinator, 201 Haecker Hall, 624-4761.

Major Requirements

Students majoring in the undergraduate program in Scientific and Technical Communication must complete requirements in each of the areas listed below. Required classes are listed. Course substitutes require program and/or College Office approval. Your adviser can offer guidance when you plan your schedule.

Liberal Education Diversified Core and Designated Themes—See the Liberal Education statement on page 8 and information at the beginning of this section.

Foundation Requirements

- Rhet 1101—Writing to Inform and Persuade (4)
- Rhet 1104—Library Research (1)
- Rhet 1151—Writing in Your Major (4)
- Rhet 1222—Public Speaking (4)
- Rhet 3266—Communication, Discussion in Small Group Decision Making (4)
- Rhet 3562—Writing in Your Profession (4)

Professional Requirements

- Writing and Editing** (14 credits minimum)
- Rhet 3565—Writing for Publication (4)
- Rhet 5560—Editing for Technical Communication (4)
or EngW 5401—Introduction to Professional Editing (4)
- Two from the following:**
 - Rhet 5572—Procedures and Policies Manual (3)
 - Rhet 5573—Grant Proposal (3)
 - Rhet 5575—Newsletter (3)

Recommended:

- Comp 3014—Writing for Quantitative Social Sciences (4)
- Comp 3015—Writing About Science (4)
- Comp 3027—Advanced Expository Writing (4)

Oral Communication (8 credits minimum)

Rhet 5257—Scientific & Technical Presentations (4)

Rhet 5258—Interviewing (4)

Recommended:

Rhet 3254—Advanced Public Speaking (4)

Spch 3201—Introduction to Broadcast Production (4)

Spch 3411—Small Group Communication Process (4)

Communication Systems (8 credits minimum)

Rhet 5170—Managerial Communications (4)

One from the following:

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

Rhet 5400—Communications Program Planning and Evaluation (4)

Rhet 5600—Transfer of Technology (4)

Recommended:

Rhet 5592—Communication in Technological and Environmental Impact Assessment (4)

Spch 3111—Leadership Communication (3)

Spch 3441—Communicating in Organizations (4)

Information Design and Management (14 credits minimum)

Rhet 1200—Information Technology in Scientific and

Technical Professions (3)

Rhet 3670—Visual Rhetoric (4)

Rhet 5581—Document Design (4)

Rhet 3574—Publications Management (3)

Recommended:

Ind 1000—Technical Drawing (3)

Ind 1602—Technical Design (3)

Ind 1620—Visual Communication Technology (3)

Ind 1622—Graphic Communication (3)

Ind 1624—Photography (3)

Rhet 3101—Functional Photography (4)

Rhet 3105—Corporate Video for Technical Communicators (4)

Communication Theory and Research (8 credits minimum)

Rhet 1220—Principles of Human Communication (4)

Rhet 3700—Rhetorical Theory (3)

Recommended:

Clas 1045—Basic Program in Technical Terminology and Word Study (3)

Engl 3851—The English Language (4)

Engl 3852—Aspects of the English Language (4)

Engl 5815—History of English Language (4)

Engl 5831—American English (4)

EPsy 5115—Adult Learning and Educational Practice (4)

EPsy 5240—Principles and Methods of Evaluation (3)

Jour 1001—Introduction to Mass Communication (2)

Ling 3001—Introduction to Linguistics (5)

Psy 3011—Introduction to Psychology of Learning (4)

Rhet 5160—Advanced College Reading (4)

Rhet 5500—Research in Communication Strategies (4)

Rhet 5541—Readings in Scientific and Technical Prose (2)

Spch 3431—Role of Persuasion in the Modern World (4)

Spch 3601—Approaches to Public Discourse (4)

Culture, Values and Technology (11 credits minimum)

Rhet 3390—Technology, Self, and Society (4)

Rhet 3582—Senior Seminar (3)

One from the following:

Rhet 3690—Scientific Controversy (3)

Rhet 5680—Gender and the Rhetoric of Science and Technology (3)

Rhet 1303—Science, Religion, and the Search for Human Nature (3)

Recommended:

HMed 3001—Doctors and Disease in History (4)

HMed 3002—Medicine and Disease in History: 17th-19th Centuries (4)

HMed 3003—Medicine and Disease in History: Modern (4)

HSci 17xx—Technology and Western Civilization (4)

HSci 18xx—Introduction to History of Science (4)

Hum 1003—Humanities in the Modern World III (4)

Hum 3625—Science and the Humanities (4)

Phil 3601—Scientific Thought (4)

Phil 56xx—Philosophy of Science (4)

Rhet 3395—In Search of Nature (4)

Internship

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

Emphasis Areas (20 credits)

While technical communicators need a general knowledge of math, science, and technology, they also must develop expertise in a scientific and technical area. With the help of an adviser, students will select at least five additional classes in a scientific or technological area. Eight credits must be at the 3000 level or above. Possible areas of emphasis are:

Agricultural Science: Animal

Agricultural Science: Plant

Health Sciences

Human Ecology

Biological Science

Mathematics

Management

Information Systems

Cognitive Science/Psychology

Computer Science

Natural Resources

Engineering

Physical Science

Food Science/Nutrition Vocational Education

Electives to reach 180 credits required for graduation with a bachelor of science degree.



Transfer Students

These majors are available to transfer students only through summer session II, 1996. Beginning fall 1996, all students must complete the liberal education requirements outlined in the New Entering Freshmen Students section of the bulletin, page 8.

Transfer Student Distribution Requirements

(These requirements apply to College of Agriculture transfer students; see individual major in Programs section for additional requirements.)

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

To help you achieve the goal of a liberal education, the College of Agriculture has set minimum requirements for the four major categories of knowledge listed below. These college distribution requirements meet or exceed the University requirements. They are firmly fixed, and petitions are rarely approved to waive credit requirements.

If you can demonstrate high ability in certain subject areas, proficiency tests are offered by many University departments. You may be excused from some course requirements. However, you must still meet the minimum credit requirement in each category.

Because of the numerous changes that occur in course numbers, titles, and content, a complete list of courses that fulfill each of the four categories below is difficult to maintain. For approval of courses not listed below, consult the College Office, 277 Coffey Hall, (612) 624-3009.

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

To graduate from the College of Agriculture, you must complete at least 17 credits in communication skills courses in English and rhetoric, foreign language, linguistics, logic, philosophic analysis, or mathematics. Consult each major program listing for specific course requirements.

Computer competency—Computer skills are necessary for today's student. As a student in the College of Agriculture, you will use computer applications in your coursework no matter which major you choose. You will be expected to have basic computer competency in word processing, spreadsheets, database management, and telecommunications. Your level of computer competency will be assessed in the advising process. If you lack needed skills, you will be given advice on which courses you will be required to take in order to learn those skills.

B. Physical and Biological Sciences (13 credits, A-F)

To graduate from the College of Agriculture, you must complete a minimum of 13 credits in the physical and biological sciences. All category B requirements listed for the individual curricula meet or exceed the college requirements.

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

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

The listing below represents a sampling of courses that will meet the intent of category C, parts one and two. For information regarding applicability of courses not noted here, check with the College Office, 277 Coffey Hall, 624-3009.

1) Analysis of Human Behavior and Institutions

- Afro 1011, 1025, 1334, 3013, 3061, 3072, 3091, 3543, 5072, 5200, 5352
- AgEc 1101, 1102, 3070, 5720
- Amin 1771, 5341, 5411, 5422
- Anth 1102, 3131, 3211, 3212, 3222, 3223, 3241, 3261, 3303, 5112, 5115, 5118, 5121, 5131, 5141, 5145, 5151, 5152, 5153, 5154, 5156, 5161, 5258, 5325, 5335, 5411
- Chic 3115, 3615, 3617, 3711, 3712
- CLit 3912, 3913, 3931, 3979, 5147, 5156
- CPsy 1301, 3302, 3303, 3304, 3332
- EAS 1032, 3211, 3315, 5481
- Econ 1101, 1102, 1104, 1105, all courses in Economic Development, Comparative Systems, Area Studies
- Fren 3599, 3650
- FSoS 1001, 1025, 3015
- Geog 1301, 3321, 3331, 3341, 3343, 3344, 3345, 3351, 3371, 3373, 3375, 3378, 3381, all courses in Regional Studies.
- Ger 3501, 3502, 3510
- IntR—all courses
- Jour 3007, 3614, 3776, 3796, 5601, 5611, 5615, 5721, 5801, 5825, 5826, 5827
- JwSt 1034, 3126, 3521,
- LAS 3131, all courses in LAS Social Sciences
- Ling 1001, 1005, 3101, 3811, 3812
- Pol—all courses except: 3070, 3080, 3085, 3109, 3110, 3352, 3353, 3751, 3970
- Psy 1001, 1004, 1005, 3101, 3135, 3201, 3604, 5138, 5202
- RelS—all courses except 5890, 5960
- Scan 1504, 3457, 5173, 5463
- Soc—all courses except methodology and topics courses
- Span 1501, 1502, 1503, 3501, 3502, 3512
- Spch 5602, 5607, 5611, 5616,
- WoSt 1001, 1002, 1101, 1102, 3102, 3203, 3204, 3300, 3305, 3602, 5106, 5107, 5108, 5202, 5203, 5601

2) Development of Civilization: Historical and Philosophical Studies

- (You must complete at least one course from this area.)
- Afro 1011, 1441, 3001, 3002, 3011, 3013, 3061, 3105, 3108, 3421, 3864, 3865, 5002, 5145, 5597
- AgEc 3040
- AgEd 1010, 5010
- Amin 3026, 3036, 3111, 3112, 3121, 3211
- AmSt—all courses
- ANE 1002, 3002, 3101, 3501, 3502, 3505
- Anth 3003, 3371, 3501, 3511, 3512, 3513, 3521, 3541, 5120, 5178
- Chic 3105, 3106, 3107, 3212, 3427, 3428, 3441, 3442
- Clas 1001, 1002, 1003, 1004, 1005, 1006, 1023, 1024, 1025, 1061, 1201, 3071, 3072, 3073, 3175, 5013, 5017, 5018, 5020, 5085, 5086
- CiCv 3940
- EAS 1063, 1461, 1462, 1463, 3464, 3465, 3467, 3468, 3471, 3472, 3481, 3868, 5032
- Fren 3511, 3512, 3513, 3550, 3590
- Ger 3511, 3512, 3513
- Hist—all courses except: 3955, 3960, 5011, 5939, 5960

HSci—all courses
 Hum—all courses
 Ital 3501, 3502
 JwSt 3100, 3521
 LAS 3401, 3402, 3403, 3500, 3501, 3512, 3513, all courses
 in LAS History
 MidE—all courses
 Phil—all courses except: 1001, 5201, 5202, 5203, 5211,
 5221, 5222
 Rhet 1301, 1302, 1303, 1310, 1311, 1376, 3370, 3374, 3375,
 3380, 3381
 Russ 3511, 3512
 Scan 3271, 3272, 3273, 5118, 5255
 SoAS—all courses
 Span 1501, 1502, 1503, 3501, 3502, 3512
 Spch 5611, 5616, 5617, 5618, 5621, 5622
 WoSt 3103, 3206, 3402, 3403, 3404, 5101, 5401, 5402

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

To graduate from the College of Agriculture, you must complete a minimum of 8 credits in the humanities, art, literature, music, or theatre arts. You may not apply technical courses, performance courses, or studio courses toward this category. Therefore, you may not apply such courses as Fundamentals of Music; Voice; Class Lessons; Band; Basic Visualization; Drawing; Design; or Introduction to Creative Writing.

The listing below represents a sampling of courses that will meet the intent of category D. For information regarding applicability of courses not noted here, check with the College Office, 277 Coffey Hall, 624-3009.

Afro 1301, 3105, 3108, 3591, 3592, 3601, 3701, 3702, 5181,
 5182, 5201, 5301, 5341, 5593, 5595, 5596, 5597
 Amln 3116, 3242, 5251
 AmSt 1001, 1002, 1003, 3111
 Arab 3213, 5900
 ArtH—all courses except 3975, 5895
 ArtS 1401 only
 Chic 3212, 3213, 3507, 3508, 3510, 3511
 Clas 1001, 1002, 1003, 1004, 1005, 1006, 1042, 3001, 3002,
 3008, 3035, 3065, 3081, 3082, 3083, 3142, 3145, 3152,
 3162, 5112
 CLit—all courses except: 3931, 3979, 5147, 5165, 5501
 Dsgn 1501, 5505
 EAS 3013, 3020, 3808, 3941, 5460
 Engl—all courses except 3851, 3852, 3860, 3931, 3932,
 5815, 5821, 5831, 5843, 5851, 5860
 Foreign languages—all advanced courses that deal
 directly with literature or the arts and that are not
 listed under category C may be used
 Hum—all courses
 JwSt 3115, 3315, 3401, 3402, 3403
 LA 1021, 1022
 LAS—all courses in LAS Humanities
 MidE 3213, 3601
 Mus 1021, 1804, 3021, 3027, 3028, 3029, 5451—all courses
 in Musicology/Ethnomusicology
 Rhet—humanities courses: 1301, 1302, 1303, 1310, 1311,
 3370, 3375, 3380, 3381
 Scan—all courses that deal with literature or art
 SoAS 3204, 5202
 Th 1101, 1102, 1405, 1805, 3171, 3172, 3173, 5171, 5172,
 5173, 5177, 5178, 5181, 5182, 5186
 WoSt 3303, 3304, 3306, 3307, 3308, 5304, 5305

Transfers From Outside the University

Students transferring to the College of Agriculture (COA) from colleges or universities outside of the University of Minnesota, Twin Cities, will complete the college's distribution course requirements that were in effect before fall 1994. Those general guidelines are published on page 8 of this bulletin. Effective fall quarter 1996 all transfer students to the COA will need to meet the new liberal education requirements.

COA views each of its majors as a four-year program integrating general distribution requirements, preparation or foundation courses, and professional courses in areas of special expertise.

Students will want to work closely with their adviser to make efficient use of their time in meeting both major and distribution requirements.

Intra-University Transfer Students

Students who enroll at the University of Minnesota, Twin Cities, as freshmen beginning in fall 1994 will follow the new all-university liberal education requirements.

Students who were first enrolled at the University of Minnesota Twin Cities' campus before fall 1994 will satisfy the College of Agriculture's distribution requirements. Those requirements are detailed on page 30 of this bulletin. Effective fall 1996 the College of Agriculture will require all transfer to students to meet the all-university liberal education requirements in order to graduate.

New entering freshmen should refer to the freshman program information on page 8.

Majors

The requirements for the College of Agriculture undergraduate majors presented in alphabetical order below are for transfer students directly entering the college. Students planning to transfer sometime in the future should check with their counselors or with the COA Prospective Student Services Office to be sure they complete courses equivalent to those required.

Agricultural Business Management

Dr. Vernon Eidman, Major Coordinator
 316 Classroom Office Building
 1994 Buford Avenue
 St. Paul, MN 55108
 612/625-5229

The Agricultural Business Management major is offered jointly by the College of Agriculture and the Carlson School of Management. The Agricultural Business Management curriculum emphasizes the use of concepts and methods from economics and business management in the identification, analysis, and solution of management problems related to food, agriculture, natural resources, and economic development. The program provides a balance between agricultural and applied economics and business administration studies, with a limited amount of agricultural science. Students may elect a variety of courses in their junior and senior years to accommodate special interests and career goals.

Graduates of this curriculum are prepared for a wide range of employment opportunities in agribusiness. Examples of employment areas include commodity trading and analysis, finance, management, marketing, sales management, administration, public and industrial relations, production management, economic and statistical analysis, managerial accounting, and transportation analysis.

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

Admission to the Major

Students are admitted to the major after satisfactory completion of a Pre-agricultural Business Management program. Admission standards are developed in conjunction with the Carlson School of Management. Application deadlines are June 15 for fall quarter, October 15 for winter quarter, and January 15 for spring quarter.

To be considered for admission to the Agricultural Business Management major you must meet the following requirements:

- 1) Complete or have in progress coursework to total 85 credits by the time of admission.
- 2) Complete the following management "tool" courses on an A-F grading basis by the time you enter the program:
 Acct 1050 or AgEc 1250
 AgEc 1101, 1102 or Econ 1101, 1102
 IDSc 1010 and OMS 1020
 Math 1142 or 1251
- 3) Earn a minimum GPA of 2.80 in all coursework.

- 4) Earn a minimum GPA of 2.50 in all of the tool courses with at least a grade of C in each.

College of Agriculture students planning to major in Agricultural Business Management who have not completed the Pre-agricultural Business Management program are assigned a faculty adviser but retain a 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 Business Management program in 316 Classroom Office Building, or from the COA Office, 277 Coffey Hall.

Major Requirements

Agricultural Business Management students must complete the requirements listed below. Consult with your adviser to determine a suitable sequence for completing the required courses. Course substitutions in categories A, B, C, and D may be made only with the approval of your adviser and the College Office. Substitutions in categories E and F can be made only with the approval of your adviser and the Agricultural Business Management Major Coordinator.

A. Communication, Language, Symbolic Systems (22 credits minimum)

Math 1142—Short Calculus (5)
 or Math 1251—One-Variable Differential and Integral Calculus I (4)

(Students contemplating graduate work are encouraged to take the Math 1251-52 sequence.)

Rhet 1101—Writing to Inform and Persuade (4)

Rhet 1104—Library Research Methods (1)

Rhet 1151—Writing in Your Major (4)

Rhet 1222—Public Speaking (4)

Rhet 3562—Writing in Your Profession (4)

B. Physical and Biological Sciences (14 credits minimum)

Biol 1009—General Biology (5)

Chem 1001—General Principles of Chemistry (4)

or Chem 1051—Chemical Principles I (4)

One of the following:

BioC 1401—Elementary Biochemistry (4)

Biol 1103—General Botany (5)

Biol 1106—General Zoology (5)

Chem 1002—Elementary Organic Chemistry (4)

C./D. The Individual and Society/Literature, Humanities, and Fine Arts (28 credits minimum)

Students develop a plan of study in areas C and D that is approved by their adviser. The program of study should include at least 28 credits of coursework and should provide breadth as well as depth in the social sciences and humanities. Minimum credit requirements must be met in each category. Students may select courses from either category to complete the 28-credit requirement.

C. Individual and Society (14 credits minimum)

See All-College Requirements, page 30.

Required courses:

Psy 1001—General Psychology (5)

Students are required to take at least one course in the area of Development of Civilization: Historical and Philosophical Studies.

Note: No courses in Agricultural and Applied

Economics or Economics may be used to meet

this requirement except AgEc 3040 or AgEc 3070.

D. Literature, Humanities, and Fine Arts (8 credits minimum)

See All-College Requirements, page 30.

E. Professional Courses in the Major

Agricultural and Applied Economics Core Courses and Electives, required of all majors.

- AgEc 1000—Orientation to Agricultural and Applied Economics (1)
 - AgEc 1101—Principles of Microeconomics (4)
 - AgEc 1102—Principles of Macroeconomics (4)
 - AgEc 3001—Applied Microeconomics: Consumers and Markets (4)
 - AgEc 3002—Applied Microeconomics: Managerial Economics (4)
 - AgEc 3006—Applied Macroeconomics: Government and the Economy (4)
 - AgEc 3007—Applied Macroeconomics: Policy, Trade, and Development (4)
 - AgEc 3240—Strategic Management of Farms and Agribusinesses(4)
 - AgEc 3260—Operations Management of Farms and Agribusinesses(4)
 - AgEc 3400—Markets, Marketing, and Prices (4)
 - AgEc 3500—Agribusiness Finance (4)
 - Two elective courses in Agricultural and Applied Economics
- Students are strongly encouraged to include an internship or special project in their program.

Carlson School of Management Core Courses and Electives, required of all majors.

- Acct 1050—Introduction to Financial Reporting (4)
 - Acct 3001—Introduction to Management Accounting (4)
 - IDSc 1010—Fundamentals of Information Development and Use (4)
 - OMS 1020—Data Analysis and Statistical Inference for Managers (4)
 - Mgmt 3001—Fundamentals of Management (4)
 - Mktg 3000—Principles of Marketing (4)
- Three elective courses in the Carlson School of Management
- Elective courses in Agricultural and Applied Economics and the Carlson School of Management may be used to meet area of emphasis requirements.

Area of Emphasis:

Students are required to select and complete at least 16 credits of coursework in one of the following areas of emphasis.

Business Management (16 credits minimum)

- BFin 3100—Financial Management (4)
- Choose additional credits from the following:
- Acct 3201—Intermediate Management Accounting (4)
 - AgEc 3450—Agricultural Input Marketing Economics (4)
 - AgEc 3920—Agricultural Law (4)
 - AgEc 5440—Cooperatives and Agribusiness Organization (4)
 - BLaw 3058—Introduction to Law, the Law of Contracts and Sales Contracts (4)
 - IR 3002—Personnel and Industrial Relations (4)
 - IR 3010—The Individual and the Organization (4)
 - Mgmt 3002—Psychology in Management (4)
 - Mgmt 3008—Entrepreneurship and the Smaller Enterprise (4)
 - OMS 3056—Production and Inventory Management (4)

Commodity and Farm Input Marketing (16 credits minimum)

- AgEc 5480—Futures Markets and Prices (4)
 - LM 3000—Introduction to Logistics Management (4)
- Choose additional credits from the following:
- AgEc 3420—Grain Marketing Economics (4)
 - AgEc 3430—Dairy Marketing Economics (4)
 - AgEc 3440—Livestock and Meat Marketing Economics (3)
 - AgEc 3450—Agricultural Input Marketing Economics (4)
 - AgEc 5400—Intermediate Market and Price Analysis (4)
 - AgEc 5750—Agricultural Trade and Commercial Policies (3)
 - LM 5020—Advanced Logistics Management (4)

Finance and Banking (16 credits minimum)

- AgEc 5500—Financial Markets and Agricultural Credit Institutions (4)

BFin 3100—Financial Management (4)

Choose additional credits from the following:

- Acct 3201—Intermediate Management Accounting (4)
- Acct 5160—Financial Statement Analysis (4)
- AgEc 3920—Agricultural Law (4)
- AgEc 5480—Futures Markets and Prices (4)
- BFin 3300—Investment Management and Financial Markets (4)
- BFin 3601—Bank Financial Management (4)
- Econ 5432—International Finance (4)
- Ins 5100—Risk Management and Insurance (4)

Food Marketing (16 credits minimum)

- AgEc 5550—Food Marketing Economics (4)
 - Mktg 3020—Marketing Operations Management (4)
- Choose additional credits from the following:
- AgEc 5480—Futures Markets and Prices (4)
 - AgEc 5580—Human Capital and Household Economics (3)
 - AgEc 5750—Agricultural Trade and Commercial Policies (3)
 - FScN 3400—Food Communication Techniques (3)
 - FScN 3472—Food Selection Principles (4)
 - FScN 5390—Introduction to Food Law (4)
 - Mktg 3010—Buyer Behavior and Market Analysis (4)
 - Mktg 3030—Sales and Distribution Management (4)
 - Mktg 3050—Marketing Communications (4)
 - Mktg 3065—Retail Management (4)

Individualized Area of Emphasis (16 credits minimum)

Students preparing for career opportunities that emphasize skills such as communications, law, or information systems may use this alternative to design an area of emphasis. A program of study under this emphasis must be approved by the adviser and the major coordinator. At least 12 of the 16 credits must be completed after receiving approval.

F. Agricultural Science Courses (16 credits minimum)

Courses should be selected to ensure coursework breadth. At least one course must be 3xxx or 5xxx. Courses in agricultural education, fisheries and wildlife, landscape architecture, rhetoric or physical and biological sciences may not be used to meet this requirement. In agricultural engineering, only AgET 3606 and 5400 may be used.

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

Agricultural Education

*Dr. Roland Peterson, Major Coordinator
320 Vocational and Technical Education Building
1954 Buford Avenue
St. Paul, MN 55108
612/624-4736*

The undergraduate major in agricultural education, offered jointly by COA and the College of Education, is for students who plan to teach agriscience, agriculture, horticulture, agribusiness, food systems, natural resource management, and agriscience education in public schools, technical colleges, community colleges, or for those who plan to work in educational positions in agricultural development and in various agricultural-related organizations. The program provides comprehensive education for those preparing for teaching, extension work, local, national, and international development, other professional careers in sales and marketing, financial management, or production agriculture. The program requires a broad study of agriculture and permits emphasis in animal science, crop science, agricultural economics, agricultural business, horticulture, soils, natural resources, and agricultural engineering technology. In the education and the natural and managed environmental systems specializations, it also offers special preparation in education necessary to qualify for licensure as a teacher of agriculture, horticultural science, agribusiness, agriscience education, and natural resources.

Admission Procedures

Students may enter a pre-agricultural education major in COA as freshmen or transfer students. Students must earn 90 credits in the pre-agricultural education major before transferring to the College of Education. Students should apply for admission to the College of Education in the final quarter of their sophomore year. This application may be completed with the faculty of Agricultural Education, 325 Vocational Technical Education Building. Students must complete the application requirements as directed by the Agricultural Education staff. Applications must be submitted within the first three weeks of the quarter preceding the desired quarter of admission.

The Natural and Managed Environmental Systems Specialization and the Agricultural Education Specialization—Students in these specializations will be eligible to teach agriculture, horticulture, natural resources, forestry, agribusiness, agriscience, food systems, and agricultural mechanics at the secondary or post-secondary levels and adult farm business management education with the agricultural education specialization, provided they have the appropriate work experience to accompany their degree. In addition, graduates from this specialization may seek employment in all of the other areas listed in the general features section.

To be eligible for admission to the agricultural education specialization or the natural and managed environmental systems specialization in the College of Education, students must have a minimum overall GPA of at least 2.50. Before admission, students must complete the Pre-Professional Skills Test (PPST), which is a test of basic reading, writing, and mathematics knowledge.

The Agricultural Development Specialization—Students in this specialization will be eligible for a wide range of positions in agricultural development. They will guide the process of change for improving an individual, organization, community, or society within the context of agriculture. They may seek employment in all fields listed in the general features section except teaching. This specialization provides an emphasis in experiential education in both the production and agribusiness phases of agriculture.

To be eligible for admission to the agricultural development specialization in the College of Education, you must have a minimum overall GPA of at least 2.30.

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

Transfer students who have completed two or more years of college work apply for admission to COA, Office of the Registrar—St. Paul, University of Minnesota, 130 Coffey Hall, 1420 Eckles Avenue, St. Paul, MN 55108. COA will review the application and evaluate the credits earned. During the first quarter of enrollment in COA, students will apply for admission to the College of Education.

Clinical Experience

In the natural and managed environmental systems and the agricultural education specialization, students must have an overall GPA of 2.50 to be eligible for clinical experience.

Graduation Requirements

Students must have an overall GPA of 2.50 to meet graduation requirements in the natural and managed environmental systems and the agricultural education specializations. They must have an overall GPA of 2.30 to graduate from the agricultural development specialization.

Work Experience

Students applying for licensure must have satisfactory work experience in agriculture production and agribusiness. In general, students must verify at least 2,000 hours of work experience in production and agribusiness agriculture.

Major Requirements

Students majoring in agricultural education must complete the requirements listed below in categories A, B, C, and D. Course substitutions in these categories may be made only with the approval of the adviser and COA. Changes in the education categories require the approval of the adviser and the College of Education. Changes in the agriculture and natural resources categories may be made with the adviser's recommendation and approval of the agricultural education coordinator.

Agricultural Education/Agricultural Development/Natural and Managed Environmental System Specializations

A. Communication, Language, Symbolic Systems (25 credits)

One mathematics course—check specialization
 Rhet 1101—Writing to Inform and Persuade (4)
 Rhet 1104—Library Research Methods (1)
 Rhet 1222—Public Speaking (4)
 Rhet 3562—Writing in Your Profession (4)
 Rhet 1200—Computer Applications in Your Profession (3)
 One of the following:

Rhet 1151—Writing in Your Major (4)
 Rhet 3254—Advanced Public Speaking (4)
 Rhet 3266—Communication, Discussion in Small Group Decision Making (4)

One course in statistics

All courses in category A may be selected from equivalent courses offered in other departments or colleges within the University.

B. Biological and Physical Sciences (32 credits minimum)

Chem 1001—General Principles of Chemistry (4)
 BioC 1401—Elementary Biochemistry (4)
 or Chem 3301—Organic Chemistry I (4)
 Biol 1009—General Biology (5)
 One course in physics (5)
 ScAg 1500—Basic Biotechnology (3)

Students must select 11 additional credits of elective courses in the biological and physical sciences
 or Chem 1051—Chemical Principles I (4)
 Chem 1052—Chemical Principles II (4)
 BioC 1401—Elementary Biochemistry (4)
 Biol 1009—General Biology (5)
 Biol 1103—General Botany (5)
 or Biol 1106—General Zoology (5)

One course in physics (5)

ScAg 1500—Basic Biotechnology (3)

Plus 2 elective credits in biological or physical science.

C. The Individual and Society (16 credits minimum)

Required:

AgEc 1101—Principles of Microeconomics (4)
 Psy 1001—General Psychology (5)

Recommended Additional Courses:

AgEd 5010—Rural Leadership Development
 Soc 1001—Introduction to Sociology (4)
 Soc 1651—Rural Sociology (4)
 Soc 3551—World Population Problems (4)
 Hist 1301—American History (4)
 Hist 1302—American History (4)
 Geog 1301—Human Geography (5)
 Geog 1401—Physical Geography (5)
 Anth 1102—Introduction to Social and Cultural Anthropology (5)
 Any additional course in anthropology
 Pol 1001—American Government & Politics (5)
 Pol 1025—World Politics (4)
 Pol 3825—The International System (4)
 Phil 1002—Introduction to Philosophy (5)
 Phil 1003—Introduction to Ethics (5)

For the Agricultural Education Development Specialization, students may take any two of the following three courses:

Psy 1001—General Psychology (5)
 Soc 1001—Introduction to Sociology (4)
 Anth 1102—Introduction to Social and Cultural Anthropology (5)

D. Literature, Humanities, and Fine Arts (12 credits minimum)

Students are encouraged to pursue 12 or more credits in a theme area. (See adviser lists for themes.) Students may apply up to 5 credits in the performing arts such as music, theatre, and studio arts in category D. (See COA's general requirements on page 31 for additional suggestions.)

Professional Requirements (3 credits)

AgEd 1001—Introduction to Agricultural Education (1)
 AgEd 1002—Principles of Career Planning in Agriculture (1)
 AgEd 3029—Directed Experience in Agricultural Education (1)

Emphasis Areas

1. Agricultural Education (Teacher Licensure Program)

Math 1031—College Algebra and Probability (4)

General Education (20 credits)

EPsy 5119—Learning and Cognitive Foundations of Education (4)
 EPsy 5139—Interpersonal and Personality Effects on Learning (4)
 EPsy 5229—Classroom Assessment Methods (2)
 EdPA 5090—School and Society (3)
 Kin 5530—Biological Foundations of Education (2)
 PubH 3004—Basic Concepts in Personal and Community Health (5)
 or PubH 3001—Personal and Community Health (3) and PubH 3003—Fundamental of Alcohol and Drug Abuse (2)

Agricultural Education (32 credits)

AgEd 5028—Teaching Methods in Agricultural Education (5)
 AgEd 5049—Agricultural Education for Adults (3)
 AgEd 5061—Program Planning and Evaluation (3)
 AgEd 5072—Practicum: Agricultural Business and Industry (3)
 VoEd 5100—Clinical Experience (2,2,8)
 VoEd 5300—Philosophy and Practice of Vocational Education (3)
 VoEd 5330—Coordination Techniques in Cooperative Education (3)

Animal Science (14 credits)

Applied Economics/Business (16 credits)

BIE 3060—Professional Sales Management (3)
 or GC 1537—Professional Selling (3)
 plus 13 additional credits in Marketing, Management (1 course), and Accounting (1 course)

Mechanical Technology & Environment (6 credits)

AgEd 1042—Current Technical Competencies (3)
 AgEd 5042—Agricultural Mechanics (3)

Natural Resources (9 credits)

Plant Science/Plant Pathology or Entomology (12 credits)

Soil Science (5 credits)

Soil 1020—The Soil Resource (5)
 or Soil 3125—Basic Soil Science (5)

Electives to complete the 198 credits required for a bachelor of science degree.

2. Agricultural Development

Math 1031—College Algebra and Probability

General Education

AdEd 5401—Adult Learning and Development Through the Life Span (3)

Agricultural Education

AgEd 5010—Rural Development Leadership (3)
 AgEd 5021—Education Through Extension Methods (3)
 AgEd 5023—Extension Methods for Developing Countries (3)
 AgEd 5025—Extension Program Development (3)
 AgEd 5055—Methods in Farming Systems Research and Extension (3)

Plus 10 credits from the following:

AgEd 3001—Experiential Learning: Production Agriculture (0-10)
 AgEd 3002—Experiential Learning: Agricultural Business (0-10)

Development

Two from the following:

AgEc 3070—Agriculture and Economic Growth in Developing Countries (4)
 AgEc 5790—World Food Problems (3)
 Econ 5401—International Economics (4)
 Pol 3477—Political Development (4)
 Pol 3835—The International System (4)

Two from the following:

- AgEc 3006—Applied Macroeconomics: Government & the Economy (4)
- AgEc 3007—Applied Microeconomics: Trade, Policy and Development (4)
- AgEc 3040—Economic Development of American Agriculture (4)
- AgEc 3610—Resource Development and Environmental Economics (4)
- Econ 5301—Economic Development (4)
- Econ 5307—Comparative Economic Systems (4)
- FScN 1102—Technology of Food Processing (4)
- FScN 1612—Principles of Nutrition (4)

Animal Science (7 credits)

Agricultural Economics (18 credits)

- AgEc 1250—Principles of Accounting (4)
or Acct 1050—Principles of Accounting (4)
- AgEc 3810—Principles of Farm Management (4)
- BIE 3060—Professional Sales Management (3)
or GC 1537—Professional Selling (4)

Plus select two courses from the following:

- AgEc 3420—Grain Marketing Economics (4)
- AgEc 3430—Dairy Marketing Economics (4)
- AgEc 3440—Livestock and Meat Marketing Economics (3)
- AgEc 3450—Agricultural Input Marketing Economics (4)
- AgEc 5440—Cooperatives and Agribusiness Organizations (4)
- AgEc 5480—Futures Markets and Prices (4)

Mechanical Technology & Environment (5 credits)

Natural Resource Management (6 credits)

Plant Science/Plant Pathology or Entomology (12 credits)

Soil Science

- Soil 1020—The Soil Resource (5)
or Soil 3125—Basic Soil Science (5)

Electives to complete the 198 credits required for a bachelor of science degree.

3. Natural and Managed Environmental Systems
(Teacher Licensure Program)

- Math 1142—Short Calculus (5)
or Math 1251 & 1252 One-Variable Differential and Integral Calculus I, II (4,4)
- Stat 3011—Statistical Analysis (4)
or Agro 3060—Field Plot Design in Agronomy (4)
- Geol 1001—The Dynamic Earth: An Introduction to Geology (4)
or Geol 1111—Introductory Physical Geology (5)
- EEB 3001—Introduction to Ecology (4)

General Education

- EPsy 5119—Learning and Cognitive Foundations of Education (4)
- EPsy 5139—Interpersonal and Personality Effects on Learning (4)
- EPsy 5229—Classroom Assessment Methods (2)
- EdPA 5090—School and Society (3)
- Kin 5530—Biological Foundations of Education (2)
- PubH 3004—Basic Concepts in Personal and Community Health (5)
or PubH 3001—Personal and Community Health (3) and PubH 3003—Fundamental of Alcohol and Drug Abuse (2)

Agricultural Economics/Business (8 credits)

- AgEc 1250—Principles of Accounting (4)
or AgEc 3810—Principles of Farm Management (4)
- AgEc 3610—Resource Development and Environmental Economics (4)

Agricultural Education

- AgEd 5028—Teaching Methods in Agricultural Education (5)
- AgEd 5061—Program Planning and Evaluation (3)
- AgEd 5072—Practicum: Agricultural Business and Industry (3)
- VoEd 5100—Clinical Experience (2,2,8)
- VoEd 5300—Philosophy and Practice of Vocational Education (3)
- VoEd 5330—Coordination Techniques in Cooperative Education (3)

Animal Science (6 credits)

- AnSc 3401—Principles of Animal Nutrition (4)

Select two from the following:

- AnSc 1301—Management Technique: Swine (1)
- AnSc 1302—Management Technique: Sheep (1)
- AnSc 1303—Management Technique: Beef (1)
- AnSc 1304—Management Technique: Dairy (1)
- AnSc 1305—Management Technique: Poultry (1)

Mechanical Technology and Environment (6 credits)

- AgEd 1042—Current Technical Competencies (3)
- AgEd 5042—Agricultural Mechanics (3)

Natural Resources & Environment Studies (15 credits)

- NRES 3001—Colloquium in Nat. Resources and Environmental Studies (1)
- NRES 3060—Water Quality in Natural Resource Management (3)
or AgET 5410—Hydrology and Water Quality (5)
- NRES 5100—Problem Solving in Natural Resources and Environmental Studies (5)
- NRES 5210—Survey, Measurement, and Modeling Methods for Natural Resource Analysis (3)

One from the following:

- NRES 1010—Issues in the Environment (3)
or FR 1201—Conservation of Natural Resources (3)
or FW 1002—Wildlife: Ecology Values, and Human Impact (3)
or FW 1101—Ethics and Values in Research Management (3)
or FW 3052—Introduction to Fisheries and Wildlife (3)

Soil and Plant Science (26 credits)

- Soil 1020—The Soil Resource (5)
or Soil 3125—Basic Soil Science (5)
- Soil 3220—Soil Conservation and Land Use Management (4)
or Soil 3416—Soil Fertility (4)
- Soil 1425—Introduction to Meteorology (4)
or Geog 1425—Introduction to Meteorology (4)
- AnPl 3010—Environment and World Food Production (4)
or AnPl 5060—Integrated Management of Cropping Systems (4)
- Agro 1010—Principles of Agronomy (5)
or Hort 1021—Woody Plant Materials (5)
or FR 1100—Dendrology (4)
- Agro 3020—Growth and Development of Field Crops (4)
or Hort 3001—Growth Regulation of Horticultural Plants (5)

Electives to complete the 198 credits required for graduation with a bachelor of science degree.

Post Baccalaureate:

Agricultural Education Teaching Specialization

This program provides an alternative teacher education experience. The program is for students with baccalaureate degrees in agriculture, or natural resources with a major in one of the following: agricultural economics, agricultural business administration, agronomy, agricultural engineering technology, soil science, horticulture science, landscape architecture, soil and water resource management, agricultural journalism, fisheries and wildlife, forest resources, natural resources and environmental studies, or other equivalent degrees under different titles with similar content. This program prepares students for initial licensure for teaching agriculture, horticulture, natural resources, forestry, agribusiness, agriscience, food systems, and agricultural mechanics at the secondary and adult levels. Applicants should have a 2.80 undergraduate GPA. After admission, students may be enrolled in both undergraduate- and graduate-level courses. Appropriate credits will be applied toward an M.Ed. program. See the *College of Education Bulletin* for program details.

Agricultural Industries and Marketing

Dr. Delane Welsch
130 Classroom Office Building
1994 Buford Avenue
St. Paul, MN 55108
612/625-3713

Industries related to modern agriculture include the manufacturers and distributors of farm production inputs (such as equipment, structures, animal feed, health products, seeds, and agricultural chemicals), and the assemblers, processors, manufacturers, and distributors of products originating in farming (such as meat, milk, eggs, wool, grains, fruits, vegetables, nursery crops, flowers, and turf) and the finance and insurance industries providing agricultural credit. These agribusiness industries employed about 18 million workers in 1988 and created nearly 16 percent of the U.S. Gross National Product that year. "Agribusinesses," such as these, regularly search for individuals who have a broad education in the scientific aspects of agriculture, effective work and communication skills, and the ability to competently use quantitative methods to solve business problems.

All departments in the College of Agriculture contribute to and are represented by the Agricultural Industries and Marketing (AIM) major. This educational program is designed to achieve two objectives:

- 1) to provide a broad-based educational program reflecting the academic strengths of the College of Agriculture and the University at large, and
- 2) to prepare 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 an Area of Emphasis in one of five areas: animal industries, horticultural industries, crops/soils industries, food industries, or an individualized emphasis. Certified advisers assist students with course selection in their area of emphasis, identify appropriate internships or practicum experiences, and select electives to develop breadth and depth in their undergraduate programs.

In addition, this major emphasizes development of oral and written communication skills in various interactive settings. Courses in business methods and economic analysis help students recognize and solve problems in the modern agribusiness world.

The cross-disciplinary AIM major requires that students become involved in "real-world" experiences (industry internships) and/or in marketing problem-solving (marketing practicum). As students progress through the program, regular meetings with faculty, agribusiness leaders, student organizations, alumni, and fellow students are a part of the educational experience.

Major Requirements

All students in the AIM major must complete 180 credits, including the requirements listed below. Faculty advisers assist students in selecting required courses, the use of electives, and the professional project (internship or practicum).

A. Communication, Language, Symbolic Systems (45 credits minimum)

1. Communications

- GC 1537—Professional Selling (4)
or BIE 3260—Professional Sales Education (3)
- Rhet 1101—Writing to Inform and Persuade (4)
- Rhet 1104—Library Research Methods (1)
- Rhet 1151—Writing in Your Major (4)
- Rhet 1222—Public Speaking (4)
- Rhet 3266—Communication, Discussion in Small Group Decision Making (4)
or Spch 3411—Small Group Communication Processes (4)
- Rhet 3562—Writing in Your Profession (4)
- Rhet 5258—Interviewing: Dynamics of Face-to-Face Communication (4)

One additional communications elective from the following courses:

- Jour 3201—Principles of Advertising (4)
- Rhet 3254—Advanced Public Speaking (4)
- Spch 3431—The Role of Persuasion in the Modern World (4)
- Spch 3441—Communication in Organizations (4)

2. Quantitative Methods

- AgEc 1250—Principles of Accounting (4)
or Acct 1050—Introduction to Financial Reporting (4)
- Math 1142—Short Calculus (5)
- Stat 3011—Statistical Analysis (4)
or IDSc 1010—Fundamentals of Information Development and Use (4) and OMS 1020—Data Analysis and Statistical Inference for Managers (4)

B. Physical and Biological Sciences

- Biol 1009—General Biology (5)
- Chem 1001—General Principles of Chemistry (4)
or Chem 1051—Chemical Principles I (4)
- Chem 1002—Elementary Organic Chemistry (4)
or BioC 1401—Elementary Biological Chemistry (4)

One of the following:

- AnPI 3010—Environment and World Food Production (4)
- Biol 1103—General Botany (5)
- Biol 1106—General Zoology (5)
- Biol 3011—Animal Biology (5)
- Biol 3012—Plant Biology (5)
- MicB 3103—General Microbiology (5)
or VPB 3103—General Microbiology (5)

C. The Individual and Society (16 credits minimum)

See All-College Requirements for suggested courses, page 30.

- Psy 1001—Introduction to Psychology (5)
or Soc 1001—Introduction to Sociology (4)

One of the following for C2 requirement:

- AgEc 3040—Economic Development of American Agriculture (4)
- Rhet 1310—Humanities: The Land in American Experience (4)
- Rhet 3375—Humanities: Agricultural Heritage (4)

Lists of recommended course clusters and sequences are available from your adviser. Work with your adviser in selecting the courses for the elective groupings.

D. Literature, Humanities, and Fine Arts

(12 credits minimum)

See All-College Requirements, page 30.

Lists of recommended course clusters and sequences are available from your adviser. Work with your adviser in selecting the courses for the elective groupings.

E. Professional Requirements

1. *Professional* (5 credits minimum)
 - AIM 1001—Orientation (1)
 - PEP 5000—Professional Experience Program (internship) (4)
 - or AIM 5001—Marketing Practicum I (2)
 - and AIM 5002—Marketing Practicum II (2)
2. *Economics/Business*
 - AgEc 1101—Principles of Microeconomics (4)
 - AgEc 3001—Applied Microeconomics: Consumers and Markets (4)
 - AgEc 3002—Applied Microeconomics: Managerial Economics (4)
 - AgEc 3400—Markets, Marketing, and Prices (4)
 - AgEc 3920—Agricultural Law (4)

One of the following:

 - AgEc 3420—Grain Marketing Economics (4)
 - AgEc 3430—Dairy Marketing Economics (4)
 - AgEc 3440—Livestock and Meat Marketing Economics (3)
 - AgEc 3450—Agricultural Input Marketing Economics (4)
 - AgEc 5480—Futures Markets and Prices (4)
 - AgEc 5550—Food Marketing Economics (4)
 - or FScN 5474—Food Marketing Economics (4)

One of the following:

 - AgEc 3500—Agribusiness Finance (4)
 - AgEc 5440—Cooperatives and Agribusiness Organization (4)
 - GC 1513—Small Business Fundamentals (5)

F. Agricultural Sciences

- AgET 3025—Engineering Principles and Applications (4)
 - or FScN 1102—Technology of Food Processing (4)
- Agro 1010—Principles of Agronomy (5)
 - or Hort 1036—Plant Propagation (5)
- AnSc 1100—Introduction to Animal Science (5)
- Soil 3125—Basic Soil Science (5)
 - or FScN 1612—Principles of Nutrition (4)

Areas of Emphasis (16 credits minimum)

Students select one of the following areas of emphasis and work with their adviser to develop technical competence.

Animal Industries

Contact: Leslie Hansen, Animal Science, 130 Haecker Hall

- AnSc 3220—Principles of Animal Breeding (5)
- AnSc 3301—Systemic Physiology (6)
- AnSc 3401—Principles of Animal Nutrition (4)

One of the following:

- AnSc 5401—Swine Nutrition and Feeding (4)
- AnSc 5403—Ruminant Nutrition (4)
- AnSc 5405—Poultry Nutrition (3)

Recommended Electives:

- AnSc 1120—Livestock and Meat Evaluation (4)
- AnSc 1510—Consumer Meat Science (2)
- AnSc 1520—Milk Production (3)
- AnSc 3113—Animal Welfare (4)
- AnSc 3131—Live Animal Performance and Selection (3)
- AnSc 3305—Reproductive Physiology, Artificial Insemination, and Lactation (5)
- AnSc 5231—Dairy Cattle Breeding (4)
- AnSc 5240—Animal Cytogenetics (4)
- AnSc 5280—Livestock Entomology (3)
- AnSc 5601—Swine Production (4)
- AnSc 5602—Sheep Production (4)
- AnSc 5603—Beef Cattle Production (4)
- AnSc 5604—Dairy Farm Management (4)
- AnSc 5605—Poultry Production (4)
- AnSc 5609—Principles of Farm Animal Environment (3)
- GCB 3022—Genetics (4)
- CAPS 3502—Animal Health and Disease (5)

Crops/Soils Industries

Contact: Vernon B. Cardwell, Crops/Soils, 309 Agronomy.

- Agro 3020—Growth, Development, and Culture of Field Crops (5)
 - Soil 3416—Plant Nutrients in the Environment (4)
- Plus at least 7 credits from the following:*
- Agro 3030—Harvest, Storage, and Utilization of Field Crops (4)
 - Agro 3060—Field Plot Design in Agronomy (4)
 - Agro 3130—Seed Technology (2)
 - Agro 3150—Advanced Seed and Grain Evaluation (4)
 - Agro 3200—Seminar (1)
 - Agro 5010—Forage Production and Utilization (4)

- Agro 5020—Introduction to Plant Breeding (4)
- Agro 5030—Weed Control (5)
- Agro 5050—Management Technologies for Crop Production in Minnesota (4)
- AnPI 3010—Environment and World Food Production (4)
- AnPI 5060—Integrated Management of Cropping Systems (4)
- Ent 1005—Economic Entomology (4)
- PIFa 3001—Management and Control of Field Crop Diseases (4)
- Soil 3118—Seminar: Soil and Water Pollution and Public Policy (1)
- Soil 3220—Soil Conservation and Land Use Management (4)
- Soil 3417—Plant Nutrients in the Environment Lab (1)
- Soil 5510—Field Study of Soils for Environmental Assessment (4)
- Soil 5240—Microclimatology (3)
- Soil 5560—Interpretation of Land Resources (3)
- Soil 5610—Soil Biology (4)

Horticultural Industries

Contact: Bert Swanson, Horticulture, 164 Alderman Hall

- Hort 1021—Woody Plant Materials (5)
 - Hort 3001—Growth Regulation of Horticulture Plants (5)
 - Hort 3002—Horticulture Cropping Systems (5)
- Plus at least 13 credits from the following:*
- Hort 3003—Plant Genetics and Improvement (4)
 - Hort 3004—Applications of Plant Biotechnology (4)
 - Hort 3030—Landscape Design of Residential and Small Commercial Sites (4)
 - Hort 3040—Landscape Design and Implementation (5)
 - Hort 3072—Turf Management (4)
 - Hort 5001—Harvest to Market of Horticultural Crops (3)
 - Hort 5026—Landscape Management (5)
 - Hort 5031—Temperate Fruit Production (4)
 - Hort 5034—Commercial Vegetable Agriculture (5)
 - Hort 5042—Turf Grass Science (5)
 - Hort 5046—Nursery Management I (4)
 - Hort 5047—Nursery Scheduling and Enterprise Development (2)
 - Hort 5048—Nursery Management II (4)
 - Hort 5054—Commercial Floriculture Crop Production (4)
 - Hort 5055—Commercial Glasshouse Systems Practices and Problems (5)

Food Industries (20 credits required)

Contact: Elaine Asp, Food Science and Nutrition, 261 Food Science and Nutrition

- FScN 1020—Introductory Microbiology (4)
 - FScN 3102—Introduction to Food Science (4)
 - AgEc 5550—Food Marketing Economics (4)
 - or FScN 5474—Food Marketing Economics (4)
- Plus at least 8 credits from the following:*
- FScN 3112—Food Analysis (4)
 - FScN 3400—Food Communication Techniques (3)
 - FScN 3472—Food Selection Principles (4)
 - FScN 3730—Quantity Food Production Management (3)
 - FScN 3732—Lecture in Quantity Food Production Management (2)
 - FScN 5643—World Food Problems (3)
 - FScN 5524—Sensory Evaluation of Dairy Products (1)

Individualized AIM Emphasis (16 credits minimum)

Courses may be selected according to the student's interests in consultation with the student's adviser and with approval of the AIM major committee.

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

Animal and Plant Systems

Dr. Bert T. Swanson, Major Coordinator
164 Alderman Hall
1970 Folwell Avenue
St. Paul, MN 55108
612/624-7432

The Animal and Plant Systems major prepares students to work as managers and technical advisers for animal and plant production systems, maintenance, and sales. This curriculum provides a science-based agricultural education with an applied principle emphasis. Students majoring in animal and plant systems are prepared to pursue careers in animal, plant, and environmental industries through a curriculum designed to increase their understanding of agriculture, science, mathematics, business and social science. Quality performance in this curriculum also allows students to pursue graduate studies in animal- and plant-related specializations.

Students majoring in Animal and Plant Systems select an area of emphasis based on their interests and career goals. The four areas available are outlined below.

Animal Production prepares students for careers in farm animal and poultry production. Career opportunities include farming, farm management, county extension work, dairy production, meat packing, farm supply, genetic and nutritional consulting, appropriate government positions, and artificial insemination.

Crops and Soils/Horticultural Food Production prepares students for careers in the production and improvement of field crops, vegetables, and fruits. Career opportunities include positions as technical representatives of agricultural chemical and seed companies, field specialists for crops, environmental protection specialists, state and federal crop regulatory agents, grain buyers and merchandisers, storage elevator operators, farm managers, field agronomists and horticulturists for production consulting firms, soil and water specialists, conservationists, and many others.

Environmental Horticulture prepares students for professional positions requiring a thorough understanding of the technical and managerial aspects of environmental horticulture. Career opportunities include floriculture; landscape design, installation and management; nursery management and production; turf management; and urban horticulture. Students learn environmental enhancement process and management techniques required in state, city, and county agencies as well as in private industry.

Integrated Pest Management (IPM) prepares students to identify and control major insect, weed, and disease problems on principal agronomic and horticultural crops. Students emphasizing IPM learn how the environment and various cropping systems affect pests. Students learn selection and application of the most comprehensive, cost-

efficient, and environmentally safe IPM procedures. This integrated approach considers such factors as soil fertility, cultivar selection, economics, and ethical concerns. This emphasis prepares students for the following career opportunities: agricultural crop protection products sales representative, crop management consultant, plant pest regulatory official for state or federal agencies, research assistant, and applicator of agricultural crop protection materials.

Major Requirements

All students in Animal and Plant Systems must complete the requirements listed below. All course substitutions may be made only with the approval of the student's adviser and the Coordinating Committee for Animal and Plant Systems and the COA Office.

A. Communications, Language, Symbolic Systems (26 credits minimum)

- Math 1031—College Algebra and Probability (4)
- Rhet 1101—Writing to Inform and Persuade (4)
- Rhet 1104—Library Research Methods (1)
- Rhet 1151—Writing in Your Major (4)
- Rhet 1222—Public Speaking (4)
- Rhet 3562—Writing in Your Profession (4)
- Stat 3011—Statistical Analysis (4)
 - or Agro 3060—Field Plot Design in Agronomy (4)
 - or IDSC 1010 Fundamentals of Information Development and Use (4)
 - or OMS 1020—Data Analysis and Statistical Inference for Managers (4)

Recommended courses:

- Math 1142—Short Calculus
- or Math 1251—One-Variable Differential and Integral Calculus I (4)

Computer Competency—Computer skills are necessary for today's student. As a student in the College of Agriculture, you will use computer applications in your coursework no matter which major you choose. You will be expected to have basic computer competency in word processing, spreadsheets, database management, and telecommunications. Your level of computer competency will be assessed in the advising process. If you lack needed skills, you will be given advice on which courses you will be required to take in order to learn those skills.

B. Physical and Biological Sciences

Biol 1009—General Biology (5)

One from of the following:

- Biol 1103—General Botany (5)
- Biol 3012—Plant Biology (5)
- Biol 1106—General Zoology (5)
- Biol 3011—Animal Biology (5)

Chemistry—Select one of the following sequences:

- 1) BioC 1401—Survey of Biochemistry (4)
 - Chem 1051—Chemical Principles I (4)
 - or Chem 1001—General Principles of Chemistry (4) and Chem 1002—Elementary Organic Chemistry (4)
- 2) Chem 1051—Chemical Principles I (4)
 - Chem 1052—Chemical Principles II (4)
 - Chem 3301—Elementary Organic Chemistry I (4)
 - Chem 3305—Elementary Organic Chemistry Lab (2)
 - Chem 3302—Elementary Organic Chemistry II (4)
 - Chem 3306—Elementary Organic Chemistry Lab (2)

One from the following:*

- Biol 5003—Genetics (4)
- GCB 3022—Genetics (4)
- Hort 3003—Plant Genetics and Improvement (4)

* Note: Required of all students except those in Environmental Horticulture.

Phys 1041—Introductory Physics (5)
 or Phys 1001, 1005—Physical World & Laboratory (4,1)
One from the following:
 AnSc 3111—Introduction to Animal Behavior (4)
 Biol 5003—Genetics (4)
 EEB 3001—Introduction to Ecology (4)
 EEB 3111—Vertebrate Behavior (4)
 Ent 5320—Ecology of Agriculture (4)
 BGC 3022—Genetics (4)
 Geo 1001, 1021—Introduction to Geology & Laboratory (4,1)
 Geo 1002—Historical Geology (4)
 Geo 1005—Geologic Perspectives on Energy (4)
 Hort 3003—Plant Genetics and Improvement (4)
 Hort 3004—Applications of Plant Biotechnology (4)
 Hort 5001—Harvest to Market of Horticultural Crops (3)
 Hort 5015—Restoration and Reclamation Ecology (4)
 Math 1142—Short Calculus (5)
 MicB 3103—General Microbiology (5)
 PBio 5105—Morphology of Vascular Plants (5)
 Phys 1042—Introductory Physics (5)
 Soil 1425—Introduction to Meteorology (4)
 Soil 5240—Microclimatology (3)
 VPB 3103—General Microbiology (5)

C. The Individual and Society (14 credits minimum)

AgEc 1101—Principles of Microeconomics (4)
 One course required in the area of Development of Civilization. See All-College Requirements, page 30.

D. Literature, Humanities, and Fine Arts

(8 credits minimum)
 See All-College Requirements, page 30.

E. General Requirements in the Major

AgET 3025—Engineering, Principles and Applications (4)
 or NRES 3060—Water Quality in Natural Resource Management (3)
 AnPI 1001—Orientation to Animal and Plant Systems (1)
 AnPI 5000—Professional Experience Program (4)
 Soil 1020—Soil Resource (5)
 or Soil 3125—Basic Soil Science (5)

One from the following:

Ent 1005—Economic Entomology (4)
 Ent 3005—Insect Biology (3)
 Ent 5250—Forest Entomology
 Ent 5280—Livestock Entomology (3)

Students must complete at least one area of emphasis.

F. Emphasis Areas

1. Animal Production

Agro 1010—Principles of Agronomy (5)
 AnSc 1100—Introductory Animal Science (5)
 AnSc 1510—Consumer Meat Science (2)
 AnSc 3220—Principles of Animal Breeding (5)
 AnSc 3301—Systemic Physiology (6)
 AnSc 3401—Principles of Animal Nutrition (4)
 CAPS 3502—Animal Health and Disease (5)

One from the following:

AnSc 5401—Swine Nutrition and Feeding (4)
 AnSc 5403—Ruminant Nutrition (4)
 AnSc 5405—Poultry Nutrition (3)

One from the following:

AnSc 5601—Swine Production (4)
 AnSc 5602—Sheep Production (4)
 AnSc 5603—Beef Cattle Production (4)
 AnSc 5604—Dairy Farm Management (4)
 AnSc 5605—Poultry Production (4)

Two from the following:

AgEc 3001—Applied Microeconomics: Consumers and Markets (4)
 AgEc 3002—Applied Microeconomics: Managerial Economics (4)
 AgEc 3430—Dairy Marketing Economics (4)
 AgEc 3440—Livestock and Meat Marketing Economics (3)
 AgEc 3810—Principles of Farm Management (4)
 AnPI 3010—Environment & World Food Production (4)
 GC 1513—Small Business Fundamentals (4)
 GC 1537—Professional Selling (4)

2. Crops and Soils/Horticultural Food Production

Agro 5030—Weed Control (5)
 AnPI 5060—Integrated Management of Cropping Systems (4)

Hort 1036—Plant Propagation (5)
 or Agro 3130—Seed Technology (2)
 Soil 3416,3417—Plant Nutrients in the Environment and Lab (4,1)

One from the following:

Agro 3020—Growth and Culture of Field Crops (4)
 Hort 3001—Growth Regulation of Horticultural Plants (5)
 PBio 3131—Survey of Plant Physiology (4)

One from the following:

Agro 3030—Harvest, Storage and Utilization of Field Crops (4)
 Agro 5020—Introduction to Plant Breeding (4)
 Hort 5001—Harvest to Market of Horticultural Crops (3)

One from the following:

AgEc 3420—Grain Marketing Economics (4)
 AgEc 3810—Principles of Farm Management (4)
 GC 1513—Small Business Fundamentals (4)
 GC 1537—Professional Selling (4)

Select either sequence below: a) Crops and Soils or b) Horticultural Food Production

a. Crops and Soils

Agro 3200—Seminar (1)
 PIPa 3001—Management and Control of Field Crop Diseases (4)
 or PIPa 3002—Management of Horticultural Crop Diseases (4)
 Soil 3220—Soil Conservation and Land Use Management (4)
 or Soil 5510—Field Study of Soils for Environmental Assessment (4)

One course in animal science

Three from the following:

Agro 3030—Harvest, Storage and Utilization of Field Crops (4)
 Agro 3150—Advanced Seed and Grain Evaluation (4)
 Agro 5020—Introduction to Plant Breeding (4)
 Agro 5050—Management Technologies for Crop Production in Minnesota (4)
 Agro 5070—Ecology of Field Crops (3)
 AnPI 3010—Environment and World Food Production (4)
 NRES 3020—Plant Resource Management and the Environment (4)
 Soil 5240—Microclimatology (3)
 Soil 5610—Soil Biology (4)

b. Horticultural Food Production

Hort 3099—Seminar (1)
 Hort 5001—Harvest to market of Horticultural Crops (3)
 Hort 5031—Temperate Fruit Production (4)
 Hort 5034—Commercial Vegetable Agriculture (5)
 PIPa 3002—Management of Horticultural Crop Diseases (4)

3. Integrated Pest Management

AgEc 3450—Agricultural Input Marketing Economics (4)
 or AgEc 3810—Principles of Farm Management (4)
 Agro 3020—Growth and Development of Field Crops (4)
 or Hort 3001—Growth Regulation of Horticultural Plants (5)

Agro 5030—Weed Control (5)
 AnPI 5060—Integrated Management of Cropping Systems (4)
 PBio 3131—Survey of Plant Physiology (4)
 PIPa 3001—Management and Control of Field Crop Diseases (4)

or PIPa 3002—Management of Horticultural Crop Diseases (4)

PIPa 5205—Plant Disease Diagnosis (2)

One course in animal science

Three from the following:

Agro 3020—Growth and Development of Field Crops (4)
 Agro 3030—Harvest, Storage and Utilization of Field Crops (4)
 Agro 5050—Management Technologies for Crop Production in Minnesota
 AnPI 3010—Environment and World Food Production (4)
 Hort 1036—Plant Propagation (5)
 Hort 3001—Growth Regulation of Horticultural Plants (4)
 Hort 3002—Horticultural Cropping Systems (5)
 Hort 3003—Plant Genetics and Improvement (4)
 Hort 3072—Turf Management (4)
 Hort 5026—Landscape Management (4)
 Hort 5031—Temperate Fruit Production (4)

Transfer Students

- Hort 5034—Commercial Vegetable Agriculture (5)
- Hort 5042—Turf Grass Science (5)
- Hort 5046—Nursery Management I (4)
- Hort 5047—Nursery Scheduling and Enterprise Development (2)
- Hort 5048—Nursery Management II (4)
- Hort 5054—Commercial Floriculture Production Practices (4)
- Hort 5055—Commercial Floriculture Production Systems (5)

One from the following:

- Ent 5020—Insect Taxonomy (5)
- Ent 5040—Insect Ecology (4)
- Ent 5215—Insects in Relation to Plant Diseases (3)
- Ent 5250—Forest Entomology (4)
- Ent 5280—Livestock Entomology (4)

One from the following:

- PIPa 5201—Biology of Plant Diseases (3)
- PIPa 5202—Biology of Plant Diseases Laboratory (2)
- PIPa 5203—Phys. and Molecular Plant-Microbe Interactions (3)
- PIPa 5204—Plant Pathology (2)
- PIPa 5206—Biology of Fungi (4)
- PIPa 5209—Biochemistry of Plant Disease (3)
- PIPa 5211—Fungal Genetics (4)
- PIPa 5212—Diseases of Forest and Shade Trees (4)
- PIPa 5213—Plant Nematology (4)
- PIPa 5214—Plant Virology (4)
- Soil 3416,3417—Plant Nutrients in the Environment and Lab (4,1)
- Soil 5610—Soil Biology (4)

4. Environmental Horticulture

- Hort 1021—Woody Plant Materials (5)
- Hort 1022—Herbaceous Plants (5)
- Hort 1036—Plant Propagation (5)
- Hort 3001—Growth Regulation of Horticultural Plants (5)
- Hort 3099—Seminar (1)
- PIPa 3002—Management of Horticultural Crop Diseases (4)
or PIPa 5212—Diseases of Forest and Shade Trees (4)
- Soil 3416,3417—Plant Nutrients in the Environment and Lab (4,1)

Select either sequence below: a) *Landscape, Nursery, and Turf* or b) *Floriculture*

a. Landscape, Nursery, and Turf

- Hort 3030—Landscape Design of Residential and Small Commercial Sites (4)
- Hort 3040—Landscape Design and Implementation (5)
- Hort 3072—Turf Management (4)
- Hort 5026—Landscape Management (4)
- Hort 5042—Turf Grass Science (5)
- Hort 5046—Nursery Management I (4)
- Hort 5047—Nursery Scheduling and Enterprise Development (2)
- Hort 5048—Nursery Management II (4)

Three from the following:

- Acct 1050—Introduction to Financial Accounting (4)
or AgEc 1250—Principles of Accounting (4)
- Acct 3001—Introduction to Management Accounting (4)
- AgEc 1102—Principles of Macroeconomics (4)
- AgEc 3001—Applied Microeconomics: Consumers and Markets (4)
- AgEc 3002—Applied Microeconomics: Managerial Economics (4)
- AgEc 3006—Applied Macroeconomics: Government and the Economy (4)
- AgEc 3007—Applied Macroeconomics: Policy, Trade, and Development (4)
- AgEc 3240—Strategic Management of Farms and Agribusinesses(4)
- AgEc 3260—Operations Management of Farms and Agribusinesses(4)
- AgEc 3400—Markets, Marketing and Prices (4)
- BFin 3000—Finance Fundamentals (4)
or AgEc 3500—Agribusiness Finance (4)
- BLaw 3058—Introduction to Law, Law of Contracts and Sales Contracts (4)
or AgEc 3920—Agricultural Law (4)
- GC 1513—Small Business Fundamentals (4)
- IDSC 1010—Fundamentals of Information Development and Use (4)

- IDSC 3030—Information Systems and Information Management (4)

- Ins 5100—Risk Management and Insurance (4)
- IR 3002—Personnel and Industrial Relations (4)
- IR 3010—Individual in the Organization (4)
- IR 3032—Governing in the Work Place (4)
- IR 5002—Systems of Conflict and Dispute Resolution (4)
- Jour 3201—Principles of Advertising (4)
- Mgmt 3001—Fundamentals of Management (4)
- Mgmt 3004—Business Policy (5)
- Mgmt 5101—Advanced Topics in Management: Small Business Management (4)
- Mktg 3000—Principles of Marketing (4)
- Mktg 3010—Buyer Behavior and Marketing Analysis (4)
- NRES 3010—Ethics and Values in Resource Management (3)
- OMS 1020—Data Analysis and Statistical Inference for Managers (4)
- OMS 3000—Introduction to Operations Management (4)
- Rhet 1200—Information Technology in Scientific and Technical Professions (3)
or GC 1571—Introduction to Microcomputer Applications (5)
or GC 1572—Introduction to Computer Programming (5)
or GC 1575—Introduction to Computers (4)
- Rhet 3266—Communication, Discussion in Small Group Decision Making (4)
- Rhet 5170—Managerial Communication (4)

b. Floriculture

- GC 1513—Small Business Fundamentals (4)
- Hort 3004—Applications of Plant Biotechnology (4)
or Hort 5001—Harvest to Market of Horticultural Crops (3)
- Hort 5054—Commercial Floriculture Production Practices (4)
- Hort 5055—Commercial Floriculture Production Systems (5)

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

Applied Economics

Dr. Kent D. Olson, Major Coordinator
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The Applied Economics major prepares students for careers in private industry, government agencies, agribusinesses, or for graduate work. Areas of emphasis include management and finance; marketing; trade and development; resources and environment; and individualized areas of emphasis that students design in consultation with their adviser. This curriculum emphasizes fundamental written and oral communication skills as well as development of a strong foundation in economic principles and their applications.

This curriculum offers flexibility while providing a strong fundamental core of knowledge. The core group of professional courses includes basic economic principles, applied micro/macroeconomic theory, accounting, and statistics. Students select the remainder of their courses according to their interests.

Note: A total of 65 credits in the entire program must be 3xxx or above.

A. Communication, Language, Symbolic Systems (26 credits minimum)

Quantitative Methods

Math 1142—Short Calculus (5)
or Math 1251—One-Variable Differential and Integral Calculus I (4)

Note: Students contemplating graduate work are encouraged to take the Math 1251-52 sequence (4,4)

Communication

Rhet 1101—Writing to Inform and Persuade (4)
Rhet 1104—Library Research Methods (1)
Rhet 1151—Writing in Your Major (4)
Rhet 1222—Public Speaking (4)
Rhet 3562—Writing in Your Profession (4)
Rhet 3254—Advanced Public Speaking (4)
or Rhet 3266—Communication, Discussion in Small Group Decision Making (4)

B. Physical and Biological Sciences (14 credits minimum)

Biol 1009—General Biology (5)
Chem 1001—General Principles of Chemistry (4)
or Chem 1051—Chemical Principles I (4)
One course from the following:
BioC 1401—Elementary Biochemistry (4)
Biol 1103—General Botany (5)
Biol 1106—General Zoology (5)
Chem 1002—Elementary Organic Chemistry (4)
Geo 1001,1021—Physical Geology, Lab (4,1)
Phys 1001,1005—The Physical World, Lab (4,1)

C. The Individual and Society (16 credits minimum)

One course in American History. See All-College Requirements, page 30.

D. Literature, Humanities and Fine Arts (16 credits minimum)

See All-College Requirements, page 30.

E. Professional Courses (59 credits minimum)

AgEc 1000—Orientation to Agricultural and Applied Economics (1)
AgEc 1101—Principles of Microeconomics (4)
AgEc 1102—Principles of Macroeconomics (4)
AgEc 3001—Applied Microeconomics: Consumers and Markets (4)
AgEc 3002—Applied Microeconomics: Managerial Economics (4)
AgEc 3006—Applied Macroeconomics: Government and the Economy (4)

AgEc 3007—Applied Macroeconomics: Policy, Trade, and Development (4)

AgEc 3400—Markets, Marketing, and Prices (4)

AgEc 1250—Principles of Accounting (4)

or Acct 1050—Introduction to Financial Reporting (4)
IDSc 1010—Fundamentals of Information Development and Use (4)

OMS 1020—Data Analysis and Statistical Inference for Managers (4)

Plus 16 additional credits with at least two agricultural economics courses plus two more courses from Agricultural Economics, Economics, or the Carlson School of Management. Students are encouraged but not required to take 12 or more of these 16 additional credits in one of the following areas of emphasis:

Management and Finance

AgEc 3240—Strategic Management of Farms and Agribusinesses (4)

AgEc 3260—Operations Management of Farms and Agribusinesses (4)

AgEc 3500—Agribusiness Finance (4)

AgEc 5440—Cooperatives and Agribusiness Organization (4)

AgEc 5500—Financial Markets and Agricultural Credit Institutions (4)

AgEc 5020—Applied Linear Programming (4)

Marketing

AgEc 3420—Grain Marketing Economics (4)

AgEc 3430—Dairy Marketing Economics (4)

AgEc 3440—Livestock and Meat Marketing Economics (3)

AgEc 3450—Agricultural Input Marketing Economics (4)

AgEc 5400—Intermediate Market and Price Analysis (4)

AgEc 5440—Cooperatives and Agribusiness Organization (4)

AgEc 5480—Futures Markets and Prices (4)

AgEc 5550—Food Marketing Economics (4)

Trade and Development

AgEc 3040—Economic Development of American Agriculture (4)

AgEc 3070—Agriculture and Economic Growth in Developing Countries (4)

AgEc 5710—U.S. Agriculture: Farm, Food, and Environmental Policy (3)

AgEc 5720—Economics of World Agriculture (3)

AgEc 5730—European Agriculture: Farm, Food, and Environmental Policy (4)

AgEc 5750—Agricultural Trade and Commercial Policies (3)

AgEc 5790—World Food Problems (3)

Resources and Environment

AgEc 3610—Resource Development and Environmental Economics (4)

AgEc 5600—Land and Water Economics (3)

AgEc 5640—Financing State and Local Governments (4)

AgEc 5650—Economics of Natural Resource and Environmental Policy (4)

Econ 5611—Resource and Environmental Economics (4)

Econ 5831—Cost-Benefit Analysis (4)

Regional and Public Economics

AgEc 5620—Regional Economic Analysis (3)

AgEc 5630—Regional Development Systems (3)

AgEc 5640—Financing State and Local Government (3)

Econ 3801—Elements of Public Finance (4)

Econ 5621—Urban Economics (4)

Econ 5623—Housing Markets and Public Policy (4)

Individualized Professional Cluster

Consult with adviser to develop such a program.

Technical Emphasis (16 credits minimum)

Applied economists need both knowledge of economics and expertise in scientific or technical areas. With the help of an adviser, students will select at least four courses in two departments. At least 1 course should be 3xxx or above. The areas should be selected according to the future job interests of the student. For example, students aiming at the food industry may want to take food science courses; those interested in grain marketing could take grain handling and storage classes; resource students may want water, forestry, or ecology courses; etc.

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

Environmental Science

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The Environmental Science (ES) curriculum 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 will become knowledgeable about environmental issues and the science behind policy decisions. Students will gain an appreciation of the important role of managed and natural systems in managing the environment in a sustaining way at the local, regional, national and international levels.

As concern for the environment grows, opportunities for ES graduates increase in agencies and firms involved in control technology, regulation of environmental contamination, and remediation of contaminated sites. Recent ES graduates have found employment in environmental consulting firms; state and local agencies such as the Minnesota Pollution Control Agency, Office of Waste Management, Department of Natural Resources, Department of Health, Minnesota Department of Agriculture, and the Metropolitan Council; federal agencies such as the Environmental Protection Agency, Soil Conservation Service, U.S. Forest Service, and Bureau of Land Management; waste management firms; environmental engineering firms; environmental education; and extension service-resource management.

Graduates would also be prepared to go on to professional school (law or public policy) or graduate school in selected disciplines.

All students require training in math and science social science, humanities, communication and applied technical aspects of environmental problems. Resolving environmental problems involves working with people and therefore emphasis in oral and written communication is required. The environmental science core draws courses from atmospheric science, soil science, hydrology, and plant science.

Students in the Environmental Science program:

- Have analytical skills and a broad understanding of environmental problems;
- Have demonstrated their abilities in scientific courses;
- Have used computers in courses and are competent with many current software tools;
- Have developed skills to communicate effectively with technical and non-technical audiences;

- Have practiced the necessary problem solving skills to develop creative solutions to environmental problems.
- Are highly motivated and committed to solving environmental problems.

Liberal Education Diversified Core and Designated Themes—See the Liberal Education statement on page 8 and information at the beginning of this section.

Foundation Requirements

Basic Sciences

- Biol 1009—General Biology (5)
- Chem 1051, 1052—Chemical Principles I, II (4,4)
- Phys 1041, 1042—Introductory Physics I, II (5,5)
- Biol 1103—General Botany (5)
 - or Biol 1106—General Zoology (5)
- BioC 1401—Elementary Biochemistry (4)
 - or Chem 3301—Elementary Organic Chemistry I (4)

Math and Statistics

- Math 1251, 1252—One-Variable Differential and Integral Calculus I, II (4,4)

One from the following:

- Stat 3011—Statistical Analysis (4)
- Stat 3091—Introduction to Probability and Statistics (4)
- Agro 3060—Field Plot Design in Agronomy (4)

Computer competency

Computer skills are necessary for today's student. As a student in COA, you will use computer applications in your coursework no matter which major you choose. You will be expected to have basic computer competency in word processing, spreadsheets, database management, and telecommunications. Your level of computer competency will be assessed in the advising process. If you lack needed skills, you will be given advice on which courses you will be required to take in order to learn those skills.

Writing and Speaking

- Rhet 1101—Writing to Inform and Persuade (4)
- Rhet 1151—Writing in Your Major (4)
- Rhet 3562—Writing in Your Profession (4)
- Rhet 1222—Public Speaking (4)
 - or Rhet 3266—Communication, Discussion in Small Group Decision Making (4)
- plus 2 other writing intensive courses (8)

History and Social Sciences

- AgEc 1101—Principles of Microeconomics (4)
- AgEc 1102—Principles of Macroeconomics (4)
- AgEc 3610—Resource Developing and Environmental Economics (4)

Professional Requirements

Environmental Courses

- ES 1001—Orientation to Environmental Science (1)
- NRES 3001—Colloquium in Natural Resources and Environmental Studies (1)
- ES 3050—Experience and Training in a Field Setting (1-4)
- ES 1050—Introductory Environmental Science (4)
 - or Biol 3051—Environmental Studies (4)
- NRES 1010—Issues in the Environment (3)
 - or NRES 3010—Ethics and Values in Resource Management (3)
- Soil 5020—Environmental Impact Assessment (3)
- NRES 5100—Problem Solving in Natural Resources (5)

Land, Water, Atmosphere and Ecology Courses

- Soil 1020—The Soil Resource (5)
 - or Soil 3125—Basic Soil Science (5)
- Soil 3416—Plant Nutrients in the Environment (4)
- AgET 5410—Hydrology and Water Quality (5)
 - or FR 5114—Forest Hydrology (3) and NRES 3060—Water Quality in Natural Resource Mgmt (3)
- EEB 3001—Introduction to Ecology (4)
 - or EEB 3101—Ecology for Engineers and Physical Scientists (4)
- Soil 1425—Introduction to Meteorology (4)
- Geo 1001—Introduction to Geology (4)
 - or Geo 1111—Introductory Physical Geology (5)

Soil, Plant and Animal Courses*Soil—select one from the following:*

- Soil 3220—Soil Conservation and Land Use Management (4)
- Soil 5210—Environmental Biophysics (4)
- Soil 5510—Field Study of Soil for Environmental Assessment (4)
- Soil 5555—Wetland Soils (4)

Plant—select one from the following:

- NRES 3020—Plant Resource Management and the Environment (4)
- Agro 3020—Growth and Development of Field Crops (4)
- Hort 3001—Growth Regulation of Horticultural Plants (5)
- PIPa 3001—Management and Control of Field Crop Diseases (4)
- PIPa 3002—Management of Horticultural Crop Diseases (4)
- PIPa 5212—Diseases of Forest and Shade Trees (4)

Animal—select one from the following:

- FW 3052—Introduction to Fisheries and Wildlife (3)
- Ent 1005—Economic Entomology (4)
- AnSc 1100—Introduction to Animal Science (5)
- AnSc 3113—Animal Welfare (4)

Emphasis Areas (24 credits)

There are no required courses. See major coordinator for suggested course lists. Specific courses are chosen with an adviser in such areas as:

Land and Water Resources: Land Use Management, Soil Resources, Sustainable Agriculture, and Water Resources (Hydrology and Climatology)

Environmental Management: Bioremediation, Environmental Measurement, and Waste Management

Environmental Education: Natural and Managed Environmental Systems Education

Electives to reach 180 credits required for graduation with a bachelor of science degree.

Natural Resources and Environmental Studies

A major in Natural Resources and Environmental Studies is available to transfer students Fall 1994 only. Course requirements for the major can be found in the 1993-94 *College of Agriculture Bulletin*. Check with the College Office, 277 Coffey Hall, for further information.

Food Science

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225 Food Science and Nutrition
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Food Science applies scientific principles to the manufacture, distribution, marketing, and consumer aspects of food. Food scientists apply the basic principles and techniques of many disciplines including chemistry, physics, economics, microbiology, nutrition, management, and marketing to food processing and preservation, new product development, and food marketing. Food scientists are concerned with the theoretical and practical aspects of the food chain from the production of raw materials to the use of food products by consumers.

This curriculum balances fundamental principles and practical applications of theory within a flexible program that permits you to tailor your studies to fit personal career goals. You can develop proficiency in a related discipline through an optional area of specialization such as consumer emphasis, process/technology, chemistry, or microbiology. Graduates of the program work in a variety of technical, marketing, and promotional positions in the consumer food industry.

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

Many graduates of the program seek employment after earning the bachelor of science degree, while others continue on to graduate study. Career areas include production management, product and process research and development, public health and regulatory agency service, education, marketing, management, technical sales and promotion, and quality control supervision. Admission to the Food Science program requires a GPA of at least 2.5.

A. Communication, Language, Symbolic Systems (23 credits minimum)

Math 1251, 1252—One-Variable Differential and Integral Calculus I and II (4,4)

or Math 1142—Short Calculus (5)

Rhet 1101—Writing to Inform and Persuade (4)

Rhet 1104—Library Research Methods (1)

Rhet 1222—Public Speaking (4)

Rhet 3562—Writing in Your Profession (4)

Stat 3011, 3012—Statistical Analysis (4,4)

or Stat 5021—Statistical Analysis (5)

B. Physical and Biological Sciences (46 credits minimum)

Biol 1009—General Biology (5)

BioC 3021—Biochemistry (4)

Chem 1051, 1052—Chemical Principles I and II (4,4)

Chem 3301, 3305—Elementary Organic Chemistry I and Laboratory (4,2)

Chem 3302, 3306—Elementary Organic Chemistry II and Laboratory (4,2)

VPB 3103—General Microbiology (5)

or MicB 5105—Biology of Microorganisms (5)

Phys 1041—Introductory Physics (5)

Phys 1042—Introductory Physics (5)

C. The Individual and Society (14 credits minimum)
See All-College Requirements, page 30. One course required in the area of Development of Civilization.
AgEc 1101—Principles of Microeconomics (4)
or Econ 1101—Principles of Microeconomics (4)

D. Literature, Humanities, and Fine Arts
(8 credits minimum)

See All-College Requirements, page 30.

E. Professional Courses in the Major (66 credits minimum)
Required courses:

- FScN 1102—Technology of Food Processing (4)
- FScN 1612—Principles of Nutrition (4)
- FScN 3102—Introduction to Food Science (4)
- FScN 3112—Food Analysis (4)
- FScN 3135—Food Processing I (4)
- FScN 3136—Food Processing II (4)
- FScN 5100—General Seminar (1)
- FScN 5110—Food Chemistry (4)
- FScN 5120—Food Microbiology (5)
- FScN 5122—Control Systems in Food Microbiology (2)
- FScN 5123—Food Fermentation and Biotechnology (4)
- FScN 5135—Food Engineering Unit Operations (5)
- FScN 5136—Unit Operations Laboratory (2)
- FScN 5312—Instrumental Analysis of Foods (3)

In addition to these required courses, a minimum of 16 credits must be chosen from the following courses. A maximum of 4 credits in FScN 5000/5111 may be used to meet the 16 credit requirement.

- FScN 3400—Food Communications Techniques (3)
- FScN 3472—Food Selection Principles (4)
- FScN 5000—Professional Experience Program (4)
- FScN 5111—Independent Study in Food Science and Nutrition (1-5)
- FScN 5314—Physicochemistry of Foods (4)
- FScN 5320—Food Biotechnology (3)
- FScN 5350—Application of Experimental Design in the Food Industry (4)
- FScN 5360—Sensory Evaluation of Food Quality (4)
- FScN 5380—Food Packaging (3)
- FScN 5390—Introduction to Food Law (4)
- FScN 5403—Experimental Study of Foods (5)
- FScN 5414—Ingredient Interactions (3)
- FScN 5474—Food Marketing Economics (4)
- FScN 5512—Meat Technology (4)
- FScN 5522—Technology of Fluid and Concentrated Milk Products (4)
- FScN 5523—Technology of Fermented Dairy Products (4)
- FScN 5524—Sensory Evaluation of Dairy Products (1)
- FScN 5530—Industrial Processing of Fruits and Vegetables (4)
- FScN 5540—Fats and Oils Chemistry and Technology (4)
- FScN 5555—Freezing and Dehydration of Foods (5)
- FScN 5562—Flavor Technology (4)
- FScN 5620—Nutrition and Metabolism (5)

F. Optional Area of Emphasis

An area of emphasis that meets the student's educational and career goals may be designed in consultation with an adviser. The area of emphasis plan must include 20 credits and be submitted to the undergraduate studies committee for approval. A minor that complements the Food Science major is another option students are encouraged to consider. Some suggested areas are chemistry, microbiology, statistics, management, economics, nutrition, international affairs, and communications.

Two special option plans with physical/biochemistry and engineering/chemical engineering emphasis are available. Consult with the program coordinator and/or department head.

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

Nutrition

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Nutrition explores how nutrients and the foods from which they are derived aid the body in health, growth, and development. With the major national and international concern for how nutrition affects health and disease, there are many career opportunities for registered dietitians and nutritionists.

The Nutrition option is for students planning to become registered dietitians by meeting the American Dietetic Association requirements. These include completion of an approved baccalaureate program, approved or accredited professional experience, and a national registration examination. Students transferring to the program must have a minimum GPA of at least 2.50. Students complete the degree program and apply for a postbaccalaureate dietetic internship, or apply, before their junior year, to the University of Minnesota's Coordinated Program in Dietetics and complete both the academic and professional experience requirements in a two-year program. Students expecting to apply to the Coordinated Program in Dietetics, an internship, or graduate school should maintain a GPA of 2.80 or better (a cumulative GPA of 3.0 or better is encouraged). Registered dietitians work in a wide variety of health care, community, educational, and corporate positions relating to food and health. Nutrition graduate choosing not to become registered dietitians may pursue a variety of careers based on their preparation in the sciences, liberal education, and nutrition.

The Nutritional Science option is for students planning to do graduate work in nutrition, related sciences, or professional programs such as medicine or dentistry. Students should be aware of the entrance requirements for the graduate or professional program of their choice and maintain a cumulative GPA of 3.00 or higher.

A. Communication, Language, Symbolic Systems
(22 credits minimum)

- Math 1031—College Algebra and Probability (4)
- Rhet 1101—Writing to Inform and Persuade (4) or equivalent course
- Rhet 1104—Library Research Methods (1)
- Rhet 1151—Writing in Your Major (4)
- Rhet 1222—Public Speaking (4)
- Rhet 3562—Writing in Your Profession (4)

Computer competency—As a nutrition student you will use computer applications in your coursework and will be expected to have basic computer competency in word processing, spreadsheets, database management, and telecommunications. Computer competency will be assessed in the advising process, and students lacking the needed skills may seek advice on courses required to learn those skills.

B. Physical and Biological Sciences (44 credits minimum)

- Biol 1009—General Biology (5)
 BioC 3021—Biochemistry (4)
 CBN 3001—Elementary Anatomy (4 or 5)
 Chem 1051, 1052—Chemical Principles I and II (4,4)
 Chem 3301, 3305—Elementary Organic Chemistry I and Lab (4,2)
 Chem 3302, 3306—Elementary Organic Chemistry II and Lab (4,2)
 VPB 3103—General Microbiology (5)
 or MicB 5105—Biology of Microorganisms (5)
 Phsl 3051—Human Physiology (5)
 or Phsl 1001—Human Physiology: Introductory Survey for Allied Health Sciences (4)

C. The Individual and Society (9 credits minimum)

See All-College Requirements, page 30. One course required in the area of Development of Civilization.

D. Literature, Humanities, and Fine Arts

(9 credits minimum)
 See All-College Requirements, page 30.

E. Professional Courses in the Major (68 credits minimum) (Students may not apply technical courses, performance courses, or studio courses toward this category.)

- FScN 1612—Principles of Nutrition (4)
 FScN 3102—Introduction to Food Science (4)
 FScN 3112—Food Analysis (4)
 FScN 3472—Food Selection Principles (4)
 FScN 3610—Community Nutrition (3)
 FScN 3612—Biological Aspects of Nutrition (4)
 FScN 3730—Quantity Food Production Management [Lab] (3)
 FScN 3732—Lecture in Quantity Food Production Management (2)
 FScN 5100—General Seminar (1)
 FScN 5612—Experimental Nutrition (2)
 FScN 5620—Nutrition and Metabolism (5)
 FScN 5665—Applied Clinical Nutrition I (3)
 FScN 5666—Applied Clinical Nutrition II (3)
 FScN 5667—Applied Clinical Nutrition III (3)
 FScN 5750—Principles of Food Service Management (4)
 LaMP 5177—Pathology for Allied Health Students: General and System Pathology (4)
 or LaMP 5172—Pathology for Allied Health Students (4)
 Mgmt 3001—Fundamentals of Management (4)

One from the following:

- FScN 5110—Food Chemistry (4)
 FScN 5120—Food Microbiology (5)
 FScN 5360—Sensory Evaluation of Food Quality (4)
 FScN 5643—World Food Problems (3)

One from the following:

- HSU 5011—The Teaching-Learning Process in the Health Care Setting (3)
 EPsy 5114—Psychology of Student Learning (3)
 EPsy 5115—Adult Learning and Educational Practice (4)

One statistics course from the following:

- EPsy 5260—Introductory Statistical Methods (4)
 PubH 5404—Introduction to Biostatistics and Statistical Decision (4)
 PubH 5450—Biostatistics I (4)
 Stat 1001—Introduction to Ideas of Statistics (4)
 Stat 3011—Statistical Analysis (4)
 Stat 3091—Introduction to Probability and Statistics (4)
 Stat 5021—Statistical Analysis I (5)

F. Alternative Programs

In addition to the course requirements specified above, you may apply for one of the following programs:

Coordinated Program in Dietetics

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

Nutritional Science

The Nutritional Science Program is for students planning to go on for graduate work in nutrition, related sciences, or professional programs such as medicine or dentistry. Students considering medical school should check the social science and humanities requirements of the schools they plan to apply to as requirements vary. For example, the U of MN Medical School requires 27 credits (non-specified courses) in Social Science and Humanities. Thus, a student would need to take 9 extra credits in these categories.

- Biol 1106—General Zoology (5)
 or Biol 3011—Animal Biology (5)
 Biol 5003—Genetics (4)
 or GCB 3022—Genetics (4)
 BioC 5025—Biochemistry Lab (2)
 FScN 3610—Community Nutrition (3)
 or FScN 5665—Applied Clinic Nutrition I (3)
 FScN 5110—Food Chemistry (4)
 or another advanced chemistry course (4)
 FScN 5622—Macro-Nutrient Metabolism (4)
 FScN 5623—Vitamin and Mineral Biochemistry (4)
 FScN 5624—Human Protein and Energy Utilization (4)
 Math 1142—Short Calculus (5)
 or Math 1251, 1252—One Variable Differential and Integral Calculus I, II (4,4)
 Physics 1104, 5, 6—General Physics (4,4,4)
 Physics 1107, 8, 9—General Physics Lab (1,1,1)
One from the following:
 Phsl 1001—Physiology: Intro. Survey for Allied Health Sciences (4)
 Phsl 3051—Human Physiology (5)
 AnSc 3301—Systemic Physiology (6)

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

Science in Agriculture

Dr. Alan Hunter, Major Coordinator
495E Animal Science/Vet. Medicine
St. Paul, MN 55108
612/624-7455

Science is the basis for progress in modern agriculture. Advances in the agricultural sciences are responsible for the unprecedented growth in quantity and quality of human food, animals, feeds, plant fibers, industrial products and aesthetic plants. Science in agriculture will be critical in addressing the environmental, resource, and technological issues facing humankind into the 21st century. Students completing the Science in Agriculture major in the College of Agriculture will be well prepared for scientific careers of the future.

The Science in Agriculture major is an interdisciplinary program of seven departments in COA. Students in this major obtain a thorough understanding of biological/physical science and mathematics principles and their applications to food and agriculture. Students may elect an area of emphasis within the major or they may choose to construct an individualized program combining courses from several disciplines. Host departments for this major are Agronomy and Plant Genetics, Animal Science, Entomology, Food Science and Nutrition, Horticultural Science, Plant Pathology, and Soil Science. Students in this major complete an undergraduate research thesis under the guidance of a faculty member in one of the host departments.

Students pursuing the Science in Agriculture major should be well prepared to undertake graduate studies in the disciplines represented by the host departments and related areas, as well as in veterinary or human medicine. The major is also excellent preparation for employment in bachelor's degree-level research positions as field or laboratory specialists in academia, government, or industry.

The host departments for the Science in Agriculture major offer excellent opportunities and facilities for gaining experience in scientific research. Students may offset some costs of their education and gain valuable 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 (PEP).

Major Requirements

All students in the Science in Agriculture major must complete the requirements listed below. A minimum of 192 credits is required for completion of the degree. Faculty academic advisers will assist students in selecting suitable courses for completion of electives. Students planning to seek admission for particular graduate

programs should consult the specific admissions requirements for those programs as guidance in selecting coursework options. The academic advisers will also assist students in selecting an undergraduate thesis topic and thesis mentor.

A. Communication, Language, Symbolic Systems (26 credits minimum)

Rhet 1101—Writing to Inform and Persuade (4)
Rhet 1104—Library Research Methods (1)
Rhet 1151—Writing in Your Major (4)
Rhet 1222—Public Speaking (4)
Rhet 3562—Writing in Your Profession (4)
Math 1142—Short Calculus (5)
or Math 1251, 1252—One-Variable Differential and Integral Calculus I and II (4,4)
One additional communications course (4-5)
Computer competency—Computer skills are necessary for today's student. As a student in the College of Agriculture, you will use computer applications in your coursework no matter which major you choose. You will be expected to have basic computer competency in word processing, spreadsheets, database management, and telecommunications. Your level of computer competency will be assessed in the advising process. If you lack these needed skills, you should take Rhet 1200—Information Technology (3).

B. Physical and Biological Sciences (63 credits minimum) Required courses:

BioC 3021—Biochemistry(4)
Biol 1009—General Biology (5)

One of the following:

Biol 1103—General Botany (5)
Biol 3012—Plant Biology (5)
Biol 1106—General Zoology (5)
Biol 3011—Animal Biology (5)
Biol 5013—Microbiology (5)
or VPB 3103—General Microbiology (5)
or MicB 5105—Biology of Microorganisms (5)
or Hort 3004—Applications of Plant Biotechnology (4)
Chem 1051, 1052—Chemical Principles I and II (4, 4)
Chem 3301, 3305—Elementary Organic Chemistry I and Lab (4,2)
Chem 3302, 3306—Elementary Organic Chemistry II and Lab (4,2)
GCB 3022—Genetics (4)
or Biol 5003—Genetics (4)
or Geol 1001, 1021—Introduction to Geology and Laboratory (4,1)
or Hort 3003—Plant Genetics and Improvement (4)
Phys 1041 and 1042—Introductory Physics (5, 5)
or equivalent

Additional courses from the following (8 credits minimum):
These course selections are intended to build a basic science foundation. Your adviser will help you choose courses that complement those chosen above.

AnPI 3010—Environmental and World Food Production (4)
Biol 1103—Botany (5)
Biol 1106—Zoology (5)
Biol 3011—Animal Biology (5)
Biol 3012—Plant Biology (5)
Chem 1133—Elementary Quantitative Analysis (5)
Chem 5520—Elementary Physical Chemistry (3)
EEB 3001—Introduction to Ecology (4)
FScN 1102—Technology of Food Processing (4)
Math 3066—Elementary Differential Equations (4)
PBio 3109—Plant Anatomy (5)
PBio 3131—Survey of Plant Physiology (2)
PBio 3201—Introductory Plant Taxonomy (4)
PIPa 5206—Biology of Fungi (4)
ScAg 1500—Biotechnology (3)
Soil 1425—Introduction to Meteorology (4)
VB 1120—Comparative Vertebrate Morphology (6)

Other: Students may substitute other basic science or mathematics courses with the approval of their adviser; however, such courses cannot be used to also fulfill the area of emphasis course requirements.

C./D. The Individual and Society/Literature, Humanities and Fine Arts (28 credits minimum)

A minimum of 28 credits must be selected in categories C and D. Advisers will assist students in developing a course program in these categories. Lists of recommended course clusters and sequences are available.

C. The Individual and Society (14 credits minimum)

See All-College Requirements, page 30. One course required in the area of Development of Civilization.

D. Literature, Humanities, and Fine Arts (8 credits minimum)

E. Professional and Supporting Courses in the Major (46 credits minimum)

Actual number of credits taken in category E will depend on area of emphasis selected.

Required courses for all students (15 credits minimum):

ScAg 1001—Orientation to Science in Agriculture (1)
or AgEd 1002—Principles of Career Planning in Agriculture (1)

ScAg 5009—Undergraduate Research Thesis (9)

Stat 5021—Statistical Analysis (5)

or Stat 3011, 3012—Statistical Analysis I and II (4,4)

Area of emphasis requirements

Emphasis Areas

1. Animal Science (32 credits)

AnSc 1100—Introductory Animal Science (5)

AnSc 3220—Principles of Animal Breeding (5)

AnSc 3301—Systemic Physiology (6)

AnSc 3401—Principles of Animal Nutrition (4)

Plus a minimum of 12 additional credits from:

AnSc 3111—Introduction to Animal Behavior (4)

AnSc 3305—Reproductive Physiology, AI, and Lactation (5)

AnSc 3510—Growth and Development of Animal Tissues (3)

AnSc 5327,5328—General Endocrine Physiology and Lab (4)

AnSc 5330—Current Topics in Endocrinology (1)

AnSc 5401—Swine Nutrition and Feeding (4)

AnSc 5403—Ruminant Nutrition (4)

AnSc 5405—Poultry Nutrition (3)

AnSc 5609—Principles of Farm Animal Environment (4)

2. Climatology (35 credits)

AgET 5410—Hydrology and Water Quality (5)

Agro 3020—Growth and Development of Field Crops (4)

Geol 1601—Oceanography (4)

Geog 3421—Climatology (4)

PIPa 3004—Air Pollution, People and Plants (3)

Soil 3125—Basic Soil Science (5)

Soil 5240—Microclimatology (3)

Soil 5424—Applied Climatology (3)

Hort 5041—Environmental Physiology of Horticultural Plants (3)

3. Food Science (31 credits)

FScN 1612—Principles of Nutrition (4)

FScN 3102—Introduction to Food Science (4)

FScN 5120—Food Microbiology (5)

Plus a minimum of 18 additional credits from:

FScN 3112—Food Analysis (4)

FScN 5110—Food Chemistry (4)

FScN 5122—Control Systems in Food Microbiology (2)

FScN 5123—Food Fermentations and Biotechnology (3)

FScN 5135—Food Engineering Unit Operations (5)

FScN 5312—Instrumental Analysis of Foods (3)

FScN 5360—Sensory Evaluation of Food Quality (4)

FScN 5403—Experimental Study of Foods (5)

FScN 5414—Ingredient Interactions (3)

FScN 5512—Meat Technology (4)

FScN 5522—Technology of Fluid and Concentrated Milk Products (4)

FScN 5530—Industrial Processing of Fruits and Vegetables (4)

FScN 5540—Fats and Oils Chemistry and Technology (4)

FScN 5555—Freezing and Dehydration of Foods (5)

FScN 5562—Flavor Technology (4)

4. Nutrition (31 credits)

FScN 1612—Principles of Nutrition (4)

FScN 3612—Biological Aspects of Nutrition (4)

FScN 5622—Macro-Nutrient Metabolism (4)

FScN 5623—Vitamin and Mineral Biochemistry (4)

BioC 5025—Biochemistry Laboratory (2)

Plus a minimum of 12 additional credits from:

FScN 3102—Introduction to Food Science (4)

FScN 5612—Experimental Nutrition (2)

FScN 5624—Human Protein and Energy Utilization (4)

FScN 5643—World Food Problems (3)

AnSc 3401—Principles of Animal Nutrition (3)

AnSc 5401—Swine Nutrition and Feeding (4)

AnSc 5403—Ruminant Nutrition (4)

AnSc 5405—Poultry Nutrition (3)

Chem 3100—Quantitative Analysis (3)

5. Plant Sciences

(27-41 credits, depending upon specialization)

Soil 3125—Basic Soil Science (5)

Agro 5030—Weed Control (5)

Plus one from the following:

Agro 3020—Growth and Development of Field Crops (4)

Hort 3001—Growth Regulation of Horticultural Crops (5)

Hort 3002—Horticultural Cropping Systems (5)

Ent 1005—Economic Entomology (4)

or Ent 3005—Insect Biology (3)

PIPa 3001—Management and Control of Field Crop Diseases (4)

or PIPa 3002—Management of Horticultural Crop Diseases (4)

In addition, choose one of the following plant science specializations:

a. Agronomy:

Agro 5020—Introduction to Plant Breeding (4)

Soil 3416, 3417—Plant Nutrients in the Environment and Lab (4,1)

Plus one from the following

Agro 5010—Forage Production and Utilization (4)

Agro 5050—Management Techniques for Crop Production in Minnesota (4)

AnPl 5060—Integrated Management of Cropping Systems (4)

b. Entomology:

Ent 5020—Insect Taxonomy (5)

Plus two from the following:

Ent 5030—Insect Physiology (3)

Ent 5040—Insect Ecology (4)

Ent 5210—Insect Pest Management (4)

Ent 5215—Insects in Relation to Plant Disease (3)

Ent 5280—Livestock Entomology (3)

Ent 5310—Sampling Biological Populations (4)

Ent 5350—Insect Pathology (3)

c. Horticultural Science:

Hort 1036—Plant Propagation (5)

Hort 3001—Growth Regulation of Horticultural Plants (5)

Plus at least one from the following:

Hort 3002—Horticulture of Cropping Systems (5)

Hort 3004—Applications of Plant Biotechnology (4)

Hort 3072—Turf Management (4)

Hort 5001—Harvest to Market of Horticultural Crops (3)

Hort 5031—Temperate Fruit Production (4)

Hort 5034—Commercial Vegetable Agriculture (5)

Hort 5046—Nursery Management I (4)

Hort 5047—Nursery Scheduling and Enterprise Development (2)

Hort 5048—Nursery Management II (4)

Hort 5054—Commercial Floriculture Production Practices (4)

Hort 5055—Commercial Floriculture Production Systems (5)

d. Plant Pathology:

PIPa 5201, 5202—Biology of Plant Diseases and Lab (3,2)

Plus three from the following:

PIPa 5203—Phys. & Molecular Plant-Microbe Interactions (3)

PIPa 5204—Field Plant Pathology (2)

PIPa 5205—Plant Disease Diagnosis (2)

PIPa 5206—Biology of Fungi (4)

PIPa 5209—Biochemistry of Plant Disease (3)

PIPa 5211—Fungal Genetics (4)

PIPa 5212—Diseases of Forest and Shade Trees (4)

PIPa 5213—Plant Nematology (4)

PIPa 5214—Plant Virology (4)

PIPa 5500—Epidemiology and Ecology of Plant Disease (3)

6. Soil Science (31 credits)

Agro 3020—Growth and Development of Field Crops (4)

Soil 3125—Basic Soil Science (5)

Soil 3220—Soil Conservation and Land Use Management (4)

Soil 3416, 3417—Plant Nutrients in the Environment and Lab (4,1)

Soil 5240—Microclimatology (3)

Soil 5510—Field Study of Soils for Environmental Assessment (4)

Remaining credits selected from:

Soil 5210—Soil Physical Properties and the Environment (4)

Soil 5232—Soil Physics (4)

Soil 5310—Soil Chemistry (3)

Soil 5515—Soil Development, Classification, and Geography (4)

Soil 5560—Interpretation of Land Resources (3)

Soil 5610—Soil Biology (4)

Soil 5710—Forest Soils (3)

7. Individualized area of emphasis

Students wanting to design a program with an emphasis different from these options should consult their adviser. Individualized programs must be approved by the major coordinating committee and have a minimum of 31 credits.

Electives to reach 192 credits required for graduation with a bachelor of science degree.



Scientific and Technical Communication

Dr. Alan Gross, Major Coordinator
 201 Haecker Hall
 1364 Eckles Avenue
 St. Paul, MN 55108
 612/624-1209

Scientific and technical communicators apply modern techniques and technologies to the distribution of knowledge in industry, business, education, and government. They write for audiences ranging from scientists to management to the consumer of technological products and services. To accomplish their objectives, scientific and technical communicators must first be generalists, well acquainted with the basic principles of science, engineering, the social sciences, and management practices. In addition, they must be familiar with and able to apply the principles of writing and editing, visual communication, communication technology, communication research and theory, and oral communication. The interdisciplinary curriculum combines the necessary theory and practical experience in a program flexible enough to allow you to plan a course of study appropriate to your career goals.

As a graduate of the program, you may be employed in government, education, and organizations in such fields as agriculture, communication, computer science, health sciences, research and development, and natural resources. You may pursue a career as a writer-editor, extension specialist, a corporate trainer or media specialist.

If you plan to pursue a graduate program in scientific and technical communication, you should consult with your adviser about selection of appropriate coursework early in your program.

Admission Requirements

Admission to the College of Agriculture does not automatically admit you to full-major status in the Scientific and Technical Communication (STC) program; students enter at pre-major status. To move from pre-major to major status, students must meet the following prerequisites:

Completion of the following coursework (with a minimum GPA of 2.50):

- 8 credits in basic rhetoric, English, or composition
- 8 credits in physical and biological sciences
- 8 credits in social science
- 8 credits in math, computer science, or engineering

For suggested course lists, contact the Department of Rhetoric or consult the All-College Requirements, page 30.

To apply for major status, students must submit the following information to the STC Program:

- application form—available in 201 Haecker Hall

- pre-major checklist—available in 201 Haecker Hall
- college transcripts
- letter of intent
- portfolio

A portfolio consists of documents showing written work, examples of graphic display and design (e.g., projects from art, drafting, or design classes, or photographs, slides, or videos), and a résumé.

Deadlines for submitting applications are: fall quarter admission, April 15; winter quarter admission, October 15; spring quarter admission, January 15.

Note: Although you only need a 2.00 GPA to be admitted to the College of Agriculture, a 2.50 GPA is required in the 32 required credit hours for acceptance to the major.

Students will retain pre-major status until they are formally accepted into the major program. Keep in mind that you cannot graduate from the College of Agriculture unless you are officially enrolled in a major in the college. In addition to meeting College of Agriculture residency requirements, as a degree candidate in Scientific and Technical Communication, you must earn at least 30 of your last 45 credits in the major following the quarter you are accepted into the major. For more information, contact the STC Program major coordinator, 201 Haecker Hall, 624-4761.

Major Requirements

Students majoring in the undergraduate program in Scientific and Technical Communication must complete requirements in each of the areas listed below. Required classes are listed. Course substitutes require program and/or College Office approval. Your adviser can offer guidance when you plan your schedule.

A. Communication, Language, Symbolic Systems (29 credits minimum)

Majors in Scientific and Technical Communication must be able to communicate effectively in environments in which technical information is processed and exchanged. The following courses are required:

- Rhet 1101—Writing to Inform and Persuade (4)
- Rhet 1104—Library Research Methods (1)
- Rhet 1151—Writing in Your Major (4)
- Rhet 1222—Public Speaking (4)
- Rhet 3266—Communication, Discussion in Small Group Decision Making (4)
- Rhet 3562—Writing in Your Profession (4)
- Math 1031—College Algebra and Probability (4) or Math 1051—Precalculus I (4)

One of the following:

- AgET 3030—Introduction to Problem Solving with Computers (4)
- CSci 3101—A FORTRAN Introduction to Computer Programming (4)
- CSci 3102—Introduction to Pascal Programming (4)
- CSci 3113—Introduction to Programming and Problem Solving (4)
- IDSc 3030—Information Systems and Information Management (4)

B. Physical and Biological Sciences (20 credits minimum)
Because scientific and technical communicators write in environments in which technical information is developed and processed, students should have an interest in science. Only science courses with laboratories will count toward this requirement. These courses should build up prerequisites for your science and technology emphasis in Category E.

Suggested courses:

- BioC 1401—Elementary Biochemistry (4)
- Biol 1009—General Biology (5)
- Biol 1103—General Botany (5)
- Biol 1106—General Zoology (5)
- Chem 1001—General Principles of Chemistry (4)
or Chem 1051—Chemical Principles I (4)
- Chem 1002—Elementary Organic Chemistry (4)
or Chem 1052—Chemical Principles II (4)
- Geo 1001,1021—Introduction to Geology and Lab (4,1)
- MicB 3103—General Microbiology (5) (CEE only)
- VPB 3103—General Microbiology (5)
- MicB 5105—Biology of Microorganisms (5)
- Phys 1001, 1005—The Physical World and Lab (4,1)
- Phys 1041—Introductory Physics (5)
- Phys 1042—Introductory Physics (5)

C. The Individual and Society (14 credits minimum)

Scientific and technical communication students benefit from courses enabling them to understand the impact of science and technology on western culture. Possible courses that fulfill this requirement are anthropology, economics, geography, sociology, political science, and psychology. Work with your adviser in selecting a sequence of courses from the suggested courses on p. 30 of this bulletin.

Students must complete one course in the area of Development of Civilization.

D. Literature, Humanities, and Fine Arts (16 credits minimum)

Scientific and technical communication students need liberal arts courses to help them become culturally literate and to help them learn how to form intelligent and informed decisions. Possible courses in this area include American studies, classics, literature, music, and theatre. Work with your adviser in selecting a sequence of courses from the suggested courses on pp. 30 of this bulletin.

E. Professional Courses in the Major (90 credits minimum)

Students must complete a minimum number of courses for the major in a variety of competency areas. The Scientific and Technical Communication major is divided into seven areas to reflect the communication, science, and technology areas needed. Certain core classes are required in each area. Students must take more than the minimum number of credits to reach the total of 90 credits.

Writing and Editing (14 credits minimum)

Students must have strong writing and editing skills in order to communicate effectively in this profession.

Required:

- Rhet 3565—Writing for Publication (4)
- Rhet 5560—Editing for Technical Communication (4)
- And two of the following:
- Rhet 5572—Procedures and Policies Manual (1)
- Rhet 5573—Grant Proposal (3)
- Rhet 5575—Newsletter (3)

Recommended:

- Comp 3014—Writing for Quantitative Social Sciences (4)
- Comp 3015—Writing about Science (4)
- Comp 3027—Advanced Expository Writing (4)
- EngW 5401—Introduction to Professional Editing (4) (CEE only)

Oral Communication (8 credits minimum)

Students must be able to retrieve, analyze, and use information that they have effectively gathered from others and present this information orally. They must be able to locate, evaluate, and integrate diverse viewpoints of project teams and their clients.

Required:

- Rhet 5257—Scientific and Technical Presentations (4)
- Rhet 5258—Interviewing: Dynamics of Face-to-Face Communication (4)

Recommended:

- Rhet 3254—Advanced Public Speaking (4)
- Spch 3201—Introduction to Broadcast Production (4)
- Spch 3411—Small Group Communication Process (4)

Information Design and Management

(14 credits minimum)

Students must be able to communicate in visual as well as verbal forms. They must be able to understand flow diagrams and models of technical components.

Required:

- Rhet 1200—Information Technology in Scientific and Technical Professions (3)
- Rhet 3670—Visual Rhetoric: Theories and Applications (4)
- Rhet 3574—Publications Management (3)
- Rhet 5581—Document Design (4)

Recommended:

- ArtS 1404—Color (4)
- BIE1100—Technical Drawing (3)
- BIE 1101—Technical Design and Product Development(3)
- BIE 1120—Communication Technology (3)
- BIE 3121—Graphic Communication (3)
- BIE 1122—Photography (3)
- DHA 1300—Introduction to Design(3)
- Rhet 3101—Functional Photography (4)
- Rhet 5105—Corporate Video for Technical Communicators (4)

Communication Systems (8 credits minimum)

Students must understand how to communicate in the corporate environment; therefore, they need to understand how to analyze systems of communication within the environment. Technical communicators must be able to manage human resources and provide leadership to project teams.

Required:

- Rhet 5170—Managerial Communications (4)

One of the following:

- Rhet 5165—Studies in Organizational Communication, Conflict, and Change (4)
- Rhet 5400—Dissemination and Utilization of Information (4)
- Rhet 5600—Transfer of Technology (4)

Recommended:

- Rhet 5592—Communication in Technological and Environmental Impact Assessment (4)
- Spch 3111—Leadership Communication (3)
- or Spch 3441—Communicating in Organizations (4)
- SW 5013—Interdisciplinary Team Training in Health Services Delivery (4)

Communication Theory and Research (8 credits minimum)

Students must be able to evaluate and integrate diverse viewpoints or data. They must effectively analyze multiple audiences/clients. To do this they also must acquire and analyze appropriate information about their clients.

Required:

- Rhet 1220—Principles of Human Communication (4)
- Rhet 3700/5700—Rhetorical Theory (3)

Recommended:

- Clas 1045—Basic Program in Technical Terminology and Word Study (3)
- Engl 3851—The English Language (4)
- Engl 3852—Aspects of the English Language (4)
- Engl 5815—History of English Language (4)
- Engl 5831—American English (4)
- EPsy 5115—Adult Learning and Educational Practice (4)
- EPsy 5240—Principles and Methods of Evaluation (3)
- Jour 1001—Introduction to Mass Communication (2)
- Ling 3001—Introduction to Linguistics (5)
- Psy 3011—Introduction to Psychology of Learning (4)
- Rhet 5160—Advanced College Reading (4)
- Rhet 5500—Research in Communication Strategies (4)
- Rhet 5541—Readings in Scientific and Technical Prose (2)
- Spch 3431—Role of Persuasion in the Modern World (4)
- Spch 3601—Approaches to Public Discourse (4)

Culture, Values, and Technology (11 credits minimum)

Students must be able to apply a historical perspective to the role of science and technology in technical communication. They must apply global perspectives to

scientific and technical issues and decisions. They must make responsible judgments on ethical and policy issues stemming from current technology and its use.

Required:

Rhet 3390—Humanities: Technology, Self, and Society (4)

Rhet 3582—Senior Seminar

One of the following:

Rhet 1303—Science, Religion and the Search for Human Nature (4)

Rhet 3690—Scientific Controversy (3)

Rhet 5680—Gender and the Rhetoric of Science and Technology (4)

Recommended:

HMed 3001—Doctors and Disease in History (4)

HMed 3002—Medicine and Disease in History: 17th-19th Centuries (4)

HMed 3003—Medicine and Disease in History: Modern (4)

HSci 17xx—Technology and Western Civilization (4)

HSci 18xx—Introduction to History of Science (4)

Hum 1003—Humanities in the Modern World III (4)

Hum 3625—Science and the Humanities (4)

Phil 3601—Scientific Thought (4)

Phil 56xx—Philosophy of Science (4)

Rhet 3395—In Search of Nature (4)

Science and Technology (20 credits minimum)

While technical communicators need a general knowledge of math, science, and technology, they also

must develop expertise in a scientific and technical area. With the help of an adviser, students will select at least five additional classes in a scientific or technological area. Eight credits must be at the 3000 level or above. Possible areas of emphasis are:

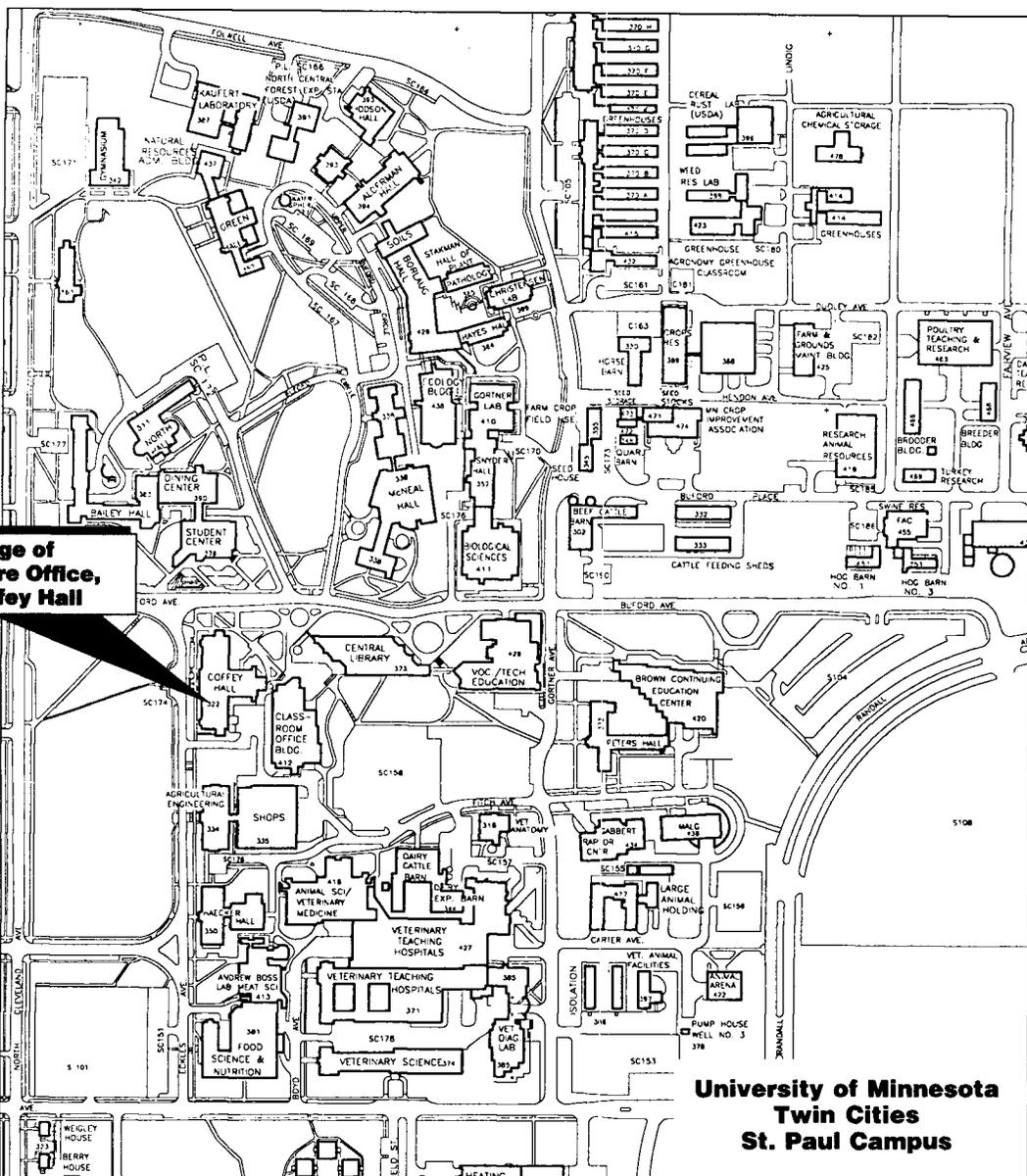
- Agricultural Science: Animal Health Sciences
- Agricultural Science: Plant Human Ecology
- Biological Science
- Information Systems
- Cognitive Science/Psychology
- Management
- Computer Science
- Natural Resources
- Engineering
- Physical Science
- Food Science/Nutrition
- Vocational Education

Rhet 5180—Internship in Technical Communication (2-6)

You must complete at least four credits of internship experience. The internship cannot be completed until you are officially enrolled in the major. For specific information about internship requirements and procedures, consult with your advisor and review the STC Internship Guide.

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

Transfer Students





Pre - Majors

The College of Agriculture offers five pre-major programs for students intending to complete the coursework needed to enter an upper division college or professional program: pre-agricultural engineering; pre-biological sciences; pre-landscape architecture; pre-medicine or dentistry; and pre-veterinary medicine.

Pre-Agricultural Engineering

(College of Agriculture)

For additional information contact:
 Dr. Chuck Clanton
 Agricultural Engineering
 Department of Agricultural Engineering
 213 Agricultural Engineering Building
 1390 Eckles Avenue
 St. Paul, MN 55108
 612/625-7733

Students interested in becoming an agricultural engineer may start their coursework in COA. Students will have the benefits of having an ag engineering faculty member as an adviser, being eligible for the COA scholarship program, the advantages of a small college and the St. Paul campus. In addition you'll find the pre-engineering track provides you the opportunity to be part of the department community and to get to know other pre-ag engineering students.

After you have satisfactorily completed your lower division courses, you will move into your upper division courses in the IT. You'll continue to work with an adviser from the ag engineering department while you complete your last two years of courses as an IT student. You will graduate from IT but will be invited to join the alumni societies in both IT and COA.

Agricultural engineering is the application of engineering principles to environmental systems involving soil, water, and air in the production and processing of plant, animal, food, and related biological materials. Agricultural engineers use their skills to enhance environmental quality while improving the efficiency and profitability of agricultural production systems; the quality of agricultural, food, and related biological products; and the quality of life of those working in and benefiting from agriculture. These objectives are met by developing, improving, and applying processes, machines, structures, and their management to achieve a balance among the factors of production, utilization, profitability, and quality of life.

Agricultural engineers are members of a diverse profession made up of environmental and natural resource agencies, agricultural and food industries, and consulting firms that work to benefit the general public. Agricultural engineers apply biological, environmental, agricultural, and physical sciences, as well as engineering science and design, to solve problems in agricultural and

biological production and processing systems in a safe, environmentally conscious manner. Agricultural engineers play a critically important role in providing high quality food throughout the world.

The agricultural engineering curriculum can be completed in four years. It requires a minimum of 190 credits. Emphasis is on the physical and engineering sciences and engineering design. Study of biology, agricultural science, communications, social science, and humanities is included to provide a liberal education and to enable agricultural engineers to work effectively with professionals in many disciplines. The program is designed to provide students with a fundamental background for continued professional growth and to prepare them to contribute to the needs of an ever-changing society.

The curriculum centers around environmental and natural resource management and biological and agricultural systems. With the assistance of an adviser, students plan a curriculum tailored to their individual interests. Students can choose additional courses in interest areas including land, soil, and water resources; waste management; biological and food engineering; bioprocessing; environmental control in buildings; agricultural structures; green house engineering; forest engineering; aquaculture engineering; agricultural safety; and machinery for production and processing of biological, agricultural, and food materials.

Engineering internships that supplement classroom instruction by providing practical training and experience with an employer are available. Students may begin their internships in the summer following either their first or second year.

The agricultural engineering program is accredited by the Engineering Accreditation Committee of the Accreditation Board for Engineering and Technology (ABET).

Students must apply to be admitted to upper division (junior and senior years) in IT. Requirements for admission into upper division agricultural engineering in IT are based on a GPA calculated using the grades from all courses taken, including repeated courses. Applications and GPA requirements are available in 215 Lind Hall.

Lower Division

- Comp 1011—Writing Practice I (5)
- Math 1211-1221—Calculus I-II (10)
- Math 1251-1252—One Variable Differential and Integral Calculus I and II (4,4)
- Math 1241-3311—Linear and Nonlinear Multivariable Analysis I-II (10)
- Math 3321—Differential Equations and General Vector Spaces (5)
- Phys 1311-1321-1331-1341—Comprehensive Introductory Physics
 or Phys 1271-1281-1291—General Physics (12 or 16)
- Phys 1275-1285-1295—General Physics Laboratory (3)
- Chem 1051, 1052—Chemical Principles I and II (4,4)
- Biological Science Elective (including Agricultural Science courses with significant biological content) (4)

AgEn 1060—Agricultural Engineering Orientation (1)
 ME 1025—Engineering Graphics (4)
 AEM 1015—Statics (4)
 AgEn 3031—Computations in Agricultural Engineering (4)
 AEM 3016—Deformable Body Mechanics (4)
 CE 3400—Fluid Mechanics (4)
 CSci 3101,
 or CSci 3102
 or AgET 3030—Computer Programming (4)
 Liberal Education Electives (12)
 Total (96 or 100)

Upper Division

Comp 3031—Technical Writing for Engineers (4)
 EE 3003-3004—Circuits and Electronics (5)
 AEM 3036—Dynamics (4)
 ME 3301-5342—Thermodynamics, Heat Transfer (8)
 ME 3900—Introduction to Engineering Statistics (4)
 Biological Science Electives (at 3000 level including
 Agricultural Science courses with significant
 biological content) (8)
 AgEn 3052—Engineering Principles of Soil-Water-Plant
 Systems (4)
 AgEn 5891-5892—Senior Design I & II (5)
 AgEn 5540—Watershed Engineering (4)
 Agricultural Engineering Electives, which must include:
 a) Two courses from: (8)
 AgEn 5070—Automatic Control and
 Instrumentation (4)
 AgEn 5072—Finite Element Method (4)
 AgEn 5074—Microcomputer Interfacing (4)
 b) One course from: (4)
 AgEn 5550—Water Management Engineering (4)
 AgEn 5910—Agricultural Waste Management
 Engineering (4)
 c) Agricultural Engineering Elective (4)
 Engineering Electives to satisfy ABET requirements of 48
 engineering science credits and 24 engineering design
 credits (12)
 Liberal Education Electives (15)
 Electives to consider student interest and to meet
 graduation requirements of 190 credits (5)
 Total (94)

Electives are chosen to develop further professional
 competence in an area of particular interest to the
 student. Sample programs are available from the
 department office or from individual advisers.

Pre-Biological Sciences

For additional information contact:

Kathleen Peterson
Student Services - Advising and Registration
College of Biological Sciences
223 Snyder Hall
1475 Gortner Avenue
St. Paul, MN 55108
612/624-9717

Students interested in pursuing a degree in the
 College of Biological Sciences (CBS) may start
 their coursework in COA and transfer to CBS once
 upper division prerequisites have been met. While
 in COA students work with a CBS adviser who will
 assist them in course selection. In addition students
 are encouraged to participate in clubs and other
 CBS sponsored activities. Most pre-CBS students
 spend from 3 to 6 quarters in COA completing
 prerequisites before transferring to CBS. CBS and
 COA are located on the St. Paul campus providing
 students with the advantages of small colleges with
 easy access to student services. As an added
 benefit, students whose academic or career plans
 change will find that their prerequisite courses
 apply to most COA majors.

For further information about biological
 sciences programs, see the *College of Biological
 Sciences Bulletin*, or contact the College of
 Biological Sciences.

Admission to CBS

Students may enter CBS at the beginning of their
 sophomore, junior, or senior year. The first years
 may be completed in COA or the College of
 Liberal Arts. Because CBS is an upper division
 college, certain requirements must be completed
 before admission:

- Successful completion of 84 credits (with a
 GPA of at least 2.00) including General
 Biology 1009, or 1201-1202. General
 Chemistry 1051-1052 and Calculus 1251-1252
 with grades of at least C are required for
 admission at the junior level. Applications can
 be acted on before grades from current
 coursework are available. Qualified students
 will be admitted subject to satisfactory
 completion of current registration.
- Students who are admitted as sophomores
 must have completed a minimum of 40 credits
 with a GPA of 2.50 or better including grades
 of C or better in Chem 1051-1052 (or
 equivalent); Math 1251 (or equivalent); and a
 college level biology course. During the
 freshman and sophomore years, students
 should plan to complete as a minimum the
 beginning English composition course,
 mathematics, general chemistry, and general
 biology. Students are encouraged to take
 organic chemistry during their sophomore
 year thereby allowing ample time for major
 coursework and research experience.

Pre-Majors

Pre-Landscape Architecture

For additional information contact:

Dr. Roger Martin
Landscape Architecture
Department of Landscape Architecture
125 Architecture Building
89 Church Street
Minneapolis, MN 55455
612/625-6860

Freshmen or sophomore students planning to complete a degree in landscape architecture will want to start their coursework in COA. COA offers a pre-landscape architecture track through the Animal and Plant Systems major. If your original academic and career plans change in regard to pursuing a landscape architecture degree, COA offers an alternative program through the environmental horticulture emphasis in the Animal and Plant Systems major. While in the pre-landscape architecture (pre-L.A.) students will be assisted with program planning by the director of undergraduate studies in landscape architecture.

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

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

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

Master of Landscape Architecture (M.L.A.) Program

This program is available for students with baccalaureate degrees who wish to pursue both professional and scholarly studies in landscape architecture. The program is jointly offered by the College of Architecture and Landscape Architecture and the Graduate School. It provides

basic professional training for the practice of landscape architecture and theoretical inquiry into the discipline.

Specific requirements for this degree are defined in the *Graduate School Bulletin*.

Bachelor of Environmental Design (B.E.D.) Program

This non-professional program is designed to allow students to explore a broad range of environmental courses while preparing for the professional M.L.A. degree. Upon completion of the B.E.D. degree requirements, students may apply to the Graduate School to continue on for the professional M.L.A. degree, or transfer to another discipline such as urban design, city and regional planning, or an area of the social or natural sciences.

A total of 180 credits are required for the B.E.D. degree. All required core courses with an LA prefix plus Hort 1021 must be completed with a minimum grade of C. It is recommended that students also complete 400 hours of summer work in landscape architecture. Individualized study programs may be arranged with faculty approval.

Admission procedures and major requirements for the Bachelor of Environmental Design program are detailed below. For additional information about the Bachelor of Environmental Design Program, see the *College of Architecture and Landscape Architecture Bulletin*.

Admission Procedures

To enter the Bachelor of Environmental Design degree program, students must submit an application by February 1 following completion of two years, minimum 90 credits of work, or the year they wish to begin L.A. design studio courses. Admission to the program is permitted only in the fall quarter unless advanced standing is granted. Policies and admission procedures change periodically. Students should check with their adviser and/or the Department of Landscape Architecture for current admission procedures.

The procedure and requirements are as follows:

1. Apply to the University of Minnesota if not already a University student.
2. Before an application will be considered, a student must have completed a minimum of 90 credits of required pre-L.A. courses; courses taken the quarter of current enrollment may be included. This total must include at least 8 credits in basic English or communications, 10 credits in physical and biological sciences, 8 credits in mathematics, 6 credits in social sciences, 12 credits in studio arts or design, and 8 credits in landscape architectural, environmental, or design theory.
3. Complete the Bachelor of Environmental Design degree program application form available from the Department of Landscape Architecture, University of Minnesota, 125 Architecture, 89 Church Street S.E., Minneapolis, MN 55455.

4. Submit a letter of intent stating the reasons for selecting landscape architecture as a profession. This letter, generally consisting of one or two pages, should give an account of the student's reason for becoming interested in the field and in becoming a landscape architect, experience in landscape architecture or related fields (art, horticulture, natural resource management, architecture, engineering, construction), experience or participation in other interests (travel, hobbies, avocations), and perception of herself or himself in the role of a landscape architect.
5. Submit an official transcript of all college work completed to date at the University of Minnesota and other colleges. Generally, a student must have a GPA of 2.75 or higher for admittance.
6. Submit a portfolio of art or design work, environmental or design reports, photographs of sculptural work, slides, or similar examples of creative work. It is suggested that the portfolio be a bound 8 x 11-inch booklet. A portfolio larger than 24 x 36 inches will not be accepted. Material not enclosed in a carrying case is also unacceptable. Slides must be in an 8 x 11-inch transparent slide carrier.

Applicants are encouraged to visit the design studios, talk to students in the program, and find out as much about the profession as they can.

The landscape architecture faculty vote on each applicant. The applicant may be admitted to the program, rejected, or assigned pre-landscape architecture status. Approval for admission is based on consideration of the following: (1) the student's academic standing and GPA; (2) the student's maturity and experience; (3) the student's letter of intent; (4) the estimated design potential of the student; and (5) the availability of staff and space.

Applicants will be notified by letter of the admission decision by June 1. Those admitted must notify the head of the Department of Landscape Architecture by July 1 of their intention to attend or their places will be forfeited. Those not accepting the opportunity in the year for which it is offered must reapply if they wish to enter the program at a later date.

Major Requirements

New freshman students should work closely with their adviser to ensure courses they select will meet the Twin Cities campus liberal education requirements.

A. Communication, Language, Symbolic Systems (26 credits)

- Rhet 1101—Writing to Inform and Persuade (4)
- Rhet 1104—Library Research Methods (1)
- Rhet 1151—Writing in Your Major (4)
- Rhet 1222—Public Speaking (4)
- Rhet 3562—Writing in Your Profession (4)
- Math 1201—College Algebra and Analytical Geometry (5)
- or Math 1142—Short Calculus (5)

One of the following:

- College-Level Math (1008 or higher)
- College-Level Statistics
- College-Level Computer Programming
- Phil 1001—Introduction to Logic (5)
- or Phil 3231—Introduction to the Philosophy of Language (4)
- IDSc 3131—Database Management Systems (4)

B. Physical and Biological Sciences (20 credits minimum)

- 5 credits of 1xxx Geology (recommended)
- Geol 1001, 1021—Introduction to Geology and Lab (4,1)
- or Geol 1111—Introductory Physical Geology (5)
- 10 credits of 1xxx Biology (recommended)
- Biol 1009—General Biology (5)
- Biol 1103—General Botany (5)

C. The Individual and Society (16 credits minimum)

- 4 credits of Geography (13xx or 15xx)
- 4 credits of 3xxx level Geography
- 8 credits of Sociology

D. Literature, Humanities, and Fine Arts

- (8 credits minimum)
- Phil 3502—Introduction to Aesthetics
- 4 credits in Art History or English Literature
- See All-College Requirements, page 30.

E. Preparation for the Major (20 credits)

- LA 3413—History of Landscape Architecture (4)
- Soil 1020—The Soil Resource (5)
- 4 credits in studio arts
- LA 1401—The Designed Environment (4)
- LA 1301—Introduction to Drawing (4)
- 8 credits of other electives

F. Post Admission Requirements (86 total credits)

Landscape Architecture (43 credits)

- LA 3311—Drawing for Design (4)

Two of the following:

- LA 5309—Advanced Graphics Course (4)
- LA 5381—Advanced Graphics Course (4)
- LA 5342—Advanced Graphics Course (4)
- LA 5211—Making Landscape Space (6)
- LA 5212—Ecological Informants of Design (6)
- LA 5213—Making Landscape Types (6)
- LA 5221—Planting Design: Aesthetic and Functional Criteria (4)
- LA 5511—Landscape Construction: Landform Systems (4)
- LA 5542—Landscape Construction: Spatial Performance (4)

Communications (4 credits)

- Rhet 3562—Writing in Your Profession (4)

Horticulture (10 credits)

- Hort 1021—Woody Plant Materials (5)
- Hort 1022—Herbaceous Plant Materials (5)

Architecture and Urban Design (12 credits)

- LA 3411—History of Architecture to 1750 (4)
- LA 3412—History of Architecture since 1750 (4)
- Arch 5138—Planning: Theory and Methodology (4)

Ecology (8 credits)

- EEB 3001—Introduction to Ecology (4)
- or EEB 3101—Ecology for Engineers and Physical Scientists (4)
- Geol 5261—Glacial Geology (4)
- or Geol 5251—Geomorphology (4)

Electives Supporting the Major (9 credits)

- G. Electives supporting the professional degree to complete the 180 credits required for graduation with the bachelor of environmental design degree.

Pre-Medicine and Dentistry

Students considering careers in the health sciences will discover most medicine and dental schools require that students entering their programs have a bachelor's degree or a specific set of courses. Competition for admission is normally very competitive and requires that students have demonstrated high ability and achievement in the physical and biological sciences. The nutritional science track in COA provides pre-health science students an alternative route into medical or dental school while also providing them a bachelor of science degree option that provides an excellent background and alternative career options.

Students should enroll in the nutrition major and pursue the nutritional science emphasis. You will find the curriculum outlined on page 23 for new freshmen and page 45 for transfers. Students enrolling in the program in COA will have the benefit of a faculty adviser, a small college and department setting and easy access to St. Paul campus services, as well as the opportunity to be considered for COA scholarships. If you succeed in your academic and career goals as a health care professional, you'll have a solid background in nutrition that will serve as a valuable tool in assisting patients to better health. If your career plans change, you will have the benefit of completing a bachelors degree in nutritional science.

Entrance requirements to graduate and professional programs are always competitive and requirements vary from school to school. Students should work closely with their adviser to meet the requirements for the school(s) they are considering. A cumulative GPA of at least a 3.00 is essential.

Pre-Veterinary Medicine

Students may complete the minimum requirements for admission to the University of Minnesota's College of Veterinary Medicine requirements through COA's pre-vet track in the Science in Agriculture major. Entering freshmen may want to explore the Science in Agriculture/ Doctor of Veterinary Medicine degree option outlined on page 26. The joint degree program allows students to complete a bachelor's degree in Science in Agriculture and later, a Doctor of Veterinary Medicine degree in 7 years. Admission is competitive, but Science in Agriculture students will receive special consideration because of the animal knowledge and experience gained in University of Minnesota animal science courses.

COA's pre-vet track is interdisciplinary, bringing the benefits of a strong science foundation along with animal science courses. Most students are able to complete their prerequisite course requirements in three years. Students can apply to veterinary medicine upon

completion of those requirements or can complete their bachelor's degree before pursuing veterinary medicine. Gaining the bachelor's degree allows students additional academic skills and other career alternatives.

COA provides an excellent setting for pre-vet preparation. Students are assigned advisers from the animal science faculty, and will have a chance to work with several faculty who hold joint appointments in COA and the College of Veterinary Medicine. Students gain the benefit of a small campus atmosphere, easy access to student services, an active pre-vet club and the opportunity to work with livestock on the St. Paul campus. The curriculum meets vet school admission requirements while increasing student animal-based knowledge and experience, enhancing chances for admission.

Competition for admission to the University's College of Veterinary Medicine, as well as other vet schools across the nation, is very keen. Students are encouraged to seek experience and knowledge of working with animals in laboratory, clinic, or production situations. Most recently, the average GPA in required courses for Minnesota, South Dakota, and North Dakota residents entering the College of Veterinary Medicine was 3.49. The average GPA for students from other states admitted was 3.76. The University of Minnesota admits about 76 students each year with 80 percent being from Minnesota, South Dakota, and North Dakota.

For information on procedures and requirements for admission to the College of Veterinary Medicine, criteria for selection, degree programs and courses offered by the college, and related subjects, consult the annual College of Veterinary Medicine mini-bulletin, or the Office of Student Affairs and Recruitment, College of Veterinary Medicine, University of Minnesota, 460 Veterinary Teaching Hospitals, 1365 Gortner Avenue, St. Paul, MN 55108 (612/624-4747).



College Information and Policies

Degrees Offered

Baccalaureate Degrees—The major curricula of COA lead to a bachelor of science degree.

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

Admission

Requirements for admission to COA for high school graduates and transfer students are explained below. Information for adult special students, international and minority students, and senior citizens is also included. For more information, consult Prospective Student Services (612/624-3045 or 1-800-866-AGRI (toll-free)).

Deadlines—The Office of Admissions will accept applications for fall quarter 1995 beginning October 1, 1994 and will admit students as long as space is available. Freshman applicants who meet the admission requirements and apply by December 15, 1994 will be guaranteed space in the fall quarter 1995 class. Final deadlines are June 1 for fall quarter; October 15 for winter quarter; and January 15 for spring quarter.

Applications for spring quarter are accepted from transfer students only.

High School Graduates—High school graduates planning to begin their studies as freshmen fall quarter 1994 or later will be expected to have completed as a minimum the following courses while in grades 9-12:

- Four years of English, with emphasis on writing, including instruction in reading and speaking skills and in literary understanding and appreciation;
- Three years of mathematics, including one year each of elementary algebra, geometry, and intermediate algebra;
- Three years of science, including one year each of biological and physical science;
- Two years of a single second language;
- Two years of social studies, including U.S. history.

Students who graduated from high school before 1987 will not be expected to meet these course requirements, although they are strongly encouraged to do so.

COA uses the following admission formulas:

Formula	Minimum Score
HSR Percentile + (2 x ACT Composite score)	110
HSR Percentile + (SAT Verbal / 10) + (SAT Math / 10)	160

Applicants with at least one of the minimum scores will be admitted routinely, provided they meet the course requirements and space is available in the entering class. Others will be reviewed on an individual basis.

Tuition Deposit—If you are admitted to COA as a freshman, you must submit a nonrefundable \$50 tuition deposit to hold your place in the freshman class. When you enroll, your deposit will be applied to your first quarter's tuition. You must pay the deposit by May 1 or within two weeks after the date on your admission notification letter. If you do not submit the deposit by the deadline, you may lose your place in the freshman class.

If you are admitted through and certified by the Office of Minority Student Affairs (i.e., as a disadvantaged or minority student), you are exempt from this requirement and do not need to pay a deposit.

Transfer Students—You may apply for admission to COA from other colleges or universities. You may be accepted if you meet the entrance requirements of the college and of the major you wish to enter. Transfer students who graduated from high school during 1987 or later and wish to be admitted must:

- Have passed intermediate algebra with a grade of "C" or better
- Have at least a "C" average in your transfer coursework
- Have demonstrated a solid foundation in math and science
- Completed at the high school level the following coursework:
 - Four years of English
 - Three years of science, including one year each of biological and physical science
 - Two years of a single second language
 - Two years of social studies, including U.S. history.

If you did not complete this coursework during your high school years, equivalent college coursework may be substituted. COA may admit some students who have not met these requirements. Students admitted lacking preparation requirements must complete all deficiencies early in their program.

If you graduated from high school before 1987, admission criterion are:

- Passed intermediate algebra with a grade of "C" or better
- Have at least a "C" average in your transfer coursework
- Demonstrated a solid foundation in math and science.

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

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

degree work elsewhere intending to transfer later, you should carefully plan your pretransfer courses to meet as many COA requirements as possible. See the requirements for the various curricula in the Transfer Students section and take special note of the distribution requirements. Please note that a maximum of 4 internship or practical experience credits may be transferred into COA.

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

International Students—International students must demonstrate competency in the English language by achieving an acceptable score on an English proficiency test. In addition, they must present evidence that they have met all admission requirements applicable to United States students and maintained a good academic record at their previous schools. International students should apply by April 1 for fall quarter admission, October 1 for winter quarter, and January 1 for spring quarter.

Commitment to Diversity—COA is committed to recruiting, enrolling, and educating a diverse population of students who represent the overall composition of our society. Advancing this commitment is a high priority for the college. A scholarship program for students with strong academic ability underscores our active recruiting effort. We invite your application.

Adult Special Students—The Adult Special category of admission in COA is primarily for (1) students who are pursuing course work in COA departments, but who are not degree-seeking students, or (2) students who are preparing for application to graduate programs offered by COA departments, but who still have some prerequisites to satisfy. Admission may be processed at any time prior to the first day of class. The AS category is also open to (3) staff members in COA departments taking courses through the Regents Scholarship Program and (4) COA graduates returning for course work to improve their skills.

If you enter the college as an adult special student with the intention of transferring later to the Graduate School, you should be aware that there are restrictions on the number of credits that may be transferred to a graduate program while you are registered as an adult special. Consult the *Graduate School Bulletin*.

Senior Citizens—Minnesota residents 62 years or older are admitted to all University of Minnesota classes on a space-available basis, provided they have completed specified prerequisites. If a course is taken without credit, there is no fee unless materials or other special charges are involved. If a course is taken for

credit, students must pay a modest fee per credit and any materials or special charges. Eligible persons should check with the Office of the Registrar—St. Paul, 130 Coffey Hall.

Planning to Transfer?

Minnesota's public colleges and universities are working to make transfer easier. You can help if you PLAN AHEAD, ASK QUESTIONS, and USE PATHWAYS created by transfer agreements.

Preparing for Transfer

If you are currently enrolled in a college or university:

- Discuss your plans with the campus transfer specialist in Prospective Student Services, 277 Coffey Hall.
- Call or visit your intended transfer college. You should obtain the following materials and information:
 - college catalog
 - transfer brochure
 - information on admissions criteria and on materials required for admission (e.g., portfolio, transcripts, test scores). Note that some majors have limited enrollments or their own special requirements such as a higher grade point average.
 - information on financial aid (how to apply and by what date)
- After you have reviewed these materials, make an appointment to talk with an adviser/counselor in the college or program you want to enter. Be sure to ask about course transfer and admission criteria.

If you are not currently enrolled in a college or university, you might begin by meeting with a transfer specialist or an admission officer at your intended transfer college to plan the steps you need to take.

Understanding How Transfer of Credit Works

- The receiving college or university decides what credits transfer and whether those credits meet its degree requirements. The accreditation of both your sending and your receiving institution can affect the transfer of the credits you earn.
- Institutions accept credits from courses and programs like those they offer. They look for similarity in course goals, content, and level. "Like" transfers to "like."
- Not everything that transfers will help you graduate. Baccalaureate degree programs usually count credits in three categories: general education, major/minor courses and prerequisites, and electives. The key question is, "Will your credits fulfill requirements of the degree or program you choose?"
- If you change your career goal or major, you might not be able to complete all degree

requirements within the usual number of graduation credits.

Applying for Transfer Admission

- Application for admission is always the first step in transferring. Fill out the application as early as you can prior to the deadline. Enclose the application fee.
- Request that official transcripts be sent from every institution you have attended. You might be required to provide a high school transcript or GED test scores as well.
- Recheck to be certain you supplied the college or university with all the necessary paperwork. Most colleges make no decisions until all required documents are in your file.
- If you have heard nothing from your intended college of transfer after one month, call to check on the status of your application.
- After the college notifies you that you have been accepted for admission, your transcripted credits will be evaluated for transfer. A written evaluation should tell you which courses transfer and which do not. How your courses specifically meet degree requirements may not be decided until you arrive for orientation or have chosen a major.
- If you have questions about your evaluation, call the Office of Admissions and ask to speak with a credit evaluator. Ask why judgments were made about specific courses. Many concerns can be cleared up if you understand why decisions were made. If not satisfied, you can appeal. See "Your Rights as a Transfer Student" below.

Your Rights as a Transfer Student

- A clear, understandable statement of an institution's transfer policy.
- A fair credit review and an explanation of why credits were or were not accepted.
- A copy of the formal appeals process. Usual appeals steps are: 1) Student fills out an appeals form. Supplemental information you provide to reviewers—a syllabus, course description, or reading list—can help. 2) Department or committee will review. 3) Student receives, in writing, the outcome of the appeal. 4) Student can appeal decision to Student Services, 277 Coffey Hall.
- At your request, a review of your eligibility for financial aid or scholarships.

For help with your transfer questions or problems, see your campus transfer specialist.

Financial Aid

Financial aid for students is available in the form of grants, loans, scholarships, and work-study.

To apply for financial aid through the Office of Student Financial Aid (OSFA), students must obtain an application packet and complete the Free Application for Federal Student Aid (FASFA) and all other required documents.

Although applications are accepted throughout the academic year, priority consideration for the following fall is given to applications that are complete and in OSFA by April. Exact deadlines are in the application packet.

For an application packet and more information, contact the Office of Student Financial Aid. The St. Paul campus office is in 197 Coffey Hall, 1420 Eckles Avenue, St. Paul, MN 55108. The Minneapolis campus office is in 210 Fraser Hall, 106 Pleasant Street S.E., Minneapolis, MN 55455 (612/624-1665).

Scholarships

COA has an extensive scholarship program for freshmen, transfer, and continuing students. Scholarship brochures and applications are usually available in November. Students can pick them up in 277 Coffey Hall. Deadlines for applications are published in the applications and brochures.

Disabled Students

Wherever possible, special consideration is given to disabled students to minimize any problems. Through the COA Office, help is available to arrange for early registration, adviser accessibility and classroom locations for students using a wheelchair, and specific resource aids. Other services are available through the University's Disability Services, 16 Johnston Hall (612/624-4037).

Registration

Each quarter you and the University complete a contract through the registration and payment process. The University agrees to provide certain instruction and facilities; you agree to attend and pay tuition and fees for the classes you have chosen. Although changes sometimes occur in course listings, the responsibility for accurate, timely registration and payment rests primarily with you.

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

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

Independent Study—You have two options for obtaining credit through independent study. In some University courses, you may request an examination (or other evaluation) after preparing for it in any way you choose. If you pass the examination, you will receive credit for the

course. You must pay a fee for each examination attempted. Check with the COA Office for further information and for Request for Special Examination application forms.

A second method of independent study is to take a course without attending classes. Under this method, you pay the usual tuition and fees for the course, meet all deadlines, and take the final examination at the regular time. All usual regulations concerning grades, incompletes, and cancellations apply to students taking independent study in this manner. A course completed under independent study counts as part of the total credit load for the quarter. Check with the department offering the course concerning permission to take it for independent study. You will need approval from the course instructor on a registration override permit. Return the completed override to the Office of the Registrar—St. Paul, 130 Coffey Hall. Enter the course you are going to take by independent study on your course request form with a Y after the course number (e.g., Rhet 3280Y).

Extra Credit—With the course instructor's approval, you may earn 1 to 3 additional credits for a course you are currently taking or have already taken. You may, for example, explore a course topic intensively or extend it to a related topic. You will do the extra work on your own according to standards set by the instructor.

You will need approval from the course instructor on a registration override permit. Submit the completed override along with your course enrollment request form with an X after the course number (e.g., Rhet 3280X). The usual regulations concerning tuition and fees, grades, and cancellations apply.

Cancel/Add Procedures—Use a course request form, available from the Office of the Registrar—St. Paul or the COA Office, to change registration. Make all such changes as early as possible in the quarter. Please Note: Cancel/adds are official only if you use the course request forms from Office of the Registrar—St. Paul.

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

- Cancellations during the first two weeks of a quarter are deleted from your record.
- Cancellations during the third through sixth weeks of a quarter require your instructor's signature on the course request form. A bracketed W is assigned. The withdrawal (W) will not affect your GPA.
- Cancellations after the sixth week require the signatures of the adviser, instructor, and Scholastic Standing Committee representative on the course request form. Withdrawal from a course after the sixth week of a quarter is seldom approved by the Scholastic Standing Committee unless there are extenuating circumstances. (See Scholastic Requirements below for information on the effect cancellation has on your coefficient of completion.)

Add—No signatures are required to add a class during the first week of a quarter. You must have your instructor's signature during the second through sixth weeks of the quarter. After the sixth week of the quarter, adding a course requires the signatures of your instructor and the Scholastic Standing Committee representative. Approval after the sixth week of the quarter is rarely granted.

Grading Change—A change from one grading system selected for a course to another (e.g., from A-F to S-N or Audit) must be made during the first two weeks of a quarter. The choice of grading system may not be changed after the end of the second week.

Cancellation of Entire Registration—If you leave the University before the end of a quarter, you must cancel your registration when you stop attending classes. Submit a course request form to the Office of the Registrar—St. Paul, 130 Coffey Hall. Cancellations are effective the day they are processed. Refunds are based on the date you officially cancel. You are entitled to a full refund if you cancel before the first day of classes. Contact the Office of the Registrar—St. Paul, 130 Coffey Hall, for current refund information.

Petition Procedures

To request permission to depart from usual procedures and regulations, you must complete a petition form available at the COA Office, 277 Coffey Hall, or at the Office of the Registrar—St. Paul, 130 Coffey Hall. Consult your adviser about writing the petition and for recommendation for approval. Present your petition to the COA Office for review by the Scholastic Standing Committee. You may pick up a copy of the decision about one week later.

Credits and Class Attendance

Advanced Placement—The Advanced Placement (AP) program of the College Board provides a way for high schools to offer college-level studies to their more advanced students and for such students to demonstrate satisfactory achievement in those studies. Through this program students may earn college credit, exemption from requirements, or placement in advanced courses when they enroll in college. For more information, contact the Office of Admissions, University of Minnesota, 240 Williamson Hall, 231 Pillsbury Drive S.E., Minneapolis, MN 55455 (612/625-2008).

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

Course Load—The typical course load per quarter is 14 to 18 credits. A credit requires an average of three hours of work each week. To carry more than 18 credits, a C average (that is, a cumulative grade

point average of not less than 2.00) is required. To carry more than 21 credits, a B average (3.00 GPA) in work of the previous quarter and permission from the Scholastic Standing Committee are required. Undergraduates must carry at least 12 credits each quarter to be considered full-time students. In some cases, financial aid programs stipulate credit minimums. Consult the Office of Student Financial Aid for more information.

Class Attendance—Attendance for certain classes in COA is compulsory because of the nature of such classes. If you miss a class for a valid reason, you may request the instructor's assistance in making up the work missed. Instructors are under no obligation to give assistance if the absence is not justifiable.

The following three situations are accepted by instructors as justifiable reasons for absence from class and for a request for assistance in making up work: (a) illnesses certified by Boynton Health Service or by your family physician; (b) emergencies caused by a death or serious illness in your immediate family; (c) participation, certified by the Office of Student Affairs (190 Coffey Hall), in University-approved, cocurricular activities.

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

Use of Elective Credits—With the approval of your adviser and the Scholastic Standing Committee, you may request that some elective courses you have completed be omitted from the list of courses counted toward your degree. A maximum of 10 credits of elective courses may be withheld to raise your 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.

Students in agriculture are not required to take courses in physical education or music. A maximum of 9 credits in physical education activities and a maximum of 6 credits in music performance may be counted as elective credits toward graduation.

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

Special Study Opportunities

Several study opportunities that allow you to earn credits in special ways are described below. In addition to these programs, many majors offer

internship or work-study opportunities. Check with your adviser.

Honors Program—The COA Undergraduate Honors Program provides a special educational opportunity for all COA students who qualify and accept the challenge of broadening, deepening, and enriching their education. The program is designed to give COA 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 a COA Honors Colloquium Course Series (AGRI 1000H) and enhance their backgrounds through a COA Honors Experience Course (AGRI 3100H). The honors experience is student-designed to meet their special interests and is supervised by experienced COA faculty. The college-wide honors program leads to the *cum laude* degree designations in all COA majors.

Check with the COA office for more information and an application.

Study Abroad—COA encourages students to study in another country as part of their degree program. Options range from a few weeks to an entire academic year. Study in English is possible at a number of sites. If a University of Minnesota program does not meet a student's needs, many other options are also available.

Identifying Study Abroad Opportunities—The International Study and Travel Center and the Global Campus together form a work/study/travel abroad advising center in 102 Nicholson Hall. You can learn about the many opportunities through an appointment with an options adviser (612/626-9000). After identifying one of many options of interest, students should see a program adviser (625-3379) for detailed program information and for credit and financial aid planning.

Study Abroad Opportunities in COA—Two types of study abroad that can especially enhance degree work in COA are field study and integrated classroom study. Minnesota Studies in International Development (MSID) is a field study program offering two-quarter winter/spring grassroots internships in Ecuador, India, Jamaica, Kenya, Morocco, or Senegal, preceded by on-campus preparatory courses in the fall; some sites require no prior language study. The Student Project for Amity and Nations (SPAN) consists of summer overseas research on a topic of the student's choosing, preceded by a year's on-campus preparation and followed by project write-up in the fall; the four destinations change from year to year. Students may also seek directed study credit for academic projects arranged in the contest of a PART International experience (see below).

Integrated classroom study programs permit students to take regular university courses alongside host-country nationals. The

University's student exchanges and consortium memberships provide access to universities in many countries. Agriculture curricula taught in English are available in Australia, Fiji, Finland, and the United Kingdom. Students with sufficient language fluency may instead choose to study in Dutch (the Netherlands), Finnish (Finland), French (France, Togo), German (Germany), Korean (South Korea), Spanish (Argentina, Dominican Republic, Honduras, Mexico). For students majoring in Applied Economics the range of options is even greater.

Other Study Abroad Opportunities—COA students need not necessarily seek credit in their major. The College encourages study abroad is encouraged 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. Contact an options adviser for more information.

Credit and Financial Aid—Advance planning and COA endorsement are essential to assure that credit from study abroad fits smoothly into the student's degree program. Students who enroll in a University of Minnesota program will receive procedural information from the sponsoring office on campus. Students seeking other options should make an appointment with a study abroad program adviser (104 Nicholson Hall, 625-3379) as early as possible to discuss credit procedures and obtain a Foreign Study Checklist. Through the Checklist, the COA Office for Student Affairs, 277 Coffey Hall, will record agreements concerning credit. The checklist also helps maintain students' enrollment status and financial aid eligibility while abroad.

For nearly all study abroad programs, students can arrange to retain their University financial aid eligibility and/or to defer past loans. Additional financial aid is available for some programs. Contact a study abroad options adviser (102 Nicholson Hall, 612/626-9000) for more information. Some scholarships are available through COA to help defray costs of overseas study-travel. A written report is required. Preference is given to proposals for non-English speaking countries. You must initiate and plan the project yourself with the aid of a faculty adviser. Check with the COA office for more information

PART International—The Practical Agricultural Reciprocal Training program (PART International) 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 will gain a cross-cultural experience by living and working with a host family in one of fifteen countries—Australia, Austria, Brazil, Denmark, Finland, France, Germany, Italy, the Netherlands, New Zealand,

Sweden, Switzerland and the United Kingdom. Departure dates are in January, April, June and September each year. For additional information contact the MAST/PART office in 199 Coffey Hall, 612/624-3740.

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.

UROP affords undergraduates the unique educational experience of collaborating with a faculty member on the design and implementation of a project. Faculty also have the opportunity to work closely with students and receive valuable assistance with their own research or professional activity. UROP adds a new dimension to the undergraduate experience. It encourages students to conduct research and pursue academic interests outside of their regular courses by employing them to work on special projects. To qualify you must be a full-time undergraduate student at the University of Minnesota in good academic standing.

Professional Experience Program (PEP)—

Junior and senior students enrolled in curricula offered by COA may participate in the Professional Experience Program (PEP). This program is designed for students who wish to reinforce their academic experience by working in an area related to their course of study. Students work full time either fall, winter, or spring quarter or during the summer. They earn 4 credits for satisfactory completion of a PEP program and may enroll in two PEP programs for a total of 8 credits. Salaries are paid by the cooperating businesses, industries, producers, and agencies participating in the program. For more information, consult your adviser or the Career Services Office, 272 Coffey Hall (612/624-2710).

Minors

COA offers three minor concentrations designed to enhance the major programs of students in agriculture or non-agriculture areas. For assistance in planning a minor, contact the COA Office, 277 Coffey Hall (612/624-3009).

Agricultural Issues and Values (26 credits)—

The Minor in Agricultural Issues and Values is a multidisciplinary program based in the humanities. It is designed both to complement professional and scientific major degree programs in agriculture and to serve students from other colleges who have an interest in the culture of agriculture. The program is based on the idea that (1) an awareness of the historical, cultural, and ethical issues surrounding agriculture is a valuable and satisfying part of all COA majors and is relevant to interested students from other colleges of the University; and (2) such a

background is essential to many leadership positions in modern agriculture. Students are introduced to the historical development and imaginative expression of agricultural experience, and they are asked to consider implications of issues involving agriculture. A special feature of the program is that students write a senior, integrative paper relating some aspect of their major field to social, cultural, and historical trends in the larger society. (Students writing the integrated paper will register for Rhet 5375. See program adviser.)

Required Courses (11 credits)

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

Rhet 3375—Humanities: Agricultural Heritage (4)

Rhet 5375—Special Problems: Agriculture, Issues, and Values (3)

Additional courses from the following approved list; other COA courses may be substituted in consultation with the adviser to the program (15 credits):

AgEc 3040—Economic Development of American Agriculture (4)

AgEc 3920—Agricultural Law (4)

AgEc 5650—Economics of Natural Resource and Environmental Policy (4)

AgEc 5710—Agricultural: Farm, Food, and Environmental Policy (3)

AgEd 5010—Rural Leadership Development(3)

Agro 5200—World Food Problems (3)

AnSc 3113—Animal Welfare (4)

CAPS 3502—Animal Health and Disease (5)

FR 1201—Conservation of Natural Resources (3)

FScN 1102—Technology of Food Processing (4)

NRES 1010—Issues in the Environment (3)

ScAg 1500—Biotechnology: Basic Concepts and Applications (3)

Soil 3118—Seminar: Soil and Water Pollution and Public Policy (1) (may be repeated for a maximum of 3 cr)

International Agriculture (30 credits)—The international agriculture minor is an interdisciplinary program that deals with the political, social, and cultural background against which agriculture and agricultural technology must operate throughout the world. Students gain insight into the problems of production, distribution, and consumption of food, feed, fiber, and domestic animals and attempted solutions in specific geographical areas. At least 30 credits are required, of which 5 must be for either an approved work/study experience or a major literature review, and 1 for a seminar in international agriculture. Students must develop their course of study in cooperation with an adviser in one of the departments of COA.

Required Courses (24 credits minimum)

Courses in agriculture outside the major (14 credits)

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

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

Research Paper (5 credits minimum)

Select one of the following:

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

Seminar

Seminar in International Agriculture—1 credit (Agri 3000)

Sustainable Agriculture (30 credits)—

Agricultural systems are complex and dynamic. In recent years, questions have been raised regarding the sustainability of energy and resource intensive agricultural systems. While all agriculturally oriented majors of the college consider issues of sustainability in agriculture, the Sustainable Agriculture minor provides a concentration of courses giving students greater understanding of scientific, technological, and socio-economic factors affecting the viability of agriculture. Students examine ecological features of agriculture and work through decision-making case studies involving integrated management of specific agricultural systems. The minor provides a degree of flexibility and individuality through several elective options. Students should develop their course of study in consultation with an adviser in one of COA major programs.

Required Courses (12 credits)

AgET 5027—Appropriate Technology for International Development (4)

AnPI 5060—Integrated Pest Management of Cropping Systems (4)

Ent 5320—Ecology of Agriculture (4)

Remaining 18 credits must be taken from at least three of the following four areas. Students should consult a COA major adviser in selecting these courses.

Pest Control

Agro 5030—Weed Control (5)

Ent 5210—Insect Pest Management (4)

Ent 5280—Livestock Entomology (4)

PIPa 3001—Management and Control of Field Crop Diseases (4)

PIPa 3002—Management of Horticultural Crop Diseases (4)

Crops, Soils, and Water

AgET 5410—Hydrology and Water Quality (5)

Soil 3416, 3417—Plant Nutrients in the Environment and Lab (4,1)

Soil 5610—Soil Biology (4)

Agricultural Economics

AgEc 3420—Grain Marketing Economics (4)

AgEc 3430—Dairy Marketing Economics (4)

AgEc 3440—Livestock and Meat Marketing Economics (3)

AgEc 3450—Agricultural Input Marketing Economics (4)

AgEc 3610—Resource Development and Environmental Economics (4)

AgEc 3810—Principles of Farm Management (4)

Integration of Agriculture and Society

AgEc 5790/Agro 5200/FScN 5643—World Food Problems (3)

AgEd 5055—Methods in Farming Systems Research and Extension (3)

AnSc 3113—Animal Welfare (4)

Biol 3052—Environmental Health and Toxicology (4)

Pol 3970—Ethics and the Environment (4)

Rhet 3390—Technology, Self, and Society (4)

Agriculture for Non-COA Students—This minor is for non-COA students who wish to explore some technical aspects of agriculture so they are better prepared as future leaders. The minor will help prepare them to:

- Understand the interdependence of rural and urban societies.
- Better manage the natural resources used by agriculture for the benefit of humanity.
- Understand the factors regulating supply and demand and the policies which determine the economics of food and fiber production.
- Understand the production practices used by agricultural producers and the environmental and social consequences of these practices.

- Understand the scientific basis of modern agriculture.

The college also offers minor concentrations in 7 areas of agriculture to complement the studies of students in non-agriculture programs. Students currently pursuing a University of Minnesota major outside of COA may pursue minors in: Agricultural and Applied Economics, Agronomy, Animal Science, Entomology, Horticulture, Scientific and Technical Communication, and Soil Science.

Contact the COA Office, 277 Coffey Hall (612/624-3009) for details and application forms. *COA students with an interest in one of these areas may want to incorporate it into an area of emphasis in their major.* Consult your major adviser.

Grading

Academic progress in COA is evaluated by one of two grading systems: the letter grade (A-F) system or the satisfactory-no credit (S-N) system. **A-F System**—Under the A-F (A-B-C-D-F) system, each letter grade carries the following meaning:

A—Represents achievement that is outstanding relative to the level necessary to meet course requirements.

B—Represents achievement that is significantly above the level necessary to meet course requirements.

C—Represents achievement that meets the basic course requirements in every respect.

D—Represents achievement that is worthy of credit even though it does not fully meet the basic course requirements in every respect.

F—Represents performance that fails to meet basic course requirements. No credit is earned.

The GPA is determined by dividing the sum of the grade points earned (A=4.00, B=3.00, C=2.00, D=1.00, F=0.00) by the sum of the credits attempted. A cumulative average of 2.00 (C) is required for graduation. Additional GPA requirements may be found under the individual curricular listings.

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

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

The following principles have been adopted as a guide for using the grading system by COA students:

- Courses identified by number and title as being required must be taken under the A-F system. Prerequisites for required courses and courses in the major must also be taken under the A-F system, unless exceptions are established. Generally, you may take under S-N grading only elective courses and courses used to satisfy all-college requirements that are not specified by number and title for your major requirements.

- All courses open to undergraduate students (those numbered below 8000) may be taken on the S-N or A-F basis, except where specifically restricted by the department offering the course or by the college, in the case of distribution requirements. Consult the course descriptions section for courses with restricted grading.

- Candidates for the baccalaureate degree from the college may present a maximum of 25 percent of the residence credits offered for graduation in courses in which they received grades of S.

- The grading system may be selected by students of the college regardless of their academic standing.

- The choice of grading must be declared at the time of registration and may be changed only up to the opening day of the third week of classes.

Your adviser or staff members in the COA Office can answer questions concerning the use of the grading system.

Other Symbols—The following symbols may be assigned under either grading system:

I—Assigned by an instructor to indicate incomplete work, in accordance with provisions announced in class at the beginning of the quarter, when in the instructor's opinion there is a reasonable expectation that the student can complete successfully the work of the course. An I that is not made up by the end of the next quarter in residence becomes an F; instructors may set dates within the quarter for make up of examinations or work. When an I is changed to a grade, the I or F is removed from the record.

W—Indicates official withdrawal from a course without a grade. The W is assigned in all cases of official cancellation during the first six weeks of a quarter. After the second week, the approval of the instructor is required for withdrawal. Withdrawal from a course after the sixth week is rarely permitted unless extenuating circumstances exist. Withdrawals (W) if approved, after the sixth week of the quarter are factored into your co-efficient of completion.

V—Indicates registration as an auditor or visitor, a noncredit, nongrade registration.

T—Posted on the transcript as a preceding supplement to the original grade to indicate credits transferred from another institution or from one college or campus to another within the University when reevaluation is required.

X—Reported in a two- or three-quarter continuing course in which a grade cannot be determined until the full sequence is completed. The instructor submits a grade for each X when the student has completed the sequence.

Dean's List—The Dean's List, published at the end of fall, winter, and spring quarters, is one way that COA recognizes outstanding academic performance by its students. To qualify for the COA Dean's List, students must complete at least 12 credits for the quarter (day school and Continuing Education and Extension combined) with a GPA of 3.70 or better. At least one course for that quarter must be completed in day school.

Scholastic Requirements

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

Academic Difficulty: Probation and Suspension Status—See your adviser regularly, especially if you are having difficulty in any of your courses. COA's mechanism for dealing with academic difficulty is called academic probation.

There are three levels of probation: academic warning (P1), academic contract (P2) and suspension (P3). A student is placed on academic warning if his/her quarterly or cumulative GPA is less than 2.00 but 1.50 or better. A student on academic warning must see an adviser in order to register and will be issued an override to register at their normal queued time. If the student's quarterly and cumulative GPAs at the end of the probationary quarter are 2.00, the student is removed from academic warning. If not, the student is placed on probation contract.

In addition to GPA, each student's co-efficient of completion is monitored annually. The co-efficient of completion indicates the percentage of courses being completed successfully. A co-efficient of .75 is considered a minimum standard. If students fail to meet the minimum of .75, they are placed on probation and their progress is monitored in the same manner detailed below.

The formula for determining this is:

$$\frac{\text{Credits Completed with grade A, B, C, D, S}}{\text{Credits Attempted with grade A, B, C, D, S, F, N, I, W}} = \text{percentage of successful completion.}$$

A student is placed on probation contract if his/her quarterly or cumulative GPA is less than 1.50. A student on probation contract must complete a specific contract drawn up by the college for academic performance and will not be allowed to

register for subsequent quarters until grades for the probationary quarter are reviewed. If the contract goals are met quarterly and cumulative GPAs are at least 2.00, the student is removed from probation. If goals are not met, the student is placed on suspension. The period of suspension is normally one academic year.

A student who is suspended may appeal the suspension. A determination of readmittance will be made jointly by the Student Services Office and the Scholastic Affairs Committee. Readmission is not automatic; to be readmitted, a student must show evidence in writing of changes in circumstances that make it more likely that the student will succeed in the academic program.

Appeal System—Decisions by the adviser, department Scholastic Standing Committee and the subcommittees of the Scholastic Standing Committee may be appealed to the COA Scholastic Affairs Committee whose decision in turn may be appealed to the COA dean.

Repeating Courses—Students may repeat, for credit, courses in which they have received grades of N or F, and only the first passing grade will be counted in the cumulative grade point average and honor point total. (The grades previously earned, however, will remain on the transcript.) Students who want to repeat courses in which they received grades of D, C, or S must petition the Scholastic Standing Committee for approval before registering for the course(s). Repeating for credit courses in which grades of A or B have been received is not permitted.

Scholastic Conduct

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

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

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

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

Students wishing to report an incident of misconduct should contact the Scholastic Affairs Committee through the COA Dean's Office, 277 Coffey Hall.

A student may appeal the decision of an instructor to the Scholastic Affairs Committee, and may appeal the decision of the Scholastic Affairs Committee to the Office of Student Judicial Services. This may lead to the President's Student Behavior Review Panel, which has final jurisdiction.

Access to Student Educational Records—In accordance with regents' policy on access to student records, information about a student generally may not be released to a third party without the student's permission. (Exceptions under the law include state and federal educational and financial aid institutions.) The policy also permits students to review their educational records and to challenge the contents of those records.

Some student information—name, address, electronic (E-mail) address, telephone number, dates of enrollment and enrollment status (full time, part time, not enrolled, withdrawn and date of withdrawal), college and class, major, adviser, academic awards and honors received, and degrees earned—is considered public or directory information. Students may prevent the release of public information only during their terms of enrollment. To do so, they must notify the records office on their campus.

Students have the right to review their educational records. The regents' policy, including a directory of student records, is available for review at 150 Williamson Hall, Minneapolis, and at records offices on other campuses of the University. Questions may be directed to the Office of the Registrar, 150 Williamson Hall (612/625-5333).

Graduation Requirements

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

1. Complete the prescribed curriculum, including required and elective courses to meet the total number of credits required;

2. Earn a minimum GPA of 2.00 in all coursework taken at the University after admission to COA;
3. Earn a minimum GPA of 2.00 in your major coursework;
4. Earn a co-efficient of completion of .75 or greater in COA.

Graduation application deadlines are set by the COA Office and are two quarters before your expected graduation. The deadline will be published in the college *Kiosk*, an information sheet that you will receive each quarter with your registration materials. You will be responsible for knowing these deadlines. Extensions of deadlines are rarely granted. You may turn in your application with an official program sheet signed by your adviser to the Office of the Registrar—St. Paul, 130 Coffey Hall.

Residency Requirements—In addition to meeting University residency requirements, baccalaureate degree candidates must earn a minimum of 30 of their last 45 credits in professional courses in the program at the 3xxx or 5xxx level while enrolled in COA. Ordinarily this will include courses described in this bulletin as well as appropriate advanced courses required in intercollegiate programs.

Graduation With Honors—Graduating with honors is determined by a combination of accumulated COA GPA (you must have a minimum of 60 credits taken while in COA at the University of Minnesota) and fulfillment of the Honors Colloquia and Honors Experience requirements.

The following Latin designations are used for COA Honors students:

- *Cum laude*—3.4 GPA for all coursework in COA plus honors requirements.
- *Magna cum laude*—3.6 GPA for all coursework in COA plus honors requirements.
- *Summa cum laude*—3.8 GPA for all coursework in COA plus honors requirements.

Information and applications for all the Honors Programs are available in 277 Coffey Hall (612/624-3009).

Graduation With Distinction and High Distinction—Graduation "with high distinction" is limited to the top three percent (usually 3.80 GPA or above) of the graduating class; "with distinction" to the next seven percent (usually 3.50 GPA or above) of the graduating class.

The calculation of the GPA to determine class rank is based on the last 90 credits taken before graduation. Only graduating students who have completed at least 90 credits as students in COA are eligible for distinction designations, regardless of the level of their academic performance.

Career Services Office

To help you secure employment after graduation, the Career Services Office, 272 Coffey Hall, announces job opportunities and assists in

arranging interviews with employers. Although the Career Services Office concentrates on full-time jobs for graduates, the Professional Experience Program—an internship program—is also offered to juniors and seniors currently enrolled in the college. Students are encouraged to take advantage of the Career Services Office for career information beginning their freshman year.

Student Organizations

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

St. Paul Campus Board of Colleges—The St. Paul Campus Board of Colleges directs and coordinates student activities and encourages student leadership throughout the St. Paul campus. Its membership is drawn from the colleges of Agriculture, Biological Sciences, 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).

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

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

Freshman Board—This group, which has an office in 190 Coffey Hall, meets weekly throughout the school year. Sponsored by the St. Paul Board of Colleges, Freshman Board gives you an opportunity to learn about the University—its organization and administration,

its governance procedures, and students' role in decision making. Activities are shared with the Minneapolis Freshman Council on the East Bank campus. All entering students receive information about Freshman Board during the summer, and the first meeting is traditionally held during the first full week of fall quarter. For further information, inquire at the Office for Student Affairs, 190 Coffey Hall.

Agricultural Ambassadors—This group of selected undergraduate students from COA volunteer their time to serve as goodwill ambassadors for the college and its students. They foster communications among the college, prospective students, and the community at large. Each ambassador gains experience in public relations and recruitment and develops valuable communications skills through public speaking engagements and small group discussions with prospective students. Agricultural Ambassadors develop leadership/management talents by participating on the executive board and special committees. For more information, contact the COA Office, 277 Coffey Hall.

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

Other COA Student Organizations—Many of the undergraduate programs sponsor student clubs. Membership and participation in these organizations can add a valuable dimension to your academic program and contribute a great deal to your professional development. Check with your adviser or the COA Office, 277 Coffey Hall, for further information.

Other clubs affiliated with the College of Agriculture include:

- Agricultural Education Club
- Block and Bridle
- Collegiate 4-H
- Gopher Dairy Club
- Gopher Crops and Soils
- Food Science and Nutrition Club
- Horticulture Club
- National AgriMarketing Association, Student Chapter (NAMA)
- Environmental Studies Club
- Nutrition Club
- American Society of Agricultural Engineers, Student Branch
- Society of Technical Communicators, Student Chapter
- Frenatar: Entomology Student Association
- Pre-Vet Med Club
- The Sheep and Goat Club
- Alpha Epsilon Delta (Pre-Med and Pre-Vet)
- American Association of Bovine and Swine



Course Descriptions

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

- * Courses in which graduate students may prepare Plan B projects.
- † All courses preceding this symbol must be completed before credit will be granted for any quarter of the sequence.
- § Credit will not be granted if credit has been received for the course listed after this symbol.
- ¶ Concurrent registration is required (or allowed) in the course listed after this symbol.
- # Registration Override Permit, completed and signed by the instructor, is required for registration.
- Δ Registration Override Permit, completed and signed by the department offering the course, is required for registration.
- H Honors course (follows the course number).
- f,w,s,su Following a course number, indicates fall, winter, spring, or summer terms.
- x Course may require more than one quarter to complete.

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

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

A comma between course numbers (e.g., 1234, 1235, 1236) indicates a series of courses that may be entered any quarter. In prerequisite listings, comma means "and" (e.g., "prereq 1101, 1102 or 1103" means the prerequisites are 1101 and either 1102 or 1103).

A prerequisite course listed by number only (e.g., prereq 5246) is in the same department as the course being described.

Agriculture (Agri)

1000H. HONORS COLLOQUIUM. (2 cr; prereq COA Honors Program; A-F only)

Colloquium courses for the College of Agriculture Honors Program. Topics change quarterly. Each colloquium introduces a topic related to "Agriculture in the 1990's" and is designed for all COA majors. Flexible format may include learning opportunities such as symposia, field trips, guest speakers, and other college/university events. Contact college office for topics.

3000. SEMINAR IN INTERNATIONAL AGRICULTURE. (1 cr)

Oral presentation and discussion of students' research papers, literature review of selected topics, discussions with students and staff about their experiences in international agriculture.

3100H. HONORS EXPERIENCE. (3-4 cr; prereq COA Honors Program; Honors Committee Approval; A-F only)

Honors experience course for the College of Agriculture Honors Program individually tailored by student in conjunction with a COA faculty supervisor. The experience could include such things as: foreign study-travel, research experience, a position or policy paper, or any experience demonstrating advanced study-service-understanding.

Agricultural and Applied Economics (AgEc)

1000. ORIENTATION TO AGRICULTURAL AND APPLIED ECONOMICS. (1 cr; S-N only)

Curricula, areas of specialization, coursework, employment opportunities, faculty, and functions of the Department of Agricultural and Applied Economics.

1101. PRINCIPLES OF MICROECONOMICS. (4 cr, §Econ 1101)
Economics of the firm and household; factor and product price determination; theory of production, consumption, and distribution; supply and demand analysis, equilibrium analysis.

1102. PRINCIPLES OF MACROECONOMICS. (4 cr, §Econ 1102)
Determinants of national income and employment levels; prices and money; the banking system; monetary and fiscal policy; economic growth and development; role of government in the economy.

1250. PRINCIPLES OF ACCOUNTING. (4 cr)
Fundamentals of business accounting; basic finance concepts; use of accounting data for income tax and managerial decision making.

3000. SEMINAR IN INTERNATIONAL AGRICULTURE. (1 cr; prereq Agri 3000; S-N; free elective for AgEc undergrads)
Oral presentation and discussion of students' research papers, literature review of selected topics, discussions with students and staff about their experiences in international agriculture.

3001. APPLIED MICROECONOMICS: CONSUMERS AND MARKETS. (4 cr, §Econ 3101; prereq 1101 or Econ 1101, Math 1142 or 1251, Stat 1001 or IDSc 1010, OMS 1020 or #)
Microeconomic theory relating to the consumer, the household, and demand for both public and private goods. Empirical applications integrated with theory, including the estimation of demand functions from actual data.

3002. APPLIED MICROECONOMICS: MANAGERIAL ECONOMICS. (4 cr; prereq 3001, Acct 1050 or AgEc 1250 or #)
Microeconomic theory relating to the firm and its application to managerial problems. Empirical applications integrated with theory, including programming and the estimation of cost and production functions.

3006. APPLIED MACROECONOMICS: GOVERNMENT AND THE ECONOMY. (4 cr, §Econ 3102; prereq 1101, 1102 or Econ 1101, 1102)

Relationship between the public sector and the market economy. Public goods, externalities, and other allocation issues. Government and the stabilization of the national economy. Overview of the new classical and Keynesian models. Principles of taxation. The individual income tax, sales, business, and property taxes. Intergovernmental fiscal relations.

3007. APPLIED MACROECONOMICS: POLICY, TRADE, AND DEVELOPMENT. (4 cr, prereq 1101, 1102 or Econ 1101, 1102)
History of agricultural and economic development; determinants of development on factor and commodity markets; elements and effects of agricultural and trade policy in the course of economic development; macroeconomic and international aspects of agricultural development, policy, and trade.

3040. ECONOMIC DEVELOPMENT OF AMERICAN AGRICULTURE. (4 cr; prereq 1101 or Econ 1101)

Review of the economic, political, social, and technical forces that have shaped the development of American agriculture; role of agricultural development in national economic development in the United States; implications for presently developing countries.

3070. AGRICULTURE AND ECONOMIC GROWTH IN DEVELOPING COUNTRIES. (4 cr; prereq 1101, 1102 or Econ 1101, 1102)

Agricultural development problems; contribution of economics to analyzing these problems; use of economics in agricultural development policy and planning.

3240. STRATEGIC MANAGEMENT OF FARMS AND AGRIBUSINESSES. (4 cr; prereq 3002, 3500 or #)

Identifying and analyzing strategic issues and problems of farms and agribusinesses, establishing business goals and developing realistic plans of action; strategy formulation, implementation and control issues; analysis of case studies.

3260. OPERATIONS MANAGEMENT OF FARMS AND AGRIBUSINESS. (4 cr; prereq 3002, 3500 or #)
Annual planning, implementation, and control in farms and agribusiness firms; design of information systems to support management operations; forecasting; risk management.

3400. MARKETS, MARKETING AND PRICES. (4 cr; prereq AgEc 1101 or equiv, Math 1142 recommended)
Market structure, demand and supply structure, regulations, and institutions that influence the behavior of firms in agricultural marketing systems will be examined. Performance in food assembly, manufacturing, and distribution industries will be investigated with respect to conduct and strategies of firms.

3410. ECONOMIC ORGANIZATION OF THE HOSPITALITY INDUSTRY. (4 cr; prereq Mktg 3000 or #)
Principles of economics applied to markets and firms serving people away from home, including food, lodging, travel, recreation, health care, and related activities.

3420. GRAIN MARKETING ECONOMICS. (4 cr; prereq 1101 or Econ 1101)
Economic relationships in the marketing of grain and grain products; analysis of supply and demand; grain grades, storage, and transportation; market structure, channels, pricing, and competition; government programs and policies.

3430. DAIRY MARKETING ECONOMICS. (4 cr; prereq 1101 or Econ 1101)
Economic relationships in the marketing of milk and milk products; analysis of supply and demand; market structure, channels, pricing, and competition; federal milk market price regulations; dairy programs and policies.

3440. LIVESTOCK AND MEAT MARKETING ECONOMICS. (3 cr; prereq 1101 or Econ 1101)
Economic relationships in the marketing of livestock and livestock products; analysis of supply and demand; livestock grades, inspection, and transportation; market structure, channels, pricing, and competition; government regulations and policies.

3450. AGRICULTURAL INPUT MARKETING ECONOMICS. (4 cr; prereq 1101 or Econ 1101)
Demand for farm inputs; structure of farm sector, factors affecting input purchases, derived demand from production functions, time series demand analysis, farmland as a production input; farmland markets; farm labor input; farm labor usage and markets; farm-generated inputs and alternative enterprise combinations. Purchased farm inputs: farm machinery and buildings, animal production input markets, crop production input markets.

3500. AGRIBUSINESS FINANCE. (4 cr; prereq 1250 or Acct 1050, AgEc 3002 or #)
Analysis of financing and investment strategies for agribusiness firms and their effects on liquidity, solvency and profitability; financial intermediaries in agriculture.

3610. RESOURCE DEVELOPMENT AND ENVIRONMENTAL ECONOMICS. (4 cr; prereq 1101, 1102 or Econ 1101, 1102 or #)
Basic concepts of resource use including physical and economic classifications; physical and economic feasibility; benefits and costs; external effects; cost sharing; selected resource use problems. Economic areas and units for planning and development; generation of alternative program elements and development of consequences; problems in choosing elements for an optimum resource development program.

3810. PRINCIPLES OF FARM MANAGEMENT. (4 cr; prereq 1101 or Econ 1101; not open to ag bus and applied econ majors)
Using farm accounts in planning; applying economic principles and budgeting procedures to developing enterprise budgets and whole farm plans; developing projected cash flows; and evaluating investment alternatives.

3920. AGRICULTURAL LAW. (4 cr; prereq 1101 or Econ 1101)
The legal system; contracts; torts; labor; property; meaning, acquisition, rights; water drainage; environmental concerns; animals; credit, finance; UCC; sales; transportation; tenancy; partnerships, corporations, cooperatives; estate and tax planning.

3980. CURRENT ISSUES IN AGRICULTURAL ECONOMICS. (Cr ar; prereq #)

Discussion and analysis of important and timely problems in agricultural economics. Topics vary quarterly and are listed in *Class Schedule*. For full details, inquire at the department office before registration.

3990. INDEPENDENT STUDY IN AGRICULTURAL AND APPLIED ECONOMICS. (Cr ar; prereq #)

Independent study and supervised reading and research on subjects and problems not covered in regularly offered courses.

5000. PROFESSIONAL EXPERIENCE PROGRAM. (4 cr; prereq #; S-N only; not for grad cr; CEE only)

Professional experience in agribusiness firms or government agencies gained through supervised practical experience; evaluative reports and consultations with faculty advisers and employers.

5020. APPLIED LINEAR PROGRAMMING. (4 cr; prereq 1101 or Econ 1101, Math 1031 or 1131)

Application of linear programming to farm and agribusiness firms. Emphasizes economic concepts using minimal mathematics. Develops skills in computer use for decision making. Profit maximization, cost minimization, and transportation analysis.

5030. METHODS OF ECONOMIC DATA ANALYSIS. (4 cr; prereq Stat 5021 or equiv; familiarity with matrix algebra recommended)

Primarily for M.S. students. Emphasizes practical aspects of economic data analysis and familiarizes students with various econometric methods and models commonly used in applied economics, and the economic and statistical theory underlying these methods.

5400. INTERMEDIATE MARKET AND PRICE ANALYSIS. (4 cr; prereq 3002 or Econ 3101 or #)

Development of analytical models and their application in various market situations. Unique market institutions that have developed in response to marketing problems and policies.

5440. COOPERATIVES AND AGRIBUSINESS ORGANIZATION. (4 cr; prereq 1101, 1102 or Econ 1101, 1102 or #)

Analysis of economic problems and issues facing agricultural cooperatives, including changing market organization, financing, taxation, and antitrust regulations.

5480. FUTURES MARKETS AND PRICES. (4 cr; prereq 1101, 1102 or Econ 1101, 1102 or #)

Economics of futures trading; the basis and theoretical price relationships in storable and nonstorable commodities; hedging and commercial use of futures markets with illustrations; arbitrage; options on agricultural futures; financial futures; speculation; futures market performance and regulation.

5500. FINANCIAL MARKETS AND AGRICULTURAL CREDIT INSTITUTIONS. (4 cr; prereq 3500 or BFin 3000 or grad or #)

Analysis of financial institutions and financial markets; managerial policy issues confronting managers of financial intermediaries with particular reference to those operating in an agricultural setting; current problems confronting financial intermediaries.

5550. FOOD MARKETING ECONOMICS. (4 cr, \$FScN 5474; prereq 3001 or Econ 3101 or #)

Economics of food marketing in the United States. Food consumption trends; consumer food behavior; food expenditure and consumption data; consumer survey methodology; the food distribution retailing system; food policy issues related to food marketing. Students pursue individual and group projects.

5580. HUMAN CAPITAL AND HOUSEHOLD ECONOMICS. (3 cr; prereq 3001 or Econ 3101 or #)

Investment in household formation, child education, health, labor force participation and non-market work will be analyzed in the context of household economics and national productivity; effects of economic variables on investment decisions and returns.

5600. LAND AND WATER ECONOMICS. (3 cr; prereq 3002 or Econ 3101 or #)

Land and water as public resources and as factors of production; economic analysis of policies that influence asset use; sale and rental markets; valuation of rights to land and water; taxation and regulation as instruments and influencing private management decisions; comparative land and water legal and market settings.

5620. REGIONAL ECONOMIC ANALYSIS. (3 cr; prereq 1101 or Econ 1101)

Analysis of regional industry and community structure; role of resource, transportation, and institutional constraints; trade, migration, and investment in regional growth and change. Use of regional economic formation in business investment and location planning.

5630. REGIONAL DEVELOPMENT SYSTEMS. (3 cr; prereq 1101 or Econ 1101)

Population, income, and employment disparities in regional growth and development in selected countries. Regional development strategies and institutions for public intervention in regional development process. Regional systems and analyses forecasts for economic policy and development planning.

5640. FINANCING STATE AND LOCAL GOVERNMENTS. (4 cr; prereq 3001 or Econ 3101 or #)

Problems and issues in financing state and local public services in the United States. State and local revenue systems, debt and expenditures. Intergovernmental fiscal relations. Budget analysis.

5650. ECONOMICS OF NATURAL RESOURCE AND ENVIRONMENTAL POLICY. (4 cr; prereq 3002 or 3610 or Econ 3101 or #)

Application of economic analysis, including project evaluation, to current natural resource and environmental issues. Emphasis on conservation and resource scarcity, environmental quality, and resource use issues and their implications for public policy.

5660. ECONOMICS OF PUBLIC SERVICES. (3 cr; prereq 3001 or Econ 3101 or #)

Issues of finance and supply and demand for public services; pricing, producing, and financing public goods; bureaucratic decision making; implementing policies.

5710. U.S. AGRICULTURE: FARM, FOOD, AND ENVIRONMENTAL POLICY. (3 cr; prereq 3002, 3006, 3007)

Development of U.S. agriculture and U.S. agricultural and trade policy; agricultural input and commodity markets; U.S. environmental policies effects on agriculture; design and economic effects of U.S. agricultural policy; determinants of U.S. agricultural and trade policies.

5720. ECONOMICS OF WORLD AGRICULTURE. (3 cr; prereq 3001, 3006 or Econ 3101, 3102 or #)

Theories of agricultural development, comparative agricultural organization and structure, technical and institutional change on agricultural development, national development policies, bilateral and multilateral assistance, international policy conflicts.

5730. EUROPEAN AGRICULTURE: FARM, FOOD AND ENVIRONMENTAL POLICY. (4 cr; prereq 3002 or Econ 3101 or #)

Characteristics of agriculture in Europe; determinants of development of European agriculture; goals and instruments of EC agricultural policy.

5740. AGRICULTURAL POLICY IN PLANNED ECONOMIES. (4 cr; prereq 3001 or Econ 3101 or #)

Principle of economics used to analyze agricultural policy and performance in centrally planned economies. Emphasis on Soviet agriculture; some attention to China and Eastern Europe.

5750. AGRICULTURAL TRADE AND COMMERCIAL POLICIES. (3 cr; prereq 3001, 3006 or Econ 3101, 3102 or #)

Patterns of trade in agricultural products; trade policies and practices of export and import nations; commodity agreements; agricultural trade policies of common market areas; negotiations and potential trade developments.

5790. WORLD FOOD PROBLEMS. (3 cr, \$Agro 5200, \$FScN 5643, \$CAPS 5280; prereq ag or pre-vet med or home econ or soc sci major or # or agricultural econ grad with #)

Multidisciplinary approach to the social, economic, and technical problems of feeding the world's growing population. Principles sought from the social, economic, plant, and animal sciences for their application to food problems.

5860f. ECONOMICS OF AGRICULTURAL PRODUCTION. (3 cr; prereq 3002 or #)

Production economics applied to agriculture; profitable combination of production factors; comparative advantage and location production.

5890. INDEPENDENT STUDY: ADVANCED TOPICS IN FARM AND AGRIBUSINESS MANAGEMENT. (1-6 cr; prereq #)

Special topics or individual work suited to the needs of particular groups of students.

5990. SPECIAL TOPICS AND INDEPENDENT STUDY IN AGRICULTURAL AND APPLIED ECONOMICS. (Cr ar; prereq #)

Special classes, independent study, and supervised reading and research on subjects and problems not covered in regularly offered courses.

For Graduate Students Only

(For descriptions, see *Graduate School Bulletin*)

8100. GRADUATE SEMINAR

8110. MASTER'S PAPER: PLAN B PROJECT

8200. ADVANCED TOPICS IN AGRICULTURE AND APPLIED ECONOMICS

8210. APPLIED ECONOMETRICS

8220. APPLIED MATHEMATICAL PROGRAMMING

8231. AGRICULTURAL PRICES

8245. AGRICULTURAL MARKETING ECONOMICS

8264. RESOURCE ECONOMICS

8266. APPLIED REGIONAL ECONOMICS

8270. APPLIED WELFARE ECONOMICS AND PUBLIC POLICY

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- x Course may require more than one quarter to complete.

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

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

A comma between course numbers (e.g., 1234, 1235, 1236) indicates a series of courses that may be entered any quarter. In prerequisite listings, comma means "and" (e.g., "prereq 1101, 1102 or 1103" means the prerequisites are 1101 and either 1102 or 1103).

A prerequisite course listed by number only (e.g., prereq 5246) is in the same department as the course being described.

- 8278. AGRICULTURAL AND ECONOMIC DEVELOPMENT
- 8287. PRODUCTION AND SUPPLY
- 8288. DYNAMIC PRODUCTION ECONOMICS
- 8345. SEMINAR: AGRICULTURAL MARKETING
- 8360. SEMINAR: LAND AND INSTITUTIONAL ECONOMICS
- 8364. SEMINAR: RESOURCE ECONOMICS AND POLICY
- 8366. SEMINAR: APPLIED REGIONAL ECONOMICS
- 8370. AGRICULTURAL AND TRADE POLICY IN DEVELOPED COUNTRIES
- 8373. SEMINAR: FOOD AND AGRICULTURAL POLICY IN THE UNITED STATES
- 8378. SEMINAR: AGRICULTURAL DEVELOPMENT
- 8382. SEMINAR: FARM MANAGEMENT AND PRODUCTION ECONOMICS
- 8590. ECONOMICS OF FOOD AND CONSUMER POLICY
- 8591. CONSUMPTION ECONOMICS
- 8777. THESIS CREDITS: MASTER'S
- 8888. THESIS CREDITS: DOCTORAL

Agricultural Education (AgEd)

- 1001. INTRODUCTION TO AGRICULTURAL EDUCATION. (1 cr)
Orientation to employment and service in agricultural education; qualifications of teachers, survey of preparatory offerings, the program in Minnesota.
- 1002. PRINCIPLES OF CAREER PLANNING IN AGRICULTURE. (1 cr)
Self-assessment and analysis of interests, skills, abilities, values, and life goals. Analysis of various agricultural occupations, employment potential, and demands in relation to employee expectations for work. Industries will be examined using information interviews.
- 1003. PERSONAL AGRICULTURE CAREER PLANNING. (1 cr; prereq 1002)
Developing personal career plans. The plan will be based on an individual assessment of 14 learner objectives plus various aptitude, value, and personality trait inventories. Individual plans will reflect information obtained in interviews with firms and occupations.
- 1042. CURRENT TECHNICAL COMPETENCIES. (3 cr)
Preparation of teachers of mechanical/technical/technology instruction. Basic competencies in the skills and knowledge used in planning, implementing, operating and maintaining structural and mechanical systems are developed. Experiential learning principles, applied problem solving, observation and practice are key elements.
- 3001. EXPERIENTIAL LEARNING: PRODUCTION AGRICULTURE. (1-14 cr [max 14 cr]; prereq #; S-N only)
Experiential learning in a production agriculture business. Planned, organized, monitored, and evaluated based on a pre-experience diagnosis of learning prerequisite to higher level courses in technical agriculture.
- 3002. EXPERIENTIAL LEARNING: AGRICULTURAL BUSINESS. (1-14 cr [max 14 cr]; prereq #; S-N only)
Experiential learning in an agricultural non-farm business. Planned, organized, monitored, and evaluated based on a pre-experience diagnosis of learning required to meet competency expectations for persons employed in agricultural businesses.
- 3029. DIRECTED EXPERIENCE IN AGRICULTURAL EDUCATION. (1-3 cr)
Observation of activities of teachers of agriculture; familiarization with the staff, curriculum, and physical facilities and equipment in a department of vocational agriculture, with opportunity to participate in the functions of a teacher.
- 3041. PRACTICUM: AGRICULTURAL EDUCATION TECHNOLOGY. (1-3 cr [may be repeated for max 5 cr])
Individualized study packages of 1 credit each of technology in agriculture, horticulture, off-farm agriculture, agricultural mechanics, adult and beginning farmer programs, youth organizations, program evaluation, and visual aids.
- 5000. PROFESSIONAL EXPERIENCE PROGRAM. (4 cr; prereq #; not for grad cr; CEE only)
Professional experience in agricultural education or government agencies gained through supervised practical experience; evaluative reports and consultations with faculty advisers and employers.

- 5010. RURAL LEADERSHIP DEVELOPMENT. (3 cr, §1010)
Role, function, and unique features of rural community leaders; personal leadership and vision development for individuals and rural community groups. Focus on unique aspects of rural communities, leadership environment, and qualities essential in successful rural leaders.
- 5021. EDUCATION THROUGH EXTENSION METHODS. (3 cr, §HEEd 5021; prereq grad or #)
Methods and techniques of formal and nonformal education used by Extension Service and other organizations.
- 5023. EXTENSION METHODS FOR DEVELOPING COUNTRIES. (3 cr, §HEEd 5023)
Extension methods to promote the rapid adoption of improved agricultural practices.
- 5024. EXTENSION HISTORY AND PHILOSOPHY. (3 cr, §HEEd 5024)
Origin, philosophy, historical development, objectives, and organizational structure of the Extension Service.
- 5025. EXTENSION PROGRAM DEVELOPMENT. (3 cr, §HEEd 5025)
Planning, implementing, and evaluating the program development process.
- 5026. EXTENSION ADMINISTRATION. (3 cr, §HEEd 5026; prereq #)
Administration of the Extension Service organization at the county, area, and state levels.
- 5027. PRACTICUM: EXTENSION EXPERIENCES. (2-9 cr [max 9 cr], §HEEd 5027; S-N optional)
Observation of and participation in activities of Extension Service staff at the county and state level; familiarization with staffing, program planning and development, and educational and administrative functions.
- 5028. TEACHING METHODS IN AGRICULTURAL EDUCATION. (5 cr)
Methods used in teaching agriculture in public schools; use of media, principles of learning, problem solving, test construction, classroom management, and specific practice in problem-solving teaching techniques; use of competency-based individualized instruction as a medium for course presentation and a model for teaching methods.
- 5032. HIGH SCHOOL CURRICULUM IN AGRICULTURE. (3 cr; prereq 10 cr ed)
Philosophy, organization, and administration of instruction in agriculture departments in secondary schools.
- 5034. PROCEDURES IN TEACHING AGRICULTURE. (3 cr)
New developments in methodology; assessment of innovations and procedures; consideration of various levels of instruction.
- 5035. METHODS AND PRACTICES IN TEACHING POST-HIGH SCHOOL AGRICULTURE. (3 cr)
Problems unique to area vocational-technical school and junior college teaching; improving ability to organize and present subject matter.
- 5041. WORKSHOP: AGRICULTURAL EDUCATION TECHNOLOGY. (1-6 cr [max 6 cr])
New understandings, techniques, and materials in animal science, plant science, horticulture, soil science, agricultural mechanics, forestry, natural resources, youth organization, visual aids, and occupational exploration.
- 5042. AGRICULTURAL MECHANICS. (1-3 cr [max 12 cr])
Technical and managerial information, techniques, and materials. Facilitates participant's instructional planning, resource development, and instruction. Topic to be identified with each offering.
- 5043. FARM MANAGEMENT. (1-3 cr [max 12 cr])
Application of agricultural economics theory, principles, techniques, and materials. Facilitates participant's instructional planning, resource development, and instruction. Topic to be identified with each offering.
- 5049. AGRICULTURAL EDUCATION FOR ADULTS. (3 cr; prereq 6 cr in ag and applied econ, 5010 or #)
Organization and implementation of systematic education programs for beginning and established farmers; organization of local programs to meet needs of production agriculture in areas of enterprises; agricultural mechanics and management; development of continuing programs.
- 5051. ENTERPRISE ANALYSIS. (3 cr; prereq #)
Analyzing farm business as basis for identifying problems; planning learning experiences to improve farm management at high school, young farmer, and adult levels.
- 5052. FARM BUSINESS MANAGEMENT EDUCATION. (3 cr; prereq 5049 or #)
Administration, organization, and operation of farm business management education programs for adults; development and use of curriculum materials based on farm business record data.
- 5055. METHODS IN FARMING SYSTEMS RESEARCH AND EXTENSION. (3 cr, §5Agro 5055, §HEEd 5055)
Methodology for integrating research and extension programs designed to identify and solve farm family system problems using interdisciplinary and holistic approaches.

5056. APPLICATION OF FARMING SYSTEMS RESEARCH AND EXTENSION. (3 cr; prereq 5055 or HEEd 5055)

Seminar and fieldwork projects; sondeos and on-farm trials conducted.

5061. PROGRAM PLANNING AND EVALUATION. (3 cr; prereq sr)

Development of program of agricultural education in community school, integration with total school program, administrative relationships, techniques and use of program evaluation in planning.

5071. SUPERVISED OCCUPATIONAL EXPERIENCES IN AGRICULTURE. (3 cr)

Organization and administration of an occupational experience program in agriculture for high schools and area schools.

5072. PRACTICUM: AGRICULTURAL BUSINESS AND INDUSTRY. (1-3 cr per qtr [max 9 cr]; prereq 5071 or #)

Observation, study, and experience in agricultural business and industry; application to educational problems in agriculture.

5078. FFA ORGANIZATION AND MANAGEMENT. (2 cr)

Development of FFA (vocational agribusiness education student organization) knowledge, organization, and integration of activities into the curriculum, and management of chapter operations.

5080. ORGANIZATION AND MANAGEMENT. (3 cr; prereq #)

Administrative structure and function of subcollegiate programs.

5081. CURRENT ISSUES FOR THE BEGINNING AGRICULTURE TEACHER. (1-3 cr [max 3 cr]; prereq #)

Teaching methods, organizing learning resource materials, managing classroom and lab learning activities, curriculum planning and organization, managing discipline situations, school and community relationships for the beginning teacher.

5082. CURRENT ISSUES IN AGRICULTURAL EDUCATION. (1-3 cr [max 9 cr]; prereq #)

Emphasizes study and clarification of current issues, strategies of response, implications of response actions, and related leadership roles.

5084. CURRICULA FOR CAREER EXPLORATION IN AGRICULTURAL OCCUPATIONS. (3 cr)

Analysis and evaluation of material; criteria for selection of material; content, organization, resource activities, and teaching techniques.

5085. CAREER DEVELOPMENT IN AGRICULTURAL EMPLOYMENT. (3 cr)

Methods and materials in teaching career development for agricultural industries.

5087. MENTORSHIP FOR BEGINNING AG TEACHERS. (6 cr [2 cr per qtr]; prereq less than 2 yrs exp as an ag teacher in 5081, #; continuous regis required in 3 consecutive qtrs; S-N only)

Year-long program of professional development during the induction year of teaching agriculture in the public schools. Emphasis on solving problems, dealing with issues and concerns of new teachers, and making a smooth transition into the teaching profession.

5088. MENTORING BEGINNING AGRICULTURE TEACHERS. (3 cr; prereq #; S-N only)

Professional development training for experienced teachers who serve as mentors for beginning teachers of vocational agriculture. Emphasis on dealing with problems, concerns, and issues of teachers during their critical period of induction into the teaching profession in applied settings.

5090. INDEPENDENT STUDY. (1-3 cr; prereq sr or #)

Topics chosen to permit study of areas within education or to supplement areas of inquiry not provided in the regular course structure.

5095. INTEGRATING PAPER: MASTER OF EDUCATION. (3 cr; prereq MEd candidate in agricultural ed)

Preparing a paper dealing with studies in agricultural education applied to professional responsibilities.

5128. METHODS OF TEACHING. (3 cr; prereq non-agricultural ed major or #)

Methods of teaching agriculture or related subjects; development of competencies in planning, organizing, implementing, and evaluating instruction, with practice in instructional techniques.

5129. CURRICULUM PLANNING. (3 cr; prereq 5128 or #5128, non-agricultural ed major or #)

Methods and procedures in planning a curriculum to teach within a specific subject matter area; curriculum construction in the subject matter field for use in native country setting.

5200. SEMINAR: WORKING WITH YOUTH THROUGH ADULTS. (1-3 cr per qtr [max 9 cr incl HEEd 5200 and YoSt 5200]; prereq Δ; S-N optional)

Interdisciplinary seminar focusing on definition of the youth work profession; essential skills for youth workers; youth needs, roles, relationships with adults; development and management of a system of support for youth work.

5244. TOPICS IN PROGRAM PLANNING FOR EXTENSION EDUCATION. (1-6 cr [max 9 cr])

Effective extension education programming in relation to situation and needs analysis; coordination of content, people, methodology; development of program models; managing available resources.

5245. TOPICS IN ADMINISTERING EXTENSION EDUCATION. (1-6 cr [max 9 cr], \$HEEd 5245)

Issues and current literature; focus on personnel hiring and supervision, financial management, leadership styles, long-range planning; application of theory to administrative practice.

5246. TOPICS IN TEACHING AND DELIVERING EXTENSION EDUCATION. (1-6 cr [max 9 cr], \$HEEd 5246)

Teaching techniques involving media, telecommunications, computers, group process methods, experiential learning in extension education settings.

5247. TOPICS IN EVALUATING EXTENSION EDUCATION. (1-6 cr [max 9 cr], \$HEEd 5247)

Overall evaluation design; issues in choosing quantitative versus qualitative evaluation methods; developing skills and conceptual frameworks to apply theory to extension settings.

For Graduate Students Only

(For descriptions, see *Graduate School Bulletin*)

8001.* RESEARCH IN AGRICULTURAL EDUCATION

8020. SEMINAR: AGRICULTURAL EDUCATION

8091. FIELD PROBLEMS

8303. SEMINAR: GRADUATE STUDIES REVIEW

Agricultural Engineering

Courses in Agricultural Engineering Technology (AgET)

Agricultural engineering technology is the application of scientific and engineering knowledge and methods combined with technical skills for problem solving in agriculture. Department of Agricultural Engineering courses may be required by certain majors or taken as electives.

1090. DIRECTED STUDIES IN AGRICULTURAL ENGINEERING. (Cr ar; prereq #)

Independent study of topic(s) involving physical principles as applied to agricultural production and land resources.

3025. ENGINEERING PRINCIPLES AND APPLICATIONS. (4 cr; prereq Math 1031 or Math 1142 or equiv, 5 cr phys or chem)

Introduction to engineering principles for non-engineering students. Application of principles to solve agricultural problems in animal and plant production, processing, soil and water management. Systems, mechanics, power, mechanisms, fluid flow, heat transfer, psychrometrics, and controls.

3091. SPECIAL PROBLEMS IN AGRICULTURAL ENGINEERING. (2-5 cr; prereq #)

Individual study of topics in agricultural engineering. Application of physical principles to agricultural production.

5027. APPROPRIATE TECHNOLOGY FOR INTERNATIONAL DEVELOPMENT. (4 cr; prereq Math 1031, Chem 1001 or 1051, Phys 1041; 3 lect, 3 lab hrs per wk; joint day school/CEE)

Definitions, history, successes and failures of appropriate technology. Social and technical appropriateness. Water supply, treatment, storage, and conveyance. Water pumps, sanitation. Power; pedal, wind, water, solar, rice-hull furnace, methane, Stirling-cycle engine. Building materials. Agricultural machinery and animal power. Transfer and adoption of technology.

5091-5092. SPECIAL PROBLEMS IN AGRICULTURAL ENGINEERING. (2-5 cr per qtr; prereq #)

Individual study project in agricultural engineering at advanced level. Application of engineering principles to a specific problem.

5410. HYDROLOGY AND WATER QUALITY. (5 cr; prereq Math 1031, Phys 1041, Chem 1051, 1052; 3 lect, 3 lab, 1 rec hrs per wk)

Hydrologic cycle—precipitation, infiltration, evaporation, surface and subsurface runoff, ground water recharge. Flow in streams, flow in aquifers, flow measurement. Soil erosion, sediment transport and deposition. Chemical pollution of surface water and groundwater.

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

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- § Credit will not be granted if credit has been received for the course listed after this symbol.
- ¶ Concurrent registration is required (or allowed) in the course listed after this symbol.
- # Registration Override Permit, completed and signed by the instructor, is required for registration.
- Δ Registration Override Permit, completed and signed by the department offering the course, is required for registration.
- H Honors course (follows the course number).
- f, w, s, su Following a course number, indicates fall, winter, spring, or summer terms.
- x Course may require more than one quarter to complete.

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

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

A comma between course numbers (e.g., 1234, 1235, 1236) indicates a series of courses that may be entered any quarter. In prerequisite listings, comma means "and" (e.g., "prereq 1101, 1102 or 1103" means the prerequisites are 1101 and either 1102 or 1103).

A prerequisite course listed by number only (e.g., prereq 5246) is in the same department as the course being described.

Courses in Agricultural Engineering in IT (AgEn)

The following courses, offered by the Institute of Technology, are open to students in the four-year engineering curriculum and those who have completed the prerequisite courses.

1060f.s. AGRICULTURAL ENGINEERING ORIENTATION. (1 cr; S-N only; 2 hrs per wk)

Introduction to agricultural engineering practice through lectures, readings, discussions, and presentations by practicing engineers. Discussion of safety, ethics, and professionalism in engineering. Identification of opportunities in the profession.

3031s. COMPUTATIONS IN AGRICULTURAL ENGINEERING. (4 cr; prereq IT student, computer programming, Math 3261 or ¶Math 3261; 3 lect, 2 rec hrs per wk)

Computational techniques applied to agricultural engineering problems: spreadsheets, elementary numerical methods, computer drafting, engineering economics, selected engineering software. Effective presentation of quantitative and graphical information.

3052f. ENGINEERING PRINCIPLES OF SOIL-WATER-PLANT SYSTEMS. (4 cr; prereq IT student, some biology background, AEM 3016 or concurrent regis; 3 lect, 3 lab hrs per wk)

Mechanical and hydraulic properties of soil; moisture relations; strength parameters for structural and mechanical design. Soil-machine action in tillage and traction. Energy and water balance in the soil-water-plant system. Plant structure and growth. Engineering and management requirements.

3970f.w.s. DIRECTED STUDIES IN AGRICULTURAL ENGINEERING. (Cr ar; prereq #)

Independent study of topic(s) involving physical principles as applied to agricultural production and land resources.

5050f.w.s. INTERN REPORTS. (2 cr per qtr; prereq IT student, #)

Student exposure to engineering practice through an intern program. Engineering reports on work assignments are reviewed by faculty and coordinated with industry advisers.

5070s. AUTOMATIC CONTROL AND INSTRUMENTATION. (4 cr; prereq upper div IT or forest products major or grad, CE 3400 or equiv; 3 lect, 2 lab hrs per wk)

Control of machines and processes. Linear feedback control. Linking of physical and biological control systems. Instrumentation for control systems and industrial development studies.

5072s. FINITE ELEMENT METHOD: FUNDAMENTALS AND APPLICATIONS. (4 cr; prereq upper div IT or grad IT major, differential equations and sr status or #; 4 lect hrs per wk)

Basic theory and principles of implementation of the finite element method for a number of fundamental engineering areas. Applications in heat transfer, fluid mechanics, solid mechanics, radial and axisymmetric field problems, and time-dependent field problems.

5074f. MICROCOMPUTER INTERFACING. (4 cr; prereq upper div IT or grad IT major, AgET 3030 or CSci 3101 or CSci 3102; 2 lect, 4 lab hrs per wk)

Introduction to digital components, integrated circuits and microcomputers. Interfacing of microcomputers for data acquisition and control.

5140w. THERMAL PROCESSES FOR FOOD. (4 cr; prereq upper div IT or grad IT major, heat transfer; 3 lect, 3 lab hrs per wk)

Engineering principles of thermal processing of food, pasteurization, microwave heating, heat exchange, evaporation, refrigeration and freezing. Process design and evaluation.

5150s. BIOLOGICAL PROCESS ENGINEERING. (4 cr; prereq BioC 3021 or Biol 5001, #; 4 lect hrs per wk)

Reaction kinetics of hydrolysis of hemicellulose, cellulose, and starch to fermentable sugars. Fundamentals of fermentation and separation of alcohols, organic acids, insecticides, and biodegradable plastics.

5191-5192f.w.s. SPECIAL PROBLEMS IN AGRICULTURAL ENGINEERING. (2-5 cr per qtr; prereq #)

Individual study project at an advanced level involving application of engineering principles to a specific problem.

5350f. AGRICULTURAL MACHINERY AND TERRAMECHANICS. (4 cr; prereq upper div IT or grad IT major, AEM 3016, AEM 3036; 3 lect, 3 lab hrs per wk)

Engineering principles governing the performance of machinery used in agriculture. Emphasis on soil-machine interaction (traction and tillage), off-road vehicle dynamics, operator-machine interaction, drive-line design, power unit selection, and duty cycle analysis.

5540f. WATERSHED ENGINEERING. (4 cr; prereq upper div IT or grad IT major, 3052 or CE 3300, CE 3400; 3 lect, 3 lab hrs per wk)

Application of engineering principles to the management of surface runoff and soil water in agricultural, range and urban lands. Designing facilities for control of surface runoff to mitigate problems of flooding and degradation of surface water quality.

5550w. WATER MANAGEMENT ENGINEERING. (4 cr; prereq upper div IT or grad IT major, 3052 or CE 3300, CE 3400; 3 lect, 3 lab hrs per wk)

Application of engineering principles to the management of water for production and environmental protection in agricultural systems. Design of facilities to irrigate and drain croplands and to enhance water quality.

5560w. MECHANICS OF FLOW IN THE UNSATURATED ZONE. (4 cr; prereq upper div IT or grad IT or COA grad student, Math 3261, Soil 5232 or #; 2 lect hrs per wk)

Fluid retention and transmission properties of unsaturated porous media. Equations of mass conservation and Darcy's law for unsaturated porous media. Simultaneous flow of immiscible fluids. Analytical, finite difference and finite element solutions to the governing equations.

5745f. VENTILATING SYSTEMS FOR INDOOR AIR QUALITY. (4 cr; prereq upper div IT or grad IT major, ME 3301, CE 3400 or AEM 3200; 4 lect hrs per wk)

Impact of indoor air quality on humans, animals, and plants. Contaminant sources. Ventilating processes, systems, control strategies, and equipment for indoor air quality control. Case studies from residential, commercial and agricultural systems.

5751f. BIOCHEMICAL ENGINEERING I. (3 cr, §ChEn 5751; prereq AgEng major or grad student or ChEn major or #; 3 lect hrs per wk)

Applications of material and energy balances and concepts from thermodynamics, kinetics, and transport phenomena to cellular and enzyme systems.

5891f. SENIOR DESIGN I. (1 cr; prereq upper div IT, sr status or #; 5891-5892†; 2 rec hrs per wk)

Introduction to design concepts. Case studies involving engineering design. Development of proposal for a senior design project (individual or group) to be completed in 5892. Oral presentation of written proposal.

5892w. SENIOR DESIGN II. (4 cr; prereq 5891; 5891-5892†; 6 rec hrs per wk)

Completion of design project started in 5891 culminating in a comprehensive design report and oral presentation of the final design.

5910w. AGRICULTURAL WASTE MANAGEMENT ENGINEERING. (4 cr; prereq upper div IT or grad IT major, 3052, Chem 1005, CE 3400; 3 lect, 3 lab hrs per wk)

Sources and characteristics of agricultural wastes including livestock, food processing, and domestic wastes. Physical, biological, chemical, rheological, and microbiological properties. Effects on the environment. Collection, storage, treatment (aerobic and anaerobic), and use/disposal. Land application of livestock and food processing wastes, municipal effluents, and sludges. On-site sewage treatment.

For Graduate Students Only

(For descriptions, see *Graduate School Bulletin*)

8000. SUPERVISED TEACHING EXPERIENCE

8100. SEMINAR

8190, 8191, 8192. ADVANCED PROBLEMS AND RESEARCH

8500. HYDROLOGIC MODELING—SMALL WATERSHEDS

8700. MOISTURE AND HEAT TRANSFER

Agricultural Industries and Marketing (AIM)

1001f. ORIENTATION: AGRICULTURAL INDUSTRIES AND MARKETING. (1 cr)

Review of AIM curriculum, areas of emphasis; introduction to the agricultural industries that provide inputs or handle outputs of farming; illustration of agribusiness marketing activities; sales, promotion, market analysis, etc.

5001f. MARKETING PRACTICUM I. (2 cr)

Multidisciplinary lecture/seminar involving development of a marketing plan for an agricultural input or product. Includes market definition and feasibility analysis, business proposition, action plan, financial evaluation, and monitoring and measurement strategies.

5002w. MARKETING PRACTICUM II. (2 cr; prereq AIM 5001)

Multidisciplinary lecture/seminar involving development of a marketing plan for an agricultural input or product. Includes planning and development of promotion and advertising materials, critique of marketing plan, and presentation of completed marketing plan.

Agronomy and Plant Genetics (Agro)

1007. BIOLOGY OF PLANT FOOD SYSTEMS AND THE ENVIRONMENT. (4 cr)

Biological principles and processes are learned in the context of food production systems and the environment. Basic elements of biology, whole plant and animal systems, and plants and animals in ecosystems. Lecture and lab.

1010. PRINCIPLES OF AGRONOMY. (5 cr; §3010, §3020, §3030)

Principles and practices of plant and related sciences as they apply to increasing efficiency, productivity, and genetic improvement of field crops. Topics include crop selection, improvement of crops through plant breeding, seeds and seeding, growth and development, minimizing production hazards, harvesting and storage. Lecture and lab.

1020. SPECIAL PROBLEMS. (1-3 cr; prereq 5 cr agro, #)

In-depth research or studies in agronomy. Intended for students who wish to pursue aspects of agronomy in greater depth than that offered in formal courses or who wish to investigate areas not presently offered in courses. Tutorial instruction under staff guidance.

3020. GROWTH AND DEVELOPMENT OF FIELD CROPS. (4 cr; prereq Agro 1007 or Biol 1009, Chem 1002, 1051 or equiv)

Principles of growth and development of field crops to achieve maximum crop productivity. Emphasis on physiological basis of growth and development, and effects of physical and biological environmental factors on crop growth and development. Lecture and lab.

3030. HARVEST, STORAGE AND UTILIZATION OF FIELD CROPS. (4 cr; prereq Agro 1007 or Biol 1009, Chem 1002 or 1051 or equiv)

Crop quality traits associated with use as they influence crop harvest, processing, and storage. Principles and technology used in crop storage to minimize damage from fungi and insects and maximize crop quality. Lecture and lab.

3060. FIELD PLOT DESIGN IN AGRONOMY. (4 cr; prereq jr)

Principles of field plot technique and design as applied to field demonstrations and experiments involving one or two variables. Experiment interpretation procedures including analysis of data, tests of significance, and treatment comparisons. Computers are used for some data processing and statistical procedures.

3120. GRAIN GRADING AND UTILIZATION. (2 cr; §AgEc 3420 recommended)

Practice and principles of grain grading; factors influencing U.S. grain grades and their importance in affecting market value and subsequent use. Lecture and lab.

3130. SEED TECHNOLOGY. (2 cr; prereq 1010)

Principles and practices of seed analysis, seed handling, conditioning and viability testing.

3150. ADVANCED SEED AND GRAIN EVALUATION. (4 cr; 3120 recommended)

Lab practice in identification of crops, weeds, and diseases and in grain grading and seed analysis. Members of the Intercollegiate Crops Team are selected from this class.

3200. SEMINAR. (1 cr; prereq jr or sr, #)

Investigation through literature review and group discussion of selected topics in agronomy. Emphasis on recent advances in agronomy.

5000. PROFESSIONAL EXPERIENCE PROGRAM. (4 cr; prereq #; not for grad cr; S-N only; CEE only)

Supervised practical professional experience in agronomic industries and farm enterprise systems, together with studies of various aspects of the industry and related fields.

5001. PROBLEMS IN AGRONOMY FOR ADVANCED STUDENTS. (1-5 cr; prereq 20 cr agro, #)

In-depth research or studies in agronomy. Intended for advanced students who wish to pursue aspects of agronomy in greater depth than that offered in formal courses or who wish to investigate areas not presently offered in courses. Independent study and research under staff guidance.

5010. FORAGE PRODUCTION AND UTILIZATION. (3 cr; prereq 1010 or #; offered 1995 only)

Interrelationships between plants and animals as they are involved in the selection, production, and use of forage crops. Crop management practices including establishment, maintenance, and harvesting of forages such as pasture, hay, or silage. Physiological basis of forage management of various species. Forage quality and use for livestock feeding with emphasis on ruminant nutrition. Lecture.

5020. INTRODUCTION TO PLANT BREEDING. (4 cr; prereq GCB 3022, Hort 3003 or equiv)

Applying genetic principles to improve crop plants. Includes self-pollinated, cross-pollinated, and asexually propagated crops. Lecture. Discussion for graduate students only.

5030. WEED CONTROL. (5 cr; prereq 1010 or #; 3020 or PBio 3131 recommended)

Survey of the magnitude of the weed problem. Regulatory aspects of weed control and herbicide usage. Principles and methods of weed control. Lecture and discussion.

5040. CORN AND SOYBEAN MANAGEMENT. (3 cr; prereq 3010, 3020, 3030, Soil 1020 or #)

Discussion and case-study approach to corn and soybean management in Minnesota, based on an integration of agronomic principles. Offered Fall 1994 only.

5050. MANAGEMENT TECHNOLOGIES FOR CROP PRODUCTION IN MINNESOTA. (4 cr; prereq one Agro course; starting 1995)

Appropriate solutions to crop management problems, emphasizing corn/soybean, small grains, and forage crop systems. Quality, productivity, and profitability emphasized in discussion, lectures, and reading.

5070. ECOLOGY OF FIELD CROPS. (3 cr; prereq 3010, 3020, 3030 or #)

Concepts and approaches to crop community interactions, field conditions, density relationships, plant competition, growth analysis, allelopathy, multiple cropping, weed crop interactions, crop rotations, crop diversity, canopy architecture, and whole-system productivity. Lecture and discussion.

5080. FIELD CROP SCOUTING AND PROBLEM DIAGNOSIS. (2 cr; prereq 3020, Ent 1005, PIPa 3001, Soil 3416 or #)

A field-based problem solving, diagnosis, skill and knowledge development course. Will be taught off-campus in a concentrated 2.5-day workshop on specific problems associated with Minnesota crops. Intended for crop protection specialists, crop advisors, agriculture and extension educators.

5120. GROWTH AND DEVELOPMENT OF FIELD CROPS. (4 cr, §3020; prereq 1007 or Biol 1009, Chem 1002, 1051 or equiv)

Principles of growth and development of field crops to achieve maximum crop productivity. Emphasis on physiological basis of growth and development, and effects of physical and biological environmental factors on crop growth, development. Lecture, lab, and discussion.

5130. HARVEST, STORAGE AND UTILIZATION OF FIELD CROPS. (4 cr, §3030; prereq 1007 or Biol 1009, Chem 1002, 1051 or equiv)

Crop quality traits associated with use as they influence crop harvest, processing, and storage. Principles and technology used in crop storage to minimize damage from fungi and insects and maximize crop quality. Lecture, lab and discussion.

5200. WORLD FOOD PROBLEMS. (3 cr, §AgEc 5790, §CAPS 5280, §FScN 5643; prereq sr or grad with #)

Multidisciplinary approach to the social, economic, and technical problems of feeding the world's growing population. Principles sought from the social and economic sciences and plant, animal, and food sciences for their application to world food problems.

5310. ORIENTATION TO FIELD CROP BREEDING. (1 cr; prereq 5020 or #)

Field study of plant breeding programs and techniques.

5320. ORIENTATION TO AGRONOMY AND SOILS FIELD RESEARCH. (1 cr; prereq 5050 or equiv)

Field survey and discussion of research techniques in crop physiology, crop and soil management, and weed science programs in agronomy and soils.

5330. PLANT BIOTECHNIQUES. (2 cr; prereq 3xxx genetics and biochemistry courses)

Molecular and traditional biotechniques will be discussed by postdoctoral research associates in the Department of Agronomy and Plant Genetics to give a broader understanding of molecular and quantitative techniques in agricultural research.

Also see these courses taught by faculty from Agronomy and Plant Genetics: ANPL 3010, 5060; AIM 5001, 5002; NRES 3020, 5020.

For Graduate Students Only

(For descriptions, see *Graduate School Bulletin*)

8000. SUPERVISED TEACHING EXPERIENCE

8010. RESEARCH IN AGRONOMY

8020. SEMINAR: AGRONOMY

8030. MODE OF ACTION OF HERBICIDES

8050. PHYSIOLOGY OF FIELD CROPS

8070. COLLOQUIUM IN AGROECOLOGY

8080. CURRENT TOPICS IN AGRONOMY

8100. FORAGE RESEARCH TECHNIQUES AND TOPICS

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- Δ Registration Override Permit, completed and signed by the department offering the course, is required for registration.
- H Honors course (follows the course number).
- f,w,s,su Following a course number, indicates fall, winter, spring, or summer terms.
- x Course may require more than one quarter to complete.

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

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

A comma between course numbers (e.g., 1234, 1235, 1236) indicates a series of courses that may be entered any quarter. In prerequisite listings, comma means "and" (e.g., "prereq 1101, 1102 or 1103" means the prerequisites are 1101 and either 1102 or 1103).

A prerequisite course listed by number only (e.g., prereq 5248) is in the same department as the course being described.

- 8200. PLANT BREEDING PRINCIPLES AND METHODS I
- 8210. PLANT BREEDING PRINCIPLES AND METHODS II
- 8220. APPLICATION OF QUANTITATIVE GENETICS TO PLANT BREEDING
- 8230. CYTOGENETICS
- 8240. CELLULAR AND MOLECULAR GENETICS OF PLANT IMPROVEMENT
- 8250. ADVANCED PLANT GENETICS
- 8260. STATISTICAL TOPICS IN PLANT SCIENCES
- 8270. SEMINAR: PLANT BREEDING
- 8280. CURRENT TOPICS IN PLANT BREEDING
- 8330.* RESEARCH IN PLANT GENETICS

Animal and Plant Systems (AnPI)

- 1001. ORIENTATION TO ANIMAL AND PLANT SYSTEMS. (1 cr)
History and role of a land-grant college, maximizing your educational program, career planning, global aspects of agriculture, environmental and food quality concerns in agriculture.
- 3010. ENVIRONMENT AND WORLD FOOD PRODUCTION. (4 cr)
Ecological properties of world agricultural systems including issues of biodiversity, natural resource conservation, agricultural pollution, water quality, and waste management.
- 5060. INTEGRATED MANAGEMENT OF CROPPING SYSTEMS. (4 cr)
Case study/simulation and discussions considering integrated production management of selected agronomic and horticultural cropping systems. Emphasis on problem analysis, principle application, and decision making involving the integration of disciplines.

Animal Science (AnSc)

- 1100. INTRODUCTORY ANIMAL SCIENCE. (5 cr)
Emphasis on fundamental concepts of physiology, nutrition, animal breeding, and management as they apply to production of livestock and poultry. Species surveys.
- 1110. DAIRY CATTLE JUDGING. (2 cr; prereq #)
Evaluation of dairy animals on the basis of physical appearance, including classes of heifers and cows from the six major breeds. Visits to many herds in the area. Training in presentation of oral reasons.
- 1120. LIVESTOCK AND MEAT EVALUATION. (4 cr)
Evaluation, grading, and pricing of live meat animals, followed by evaluation of the conformation, quality, and finish of carcasses and cuts. Principles of judging and grading of meat.
- 1301. MANAGEMENT TECHNIQUE: SWINE. (1 cr; prereq #; S-N only)
Practical experience in management skills and routines in the care of swine.
- 1302. MANAGEMENT TECHNIQUE: SHEEP. (1 cr; prereq #; S-N only)
Practical experience in management skills and routines in the care of sheep.
- 1303. MANAGEMENT TECHNIQUE: BEEF. (1 cr; prereq #; S-N only)
Practical experience in management skills and routines in the care and production of beef cattle.
- 1304. MANAGEMENT TECHNIQUE: DAIRY. (1 cr; prereq #; S-N only)
Practical experience in management skills and routines in the care of dairy cattle and production of milk.
- 1305. MANAGEMENT TECHNIQUE: POULTRY. (1 cr; prereq #; S-N only)
Practical experience in management skills and routines in the care of poultry and the production of poultry meat and eggs.
- 1510. CONSUMER MEAT SCIENCE. (2 cr)
Compositional variation, processing, selection, storage, cookery, palatability, and nutritional value of red meat.
- 1520. MILK PRODUCTION. (3 cr; prereq 1100 or #)
Relationships of production and management concepts to dairy farm planning and production and marketing of high-quality milk.
- 3111. INTRODUCTION TO ANIMAL BEHAVIOR. (4 cr; prereq Biol 1008 or Biol 1009 or #)
Survey of the biological study of animal behavior including questions of causation, development, function, and evolution; emphasizes the evolution of adaptive behavior, especially social behavior, in the natural environment.
- 3113. ANIMAL WELFARE. (4 cr; prereq soph)
Socioeconomics of the use of other animals by humans. Assessment of animal suffering and welfare. Historical roots of attitudes toward other animals. Management practices and welfare of domestic and wild animals.
- 3120. ADVANCED MEAT ANIMAL, CARCASS EVALUATION. (1 cr; prereq 1120; 3130 or 3131, 3142, 3143 recommended)
Evaluation, grading, and pricing of live meat animals and carcasses; judging, placing, breeding animals using growth and reproduction records. Preparation for collegiate meat animal evaluation team competition.
- 3130. BEGINNING LIVESTOCK JUDGING. (2 cr; prereq soph or #; 1120 recommended)
Visual evaluation of beef cattle, swine, and sheep for type, muscling, degree of finish, structure, and soundness. Short oral presentations. For students with limited livestock judging experience; preparation for collegiate livestock judging team competition.
- 3131. LIVE ANIMAL PERFORMANCE AND SELECTION. (3 cr)
Meat animal performance and selection through the use of live animal, carcass, and record evaluation. Each class includes a one-hour lecture and a two-hour lab. Recommended for students planning vocations in meat animal production, extension, vocational agriculture, and agribusiness.
- 3141. ADVANCED DAIRY JUDGING. (1 cr; prereq 1110)
Evaluation and selection of dairy cattle. Visits to local dairy herds. Training in presentation of oral and written reasons. Students selected from this course participate in intercollegiate judging contests.
- 3142. ADVANCED LIVESTOCK JUDGING. (1 cr; prereq 1120, 3130)
Visual evaluation of beef cattle, swine, and sheep for type, muscling, finish, structure, and soundness. Use of production (growth and reproduction) records in evaluation. Oral presentations. For students with previous livestock judging experience; preparation for national collegiate livestock judging team competition.
- 3143. MEATS JUDGING AND GRADING. (2 cr; prereq 1120 or ¶1120)
In-depth training in beef, pork, and lamb judging, writing reasons, and carcass grading. Field trips to packing plants. Students selected from this course participate in Intercollegiate Meats Judging Contests.
- 3144. WOOL EVALUATION. (2 cr)
Principles of classification and grading. Active learning with practical experience to determine fiber diameter, yield, and economic value of fleeces. Evaluation and judging of fleece classes. Preparation for collegiate wool judging team competition.
- 3220. PRINCIPLES OF ANIMAL BREEDING. (5 cr; GCB 3022 recommended)
Application of qualitative genetic principles to animal breeding. Quantitative genetics. Concepts of livestock improvements through breeding and selection systems.
- 3301. SYSTEMIC PHYSIOLOGY. (6 cr; prereq Biol 1009; BioC 3021 recommended)
Animal physiology, emphasizing the function of the organ systems.
- 3305. REPRODUCTIVE PHYSIOLOGY, ARTIFICIAL INSEMINATION, AND LACTATION. (5 cr; prereq 3301)
Functions of the reproductive organs, fertilization, the estrous cycle and its endocrine control, reproductive efficiency, and problems and principles of artificial insemination. Anatomy, physiology, and biochemistry of the mammary gland. Mammary growth, initiation and maintenance of lactation, milk synthesis, and factors influencing the lactation curve.
- 3401. PRINCIPLES OF ANIMAL NUTRITION. (4 cr; prereq Chem 1002 or Chem 3301)
Classification and function of nutrients; use of nutrients for body maintenance, growth, egg production, gestation, and lactation; comparative study of the digestive systems of farm animal species.
- 3510. INTRODUCTION TO HUMAN AND ANIMAL GROWTH AND DEVELOPMENT. (4 cr; prereq 3301, Biol 1009)
Basic principles of human and animal growth; critical evaluation of interaction of nutrition, hormones, exercise, heredity, and disease in regulating growth.
- 5000. PROFESSIONAL EXPERIENCE PROGRAM. (4 cr; prereq #; S-N only; free elective for animal science undergrads; not for grad cr; CEE only)
Professional experience in animal science firms or government agencies through supervised practical experience; evaluative reports and consultations with faculty advisers and employers.

5231. DAIRY CATTLE BREEDING. (4 cr; prereq 3220 or #)

Applying quantitative genetic principles to the breeding of dairy cattle. Primary emphasis on evaluation of males, females, and systems of breeding. Rates of genetic improvement with and without artificial insemination.

5280. LIVESTOCK ENTOMOLOGY. (3 cr, §Ent 5280)

Biology and management of arthropods that are directly and indirectly significant to livestock health and animal production systems. Emphasis on regional and national problems.

5322. PHYSIOLOGY OF REPRODUCTION. (5 cr; prereq 6 cr systemic physiology)

Principles of reproductive physiology with emphasis on endocrinological aspects.

5327. GENERAL ENDOCRINE PHYSIOLOGY. (3 cr; prereq 3301 or #)

Biological effects, biochemistry, methods of assay, and regulatory aspects of hormones.

5328. GENERAL ENDOCRINE PHYSIOLOGY LABORATORY.

(2 cr; prereq 5327 or #)

Demonstration of concepts in endocrinology using experimental approaches.

5330. CURRENT TOPICS IN ENDOCRINOLOGY. (1 cr; prereq 3301, BioC 3021 or Biol 5001)

Current developments in endocrinology including introductory and review material, methodology, applicability of results to basic and applied research, and impact on existing endocrine principles.

5401. SWINE NUTRITION AND FEEDING. (4 cr; prereq 3401)

Nutrient requirements of swine, all phases of life cycle considered; feed sources, their composition and use in formulation of adequate diets. Least cost formulations, nutritional interrelationships, and feeding systems. Use of feed additives.

5403. RUMINANT NUTRITION. (4 cr; prereq 3401)

Nutrient requirements of ruminants (beef and dairy cattle, sheep); nutrient content of feedstuffs, primarily forages; protein and nonprotein nitrogen use; energy use; nutritional disorders; and formulation of adequate rations.

5404. APPLIED ANIMAL NUTRITION. (2 cr; prereq CAPS 5165)

Applying nutrition principles to feeding programs for livestock, poultry, and small animals. For veterinary students without previous nutrition courses.

5405. POULTRY NUTRITION. (3 cr; prereq 3401)

Nutrient requirements of chickens and turkeys; feed composition and use in formulation of adequate diets. Role of feed additives. Least cost formulations, nutritional interrelationships, and feeding systems.

5601. SWINE PRODUCTION. (4 cr; prereq 3401; 3220 recommended)

Applying principles of animal breeding, nutrition, physiology, and economics. Swine production systems including swine feeding, breeding programs, selection of breeding animals, management of all classes of swine, housing, diseases, parasites.

5602. SHEEP PRODUCTION. (4 cr; prereq 3401 or #; 3220, 5403 recommended)

Status and characteristics of the sheep industry; applying principles of animal breeding, nutrition, physiology, and economics to management of sheep flocks. Sheep production systems including breeding programs, selection of breeds and breeding animals, feeding, health programs, dairy sheep, marketing and budgets.

5603. BEEF CATTLE PRODUCTION. (4 cr; prereq 3401; 3220, 5403 recommended)

Status and characteristics of the beef cattle industry; applying principles of animal breeding, nutrition, physiology, and economics to management of beef cattle breeding herds. Ration formulation, management, and marketing of feedlot cattle.

5604. DAIRY FARM MANAGEMENT. (4 cr; prereq 1520, 5403 or #; 3220 recommended)

Applying principles of animal breeding, nutrition, physiology, and economics to planning and management of the dairy farm; genetic influences, housing requirements, health programs for large herds, feed budgets, and record analysis emphasized.

5605. POULTRY PRODUCTION. (4 cr; prereq 3401; 5405 recommended)

Physiology, genetics, diseases, and nutrition of poultry and their relation to current management practices for production of eggs, broilers, and turkeys. Technical and practical phases of production and marketing in relation to their underlying principles. Visits to commercial production units.

5609. PRINCIPLES OF FARM ANIMAL ENVIRONMENT.

(4 cr; prereq jr, 3301 or #)

Biological and physical processes involved in the adjustment of animals to ambient environments and their applications to farm animal management.

5710. SPECIAL PROBLEMS. (Cr ar; prereq #)

Research in an area of animal science under supervision of a staff member. Written report on the research required.

5715. TUTORIAL. (Cr ar; prereq #)

Informally structured course to encourage study in depth of a specific discipline in animal science. Pertinent readings, centered on fundamental propositions suggested; preparation of written essays of high quality required. Tutorials available in cryobiology, cytogenetics, genetics, meats, nutrition, and physiology.

For Graduate Students Only

(For descriptions, see *Graduate School Bulletin*)

8220. * ADVANCED ANIMAL BREEDING

8221. * QUANTITATIVE INHERITANCE

8325. PHYSIOLOGY OF FERTILIZATION AND GESTATION

8326. IMMUNOREPRODUCTION

8332. PRESERVATION OF SPERMATOZOA AND EMBRYO

8335. MOLECULAR BIOLOGY TECHNIQUES IN ANIMAL SCIENCE

8420. * ANIMAL BIOENERGETICS AND NUTRITIONAL PHYSIOLOGY

8421. * PROTEIN AND AMINO ACID NUTRITION

8440. * RUMINANT NUTRITION

8441. RESEARCH TECHNIQUES IN RUMINANT NUTRITION

8603. GRADUATE SEMINAR

8740. CONCEPTS AND DEVELOPMENTS IN RUMINANT NUTRITION

8741. CONCEPTS AND DEVELOPMENTS IN AVIAN NUTRITION

8742. CONCEPTS AND DEVELOPMENTS IN SWINE NUTRITION

8750x. CONCEPTS AND DEVELOPMENTS IN MEAT SCIENCE AND TECHNOLOGY

8810x. * RESEARCH IN ANIMAL SCIENCE

8820x. * RESEARCH IN ANIMAL GENETICS

8830x. RESEARCH IN ANIMAL PHYSIOLOGY

8840x. * RESEARCH IN ANIMAL NUTRITION

8850x. * RESEARCH IN MUSCLE CHEMISTRY AND PHYSIOLOGY

Clinical and Population Sciences (CAPS)

Offered by the College of Veterinary Medicine

3502. ANIMAL HEALTH AND DISEASE. (5 cr)

For nonveterinary students. Veterinary science as it applies to health and disease of domestic animals. Emphasis on basic concepts of disease and common animal diseases that demonstrate these concepts. How stress and management practices aggravate and create new disease conditions.

5280. WORLD FOOD PROBLEMS. (3 cr, §AgEc 5790, §Agro 5200, §FScN 5643; prereq major in ag or vet med or nutr sci or social sci field or #; grads by #)

Multidisciplinary approach to the social, economic, and technical problems of feeding the world's growing population. Principles sought from the social, economic, plant, animal, and nutritional sciences for their application to food problems.

5650. VETERINARY EPIDEMIOLOGY AND STATISTICS. (4 cr; prereq 10 cr biol, 12 cr chem or #)

Principles of epidemiology, ecology, and veterinary public health. Biostatistics applied to the measurement of health and disease in populations.

Entomology (Ent)

1005f. ECONOMIC ENTOMOLOGY. (4 cr; prereq Biol 1009 or #)

Structure and classification of insects; management of insect populations; life histories, habits, and recognition of insect pests of livestock, orchards, field crops, vegetables, and ornamentals.

3005. INSECT BIOLOGY. (3 cr; prereq Biol 1009 or equiv)

Biodiversity and natural history of insects; functional roles in natural and managed environment; effects of insects on human history and approaches to managing problems caused by insects.

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- § Credit will not be granted if credit has been received for the course listed after this symbol.
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- Δ Registration Override Permit, completed and signed by the department offering the course, is required for registration.
- H Honors course (follows the course number).
- f,w,s,su Following a course number, indicates fall, winter, spring, or summer terms.
- x Course may require more than one quarter to complete.

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

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

A comma between course numbers (e.g., 1234, 1235, 1236) indicates a series of courses that may be entered any quarter. In prerequisite listings, comma means "and" (e.g., "prereq 1101, 1102 or 1103" means the prerequisites are 1101 and either 1102 or 1103).

A prerequisite course listed by number only (e.g., prereq 5246) is in the same department as the course being described.

3020s. PRINCIPLES OF BEEKEEPING. (4 cr; prereq Biol 1009 or #)

Lecture and lab demonstrations. History of beekeeping; life history and behavior of honey bees; colony and apiary management; pollination and hive products; honey bee diseases and their control.

3200s. SOCIAL INSECTS. (4 cr; prereq college-level general bio course)

Termites, ants, social wasps, and social bees. Natural history, caste determination and regulation, group effects and control of nestmates, communication and pheromones, the superorganism concept, and the evolution of sociality.

5000f,w,s. PROFESSIONAL EXPERIENCE PROGRAM.

(4 cr; prereq #; S-N only; free elective for ag undergrads; not for grad cr; CEE only)

Professional experience in entomology firms or government agencies through supervised practical experience; evaluative reports and consultations with faculty advisers and employers.

5010f. INSECT MORPHOLOGY. (5 cr; prereq 3005 or #; offered 1995 and alt yrs)

Comparative study of insect structure within an evolutionary and phylogenetic perspective.

5020f. INSECT TAXONOMY. (5 cr; prereq 3005 or equiv)

Identification of adult insects to family; evolution and classification of insects; techniques of collecting and curating insects; principles of phylogeny reconstruction.

5030w. INSECT PHYSIOLOGY. (3 cr; prereq #; BioC 5001, 5002 or MdBc 5100 recommended)

Essential processes of insects. Nerve and muscle mechanisms, energy metabolism, respiration, nutrition and digestion, excretion, regulation and interactions of processes, sensory mechanisms, and behavior. Reproductive behavior, embryology, and postembryonic development of insects.

5040f. INSECT ECOLOGY. (4 cr; prereq Biol 5041 or EBB 5122 or #)

Synthetic analysis of the causes of insect diversity and of fluctuations in insect abundance. Focus on abiotic, biotic, and evolutionary mechanisms influencing insect populations and communities.

5210w. INSECT PEST MANAGEMENT. (4 cr; prereq 1005 or #)

Management of insect, mite, and weed populations through integration of various methods and techniques (including biotic agents, host plant resistance, artificial measures, and cultural practices) as harmonious systems that, in the context of the associated environment and population dynamics, maintain subeconomic pest densities.

5215s. INSECTS IN RELATION TO PLANT DISEASES.

(3 cr; prereq 5 cr ent, 5 cr plant path or equiv or #; offered 1995 and alt yrs; same as PIPa 5215)

Insect transmission and dissemination of plant pathogens; development of plant-insect relationships and habits of principal insect vectors.

5250s. FOREST AND SHADE TREE ENTOMOLOGY. (4 cr;

prereq any two courses among the forestry, zoological, botanical, biological, or agricultural sciences)

Lectures and lab concerning ecology and population management of forest and shade tree insects, with heavy emphasis on tree factors and integrated control.

5275f. MEDICAL ENTOMOLOGY. (3 cr; prereq 3005 or #; offered 1996 and alt yrs)

Biology of arthropod vectors of human disease. Emphasis on disease transmission and host, vector, and pathogen interactions.

5280w. LIVESTOCK ENTOMOLOGY. (4 cr, §AnSc 5280)

Biology and management of insects, mites, and ticks that affect domestic livestock and pets.

5310w. SAMPLING BIOLOGICAL POPULATIONS. (4 cr; prereq Stat 5021 or equiv; offered 1995 and alt yrs)

Design of sampling plans for studying field and lab populations of living organisms. Sampling distributions and techniques for detecting and coping with aggregation. Randomization, required sample size, and optimal resource allocation within alternative sampling designs.

5320f. ECOLOGY OF AGRICULTURE. (4 cr, one 3xxx + level course in agro or hort or an sci, one 3xxx + level course in ent or plant path or soil or #)

Ecological perspective on post-industrial agriculture; origins of agriculture, social functions, and ecology of contemporary and extinct agricultural systems. Soils, plant development, pest ecology, forage quality, animal production, and food quality as an interactive network of factors.

5340. BIOLOGICAL CONTROL OF INSECTS. (2 cr; prereq 5210, intro ent, course in ecol)

Principles of biological control: history, ecological basis, classical biological control, augmentation, analysis of selected projects.

5350f. INSECT PATHOLOGY. (3 cr; prereq 5030; offered 1995 and alt yrs)

Survey of the major pathogenic microorganisms that cause diseases in insects; routes of infection of insects; lab propagation of disease agents; factors involved in application of disease to control of pest insects with safety considerations.

5360s. AQUATIC ENTOMOLOGY. (3 cr; prereq 3005 or equiv or #; offered 1996 and alt yrs at Itasca)

Taxonomy and natural history of aquatic insects, including their importance in aquatic ecology, water resource management, recreation, and conservation. Emphasis on family level identification. Field trips scheduled to local aquatic habitats. A collection is required.

5370s. PRINCIPLES OF SYSTEMATICS. (3 cr; prereq 3005 or equiv, E020; offered 1996 and alt yrs)

Theoretical and practical procedures of systematic entomology, including phylogeny reconstruction, classification, systematic literature, zoological nomenclature, and presentation of results of systematic research.

5480w. INVERTEBRATE NEUROBIOLOGY. (2 cr, §NSc 5480)

Fundamental principles and concepts underlying cellular bases of behavior and "systems" neuroscience. Particular invertebrate preparations discussed.

5900f,s. BASIC ENTOMOLOGY. (Cr ar; prereq #)

Opportunity to make up certain deficiencies in biological background.

5910f,w,s. SPECIAL PROBLEMS IN ENTOMOLOGY. (Cr ar; prereq #)

Individual field, lab, or library studies in various aspects of entomology.

5920f,w,s. SPECIAL LECTURES IN ENTOMOLOGY. (Cr ar; offered when feasible)

Lectures or lab in special fields of entomological research given by a visiting scholar or regular staff member.

For Graduate Students Only

(For descriptions, see *Graduate School Bulletin*)

8040. ADVANCED INSECT GENETICS

8050s. TOXICOLOGY

8200. COLLOQUIUM IN APICULTURE

8230f. COLLOQUIUM IN INSECT PHYSIOLOGY

8240f,w,s. COLLOQUIUM IN INSECT ECOLOGY

8300f,w,s. GRADUATE SEMINAR

8500f,w,s.* RESEARCH IN ENTOMOLOGY

Environmental Science (ES)

1001. ORIENTATION TO ENVIRONMENTAL SCIENCE. (1 cr)

Students explore the environmental science major through discussions of current events, faculty research, alumni reports and portfolio preparation.

1050. INTRODUCTORY ENVIRONMENTAL SCIENCE. (4 cr)

Ecology and current environmental issues, including air and water pollution, human population growth, toxic and hazardous wastes, urbanization, land use, biological diversity, energy, environmental health, conservation history, attitudes towards nature, environmental politics, and ethics.

3050. FIELD OR WORK EXPERIENCE IN ENVIRONMENTAL SCIENCE. (1-4 cr)

Students are required to obtain internship forms prior to registering. A written and oral report on the student's internship is required. For 1 credit, the written report is 4-8 pages. Additional credits require a more in-depth report.

Food Science and Nutrition (FScN)

1020. INTRODUCTORY MICROBIOLOGY. (4 cr; prereq 3rd-qr fr or #; especially for home ec students)

Fundamental principles of microbiology. Characteristics of bacteria, yeasts, molds, and other microorganisms; their importance in the preparation and preservation of foods, and their relation to the health and well-being of the individual and the family.

1102. TECHNOLOGY OF FOOD PROCESSING. (4 cr; prereq high school biol, high school chem)

The technology of processing foods with special reference to the prevention of biological, microbiological, physical, and chemical deterioration. Changes in food composition; microbiological safety; food laws and regulations; technologies of major food processes such as canning, freezing, and drying.

1612. PRINCIPLES OF NUTRITION. (4 cr; prereq high school biol, high school chem)

Fundamental concepts: human nutritional requirements, the function of nutrients, and nature of deficiencies. Vegetarianism, weight loss, fad diets, activity, obesity, cancer, heart disease, food processing, safety, and world food problems.

3102. INTRODUCTION TO FOOD SCIENCE. (4 cr; prereq Chem 1002 or 1052)

Composition and chemical and physical properties of foods; interaction, reaction, and evaluation of foods due to formulation, processing, and preparation.

3112. FOOD ANALYSIS. (4 cr; prereq 3102)

Application of analytical techniques in the analysis of food composition (proximate, mineral, vitamins, and food contamination). Physical methods of analysis.

3135. FOOD PROCESSING I. (4 cr; prereq 1102, 3102, Math 1031)

Qualitative and quantitative discussion of principles of product movement and modification used in food processing. Operations needed for proper functioning of a food processing facility such as pumping, homogenization, membrane separations, milling, and dry blending.

3136. FOOD PROCESSING II. (4 cr; prereq 3135)

Discussion of major food processing operations including heating and cooling, evaporation, drying, and process automation, from the perspective of the introduction and principles of equipment and quantitative base for operations.

3400. FOOD COMMUNICATION TECHNIQUES. (3 cr; prereq 3102)

Communication of information about food products (from proposal to marketing strategy) or recipes (from proposal to cookbook page). Individual and team oral and written presentations; demonstrations, food photography.

3472. FOOD SELECTION PRINCIPLES. (4 cr; prereq 4 cr food sci and nutr)

Consumer trends and food selection. Food distribution system. Food selection principles. Information used when making and evaluating food selection decisions. Use of computer-based nutrient calculation systems.

3610. COMMUNITY NUTRITION. (3 cr; prereq 1612 or equiv, 5 cr anth or psych or soc)

Goals of community food and nutrition programs including national, international, public and private programs; an overview of cultural food patterns; and the management of (assessing needs, planning, implementation, and evaluating) food and nutrition programs for groups of people.

3612. BIOLOGICAL ASPECTS OF NUTRITION. (4 cr; prereq 1612, Chem 3302 or equiv)

Biological aspects: influence of biological changes throughout the life cycle on nutrient requirements, needs as affected by exercise, digestion and absorption, energy and other nutrient balances, protein energy malnutrition, infection.

3662. INTRODUCTION TO THE CLINICAL PRACTICE OF DIETETICS. (2 cr; prereq 12 cr in food sci and nutr, regis in coordinated program in dietetics)

Introduction to the practice of dietetics in hospitals, outpatient clinics, public service agencies, and food services.

3703. FIELD EXPERIENCE IN FOOD SERVICE MANAGEMENT. (3-18 cr; prereq regis in coordinated program in dietetics or #)

Supervised food service production and management experience in a community or health care facility.

3730. QUANTITY FOOD PRODUCTION MANAGEMENT. (3 cr; prereq 3102, 3472)

Participation in the management procedures used in the selection, storage, preparation, pricing, and service of food in quantity. Quantity food service facilities used as laboratories. Field trips may be required.

3732. LECTURE IN QUANTITY FOOD PRODUCTION MANAGEMENT. (2 cr; prereq 3102, 3472)

Understanding of management procedures used in selection, storage, preparation, pricing, and service of food in quantity.

5000. PROFESSIONAL EXPERIENCE PROGRAM. (4 cr; prereq 15 cr in food sci and nutr, #; not for grad cr; CEE only)

Up to 12 weeks of planned experience in a selected position in the food industry; evaluative reports and consultations with faculty advisers and employers.

5100. GENERAL SEMINAR. (1 cr; A-F only; prereq sr or #)

Literature review and presentation of papers in selected areas of food science and nutrition.

5110. FOOD CHEMISTRY. (4 cr; prereq 3102, BioC 3021 or Biol 5001)

Study of chemical structures and functional properties of food components in relationship to their roles as parts of complex biochemical systems and as modified by various environmental and processing factors.

5111. INDEPENDENT STUDY IN FOOD SCIENCE AND NUTRITION. (1-5 cr [may be repeated for cr]; prereq Δ)

Individual lab or library research in some area related to food science or nutrition.

5120. FOOD MICROBIOLOGY. (5 cr; prereq 1102, 3112, VPB 3103 or MicB 5105 or #)

Relationship of environment to occurrence, growth, and survival of microorganisms in foods; methods of evaluation, mechanisms to control, genera and species of importance, control of food-borne pathogens and toxins. Enumeration, isolation, and identification of microbes in foods.

5122. CONTROL SYSTEMS IN FOOD MICROBIOLOGY. (2 cr; prereq 5120)

Control and destruction of microorganisms in foods; hazard analysis; critical control points for control of microbes; chemical, physical, and microbiological considerations in cleaning and sanitizing food contact surfaces and equipment; microbiological criteria for raw and processed foods; sampling methodologies.

5123. FOOD FERMENTATIONS AND BIOTECHNOLOGY. (3 cr; prereq 5120)

Food fermentation processes; characteristics of microorganisms involved in food fermentations and production of food ingredients; composition and factors influencing activity of starter culture; microbiology of natural and controlled fermentation; properties of lactic bacteriophages and methods of control during dairy fermentations.

5135. FOOD ENGINEERING UNIT OPERATIONS. (5 cr; prereq 1102 or 11102, Math 1142, Phys 1041-1046)

Principles and food system applications of these unit operations: fluid flow, heat transfer, drying, evaporation, contact equilibrium (distillation, extraction, crystallization, and membrane processes), and mechanical separation (filtration, centrifugation, sedimentation, and sieving).

5312. INSTRUMENTAL ANALYSIS OF FOODS. (3 cr; prereq 3112, 5110)

Applying instrumental methods of analysis to the examination of food products.

5314. PHYSICO-CHEMISTRY OF FOODS. (4 cr; prereq 5100)

Characterization of crystalline systems, gels, emulsions, and foams; functionality of food macromolecules in these systems.

5316. QUANTITATIVE LIGHT MICROSCOPY IN AGRICULTURE AND FOOD RESEARCH. (4 cr; prereq Biol 1009 or Chem 1052)

The light microscope and its variants. Description and applications of quantitative instruments for characterizing cell, tissue and other raw or processed materials. Includes digital image analysis, scanning microspectrophotometry and laser scanning microscopy.

5360. SENSORY EVALUATION OF FOOD QUALITY. (4 cr; prereq 3102, Stat 3012 or 5021)

Fundamentals of sensory perception. Test designs and methods used in studying sensory quality of foods.

5380. FOOD PACKAGING. (3 cr; prereq 1102, 3102 and Phys 1042)

Basics of packaging materials and the principles of packaging development and product protection as they apply to foods.

5390. INTRODUCTION TO FOOD LAW. (4 cr; prereq 1102 or #)

Federal and state legal requirements and case law history affecting production, processing, packaging, marketing, and distribution of food and food products.

5404. CURRENT ISSUES IN FOOD AND NUTRITION.

(2-4 cr; prereq 15 cr food sci and nutr or #)

Evaluation of popular and scientific literature dealing with nutrition, food additives, food safety, food fads, health foods, environmental contamination, the consumer movement, naturally occurring food toxicants, processed foods, synthetic foods, organically grown foods.

5462. ADVANCED TOPICS IN SENSORY EVALUATION OF FOOD. (2-4 cr; prereq 5360)

Review of current literature pertinent to specific topics under active investigation.

5474. FOOD MARKETING ECONOMICS. (4 cr, \$AgEc 5550; prereq AgEc 3001 or equiv)

Economics of food marketing in the United States. Food consumption trends; consumer food behavior; food expenditure and consumption data; consumer survey methodology; the food distribution and retailing system; food policy issues related to food marketing. Students pursue individual and group projects.

5512. MEAT TECHNOLOGY. (4 cr; prereq 5110)

Industrial processing of meat, fish, and poultry products, including protein functionality, thermal processing, curing, smoking, and deterioration during storage. Use of preblending and least-cost analysis in product development and formulation.

5522. TECHNOLOGY OF FLUID AND CONCENTRATED MILK PRODUCTS. (4 cr; prereq 3136, 5110)

Applying scientific principles to problems involved in processing fluid and dehydrated milk systems and their control. Demonstration of basic processing operations including heating, cooling, homogenization, evaporation, drying, crystallization, and freezing.

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A comma between course numbers (e.g., 1234, 1235, 1236) indicates a series of courses that may be entered any quarter. In prerequisite listings, comma means "and" (e.g., "prereq 1101, 1102 or 1103" means the prerequisites are 1101 and either 1102 or 1103).

A prerequisite course listed by number only (e.g., prereq 5246) is in the same department as the course being described.

5523. TECHNOLOGY OF FERMENTED DAIRY PRODUCTS.

(4 cr; prereq 5110, 5123)

Integration of chemical, microbiological, and physical principles involved in the manufacture and storage of cheeses and fermented milks.

5524. SENSORY EVALUATION OF DAIRY PRODUCTS.

(1 cr; prereq 3102)

Lab and commercial procedures for evaluating the sensory properties and market quality of dairy products. Cause and identification of common defects in flavor, physical properties, and appearance.

5530. INDUSTRIAL PROCESSING OF FRUITS AND VEGETABLES.

(4 cr; prereq 3136, 5110, 5120, 5135; 3 lect, 3 lab hrs per wk)

Relationship of chemical, physical, and microbiological principles to commercial processing of fruits and vegetables from procurement of raw products through preparation, preservation, packaging, storage, transportation, and merchandising. Emphasis on preservation methods involving heat sterilization, freezing, dehydration, and fermentation.

5540. FATS AND OILS CHEMISTRY AND TECHNOLOGY. (4 cr; prereq 5110)

Nature of fats and oils; their structure, composition, chemical and physical properties; raw materials for fat and oil products; extraction, refining, hydrogenation, and other industrial manipulations; handling, storage, analysis and grading of raw materials and finished products.

5550 GRAINS: INTRODUCTION TO CEREAL CHEMISTRY AND TECHNOLOGY. (4 cr; prereq Biol 1009 or Chem 1052)

Origins, structure, biochemistry and cellular properties of major cereal grains, as they relate to primary processing (milling), and secondary processing (production of cereal products). Relationship between structure and functionality as determinants of quality in grains and grain products. Quality evaluation technologies.

5555. FREEZING AND DEHYDRATION OF FOODS. (5 cr; prereq 1102, 5135)

Principles involved in the processing, handling, and storage of frozen, dry, and intermediate moisture food with emphasis on physicochemical properties of water in foods.

5562. FLAVOR TECHNOLOGY. (4 cr; prereq 1102, 5110)

Flavor and off-flavor development in foods. Industrial production of food flavorings and their proper application to food systems.

5600. NUTRITION SEMINAR. (1 cr; prereq #; CEE only)

Literature review and presentation of papers in selected areas of nutrition.

5612. EXPERIMENTAL NUTRITION. (2 cr; prereq 3612, ¶BioC 3021 or Biol 5001)

Lab experience in chemical and biochemical methods of analysis of nutritional status.

5620. NUTRITION AND METABOLISM. (3 cr; prereq 3612 or #, BioC 3021 or Biol 5001)

Physiological function and metabolic fate of carbohydrates, lipids, and proteins and their involvement in fulfilling energy needs for maintenance, growth, and work. Physiological function of vitamins and minerals.

5622. MACRO-NUTRIENT METABOLISM. (4 cr; prereq 3612, BioC 3021 or Biol 5001, Phsl 3051)

Physiological function and metabolic fate of carbohydrates, lipids, and proteins and their involvement in fulfilling energy needs for maintenance, growth, and work.

5623. VITAMIN AND MINERAL BIOCHEMISTRY. (4 cr; prereq 3612, BioC 3021 or Biol 5001, Phsl 3051)

Nutritional, biochemical, and physiological function of essential vitamins and minerals in humans and experimental and animal models.

5624. HUMAN PROTEIN AND ENERGY UTILIZATION.

(4 cr; prereq 5622, 5623)

Regulation of human protein and energy use, interactions, adaptations; critical evaluations of methods of determining requirements; technical and ethical problems in human experimentation, and determination of recommended levels of intake.

5642. FIELD EXPERIENCE IN COMMUNITY NUTRITION.

(3-18 cr; prereq at least one course in human nutr, #)

Application of nutrition information to problems of health and welfare; assigned readings, discussions, and experience in a community agency.

5643. WORLD FOOD PROBLEMS. (3 cr, \$AgEc 5790, \$Agro 5200, \$CAPS 5280, Soc 5675; prereq sr or grad; limited enrollment)

Multidisciplinary approach to the social, economic, and technical problems of feeding the world's growing population. Principles sought from the social, economic plant, animal, and food sciences for their application to world food problems.

5662. CURRENT ISSUES IN CLINICAL NUTRITION. (3 cr; prereq 5620, 5667)

Evaluation of current scientific research and literature related to clinical nutrition.

5664. FIELD EXPERIENCE IN CLINICAL NUTRITION.

(3-18 cr; prereq human nutr course, #)

Applying nutrition information to problems of health and disease; assigned readings, discussions, and experience in a clinical facility.

5665. APPLIED CLINICAL NUTRITION I. (3 cr; prereq BioC 3021 or Biol 5001, LaMP 5177 or 5177, Phsl 3051 or 1002)

Nutritional assessment and support; fluid and electrolyte balance; diet/drug interactions. Nutritional intervention in disorders of the gastrointestinal system and in cancer.

5666. APPLIED CLINICAL NUTRITION II. (3 cr; prereq 5665, 5662 or ¶5662)

(Continuation of 5665) Pathology, treatment, and nutritional therapy of diseases of cardiovascular and respiratory systems and common disorders of endocrine system, notably diabetes mellitus; nutrition intervention in obesity.

5667. APPLIED CLINICAL NUTRITION III. (3 cr; prereq 5666)

Pathology, treatment, and nutrition therapy for diseases of urinary tract, inborn errors of metabolism and allergies. Nutritional considerations in eating disorders, and neurological, muscular, and skeletal disorders. Special nutrition considerations in the care of pediatric patients.

5668. ADVANCED CLINICAL NUTRITION. (2 cr; prereq dietetic internshp status, 5662 or #)

Integrated approach to prevention and treatment of illness focusing on the role of nutrition in total medical care.

5693. SELECTED ASPECTS OF NUTRITION. (2-4 cr [may be repeated for max 12 cr]; prereq sr, 3102, 3612)

In-depth investigation of a single, preselected aspect of nutrition in any one offering. Teaching procedure and approach determined by nature of topic and student needs. Specific topic announced in advance of course offering.

5694. METABOLIC BASIS FOR THERAPEUTIC NUTRITION.

(4 cr; prereq 5664 or #)

Physiological and biochemical bases for dietary treatment, dietary principles related to adequate nutrition. Case study presentations and clinical experience included.

5702. SELECTED ASPECTS OF FOOD SERVICE MANAGEMENT IN HEALTH CARE FACILITIES. (3 cr; prereq 3 cr elem stat, 6 cr econ, #)

Management techniques applied to food services for health care facilities. Methods of analysis and control.

5705. FIELD EXPERIENCE IN FOOD SERVICE MANAGEMENT.

(3 cr; prereq 3 cr elem stat, 6 cr econ, #)

Management techniques applied to food services for health care facilities. Methods of analysis and control.

5732. PRINCIPLES OF FOOD SERVICE ORGANIZATION AND MANAGEMENT. (4 cr; prereq sr, 3732, Mgmt 3001, regis in coordinated program in dietetics)

Management of food service personnel, financial control, regulations, related administrative problems.

5750. PRINCIPLES OF FOOD SERVICE MANAGEMENT.

(4 cr; prereq 3730 or 3732, Mgmt 3001)

Applying management principles in a food service. Business procedures, personnel management, cost control, financial management, and related administrative problems. Field trips may be required.

5755. CURRENT TOPICS IN FOOD SERVICE MANAGEMENT.

(4 cr [may be repeated for max 8 cr]; prereq #)

In-depth examination of timely issues. Content varies quarterly.

For Graduate Students Only

(For descriptions, see *Graduate School Bulletin*)

8101. RESEARCH SEMINAR

8205. GENERAL SEMINAR

8311. FLAVOR CHEMISTRY

8312. REACTION KINETICS OF FOOD DETERIORATION

8315. FOOD PROTEINS

8322. MICROBIOLOGY AND ENGINEERING OF FOOD STERILIZATION PROCESSES

8323. MICROBIAL STARTER CULTURES

8324. MICROBIAL TOXINS AND TOXIC MICROORGANISMS IN FOODS

8401. INDEPENDENT STUDY: FOOD SCIENCE

8403. ADVANCED TOPICS IN FOOD SCIENCE

8412. INTERRELATIONSHIPS AND FUNCTIONS OF FOOD COMPONENTS

8603. ADVANCED TOPICS IN NUTRITION

8621. INDEPENDENT STUDY: NUTRITION

8777. THESIS CREDITS: MASTER'S

8888. THESIS CREDITS: DOCTORAL

Nutr 8745. SEMINAR

Nutr 8777. THESIS CREDITS: MASTERS

Nutr 8888. THESIS CREDITS: DOCTORAL

Nutr 8990. GRADUATE RESEARCH

Horticultural Science (Hort)

1010. HOME HORTICULTURE. (4 cr)

For non-horticulture majors. Fundamental concepts of plant identification, growth, and culture with practical applications to home landscape, floral design, house plants, and fruit, flower, and vegetable gardening. Lecture and lab.

1021. WOODY PLANT MATERIALS. (5 cr)

Taxonomy, ecology, and landscape uses of trees, shrubs, and evergreens. Lecture, lab, field trips.

1022. HERBACEOUS LANDSCAPE PLANTS. (5 cr)

Taxonomy, ecology, and landscape uses of perennial and annual flowers, ferns, weeds, tender and hardy bulbs, grasses, herbs and native plants. Lecture, lab, field trips and garden experience.

1023. INDOOR PLANTS AND LANDSCAPES. (3 cr)

Indoor plants and landscapes benefit people in many ways. This course focuses on the selection, identification, care, growth, and use of plants in the home and other human environments. Field trips provide examples of interior landscaping.

1036. PLANT PROPAGATION. (5 cr)

Principles and techniques of propagating plants by seeds, cuttings, grafts, buds, layers, division, and plant tissue culture. Lecture and lab.

3001. GROWTH REGULATION OF HORTICULTURAL PLANTS. (5 cr; prereq Biol 1103 or equiv)

Scientific basis for horticultural practices that manipulate growth, development, and yield. Comparative approach including lab encourages active learning.

3002. HORTICULTURAL CROPPING SYSTEMS. (5 cr; prereq 1036, Biol 1103)

Identification, manipulation, and management of production systems generic to all horticulture commodities. Greenhouse, field, and container production studied to provide basic optimum conditions for yield maximization with appropriate resources.

3003. PLANT GENETICS AND IMPROVEMENT. (4 cr; prereq Biol 1009)

Principles of plant genetics, genetic and environmental variation, relationships of genetics to crop evolution and plant breeding, conservation and use of wild crop relatives in breeding. Lab experiments investigate hybridization, variation, and selection in horticultural crops and other plants.

3004. APPLICATIONS OF PLANT BIOTECHNOLOGY. (4 cr; prereq 3003 or GCB 3022, Chem 1002 or Chem 1052 or BioC 1401)

Fundamentals of plant molecular biology and biotechnology and their practical applications to plant propagation, crop improvement, and research. Labs on biotechnology skills.

3030. LANDSCAPE DESIGN OF RESIDENTIAL AND SMALL COMMERCIAL SITES. (4 cr; prereq 1021, 1022, LA 1025 or #)

Fundamentals of landscape design theory including organization of space, complementary shapes and forms, site analysis, and the relationship of structure, texture, and seasonal interest in the landscape; includes further study of plans and environmental requirements as they influence design.

3040. LANDSCAPE DESIGN AND IMPLEMENTATION. (5 cr; prereq 3030)

Builds on design techniques 3030. Architectural and graphic techniques as well as design concepts in relation to horticultural plant performance and maintenance. Grading, site manipulation, and plant installation.

3072. TURF MANAGEMENT. (4 cr; prereq Soil 3125, PBio 1103, Agro 3020 or Hort 1036)

General landscape maintenance and turf culture. Work in areas of industrial grounds maintenance, park and recreation area maintenance, and general lawn care.

3097. HORTICULTURE PRACTICUM. (2-4 cr; prereq upper div hort emphasis or sequence, Δ)

Approved field, lab, or greenhouse experiences in application of horticultural information and practices.

3099. SEMINAR. (1 cr [may be repeated for max 2 cr]; prereq jr)
Horticultural problems, research projects, work experience, and employment opportunities.

5000. PROFESSIONAL EXPERIENCE PROGRAM. (4 cr; prereq #: S-N only; free elective for hort undergrads, not for grad; CEE only)

Professional experience in horticulture firms or government agencies through supervised practical work evaluation of reports and consultations with faculty advisers and employers.

5001. HARVEST TO MARKET OF HORTICULTURAL CROPS. (3 cr; prereq PBio 3131)

Physiological processes of horticultural crops after harvest related to maturity, time to harvest, quality, ripening, senescence, handling, storage, and marketing. Interdisciplinary approaches to problem solving and decision management.

5015. RESTORATION AND RECLAMATION ECOLOGY. (4 cr; prereq 1 course in plant biology or botany and ecology)

Ecological and physiological concepts as a basis for the revegetation of grasslands, wetlands, forests, and other landscapes. Methods for plant materials selection, stand establishment, evaluating revegetation success. Overview of state and federal programs that administer restoration and reclamation programs. Weekend and evening trips to examine reclamation and restoration sites in several areas of Minnesota.

5026. LANDSCAPE MANAGEMENT. (4 cr; prereq completion of 75% of credits required in landsc, nursery, and turf sequence and business enrichment)

This course integrates the environmental horticulture industry disciplines and commodities while superimposing appropriate business management principles. Use of scientific methods and technical applications is incorporated through problem solving and case studies.

5031. TEMPERATE FRUIT PRODUCTION. (4 cr; prereq 3001; PBio 3131 recommended; offered fall of odd years)

Principles of fruit production emphasizing temperate fruit crops. Integrated management of fruit cropping systems, including site selection, cultural management practices, taxonomic classification, physiological and environmental control of plant development. Integration of writing into understanding various fruit cropping systems.

5034. COMMERCIAL VEGETABLE AGRICULTURE. (5 cr; prereq 3002, Agro 1010 or Soil 3125)

Crop cultural and product handling and use systems in various world regions. History and evolution of species and product development. Seed and stand establishment, propagation, pest management. Applied physiology and genetics of fruit, bulb, tuber initiation; sink development, maturation, and quality. Lecture, lab, field trips.

5040. PLANT GROWTH REGULATION. (4 cr; prereq 15 cr plant sci incl 3 cr plant physiology; offered winter qtr of even yrs)

Principles of plant growth and development in relation to optimizing cropping efficiency and product quality. Emphasis on analysis of physiological and morphogenetic basis of horticultural practices to regulate growth and development. Exercises in using these principles to solve horticultural problems.

5042. TURFGRASS SCIENCE. (5 cr; prereq 3001, 3072, PIPa 5001, PBio 3131)

For advanced students in turf with career objectives in professional turf management. All phases of the turf industry, with emphasis on the ecology, physiology, and theory of turf population dynamics and on specialized management situations such as golf course, commercial sod production, and fine turf athletic situations.

5046. NURSERY MANAGEMENT I. (4 cr; 5046-5047-5048†; prereq 1021, 1036)

Introduction, history, organization, and scope of the nursery industry. General nursery business administration, production schedules, and cultural management for seed beds and field grown stock. Field trips required.

5047. NURSERY SCHEDULING AND ENTERPRISE DEVELOPMENT. (2 cr; 5046-5047-5048†; prereq 5046)

Development of specific crop schedules using current technical and economic data for efficient production. Development of a total nursery enterprise designed for a workable and profitable business establishment.

5048. NURSERY MANAGEMENT II. (4 cr; 5046-5047-5048†; prereq 5047)

Pest management and government regulations concerning the nursery industry. Container growing operations and marketing of all products. Specific topic research and nursery operation development by the student. Lab includes field trips and greenhouse and field training in nursery operations. Field trips required.

5054. COMMERCIAL FLORICULTURE PRODUCTION PRACTICES. (4 cr; prereq 1036, 3002, PBio 3131)

Principles of commercial bedding plant production systems. Major bedding plant crops and their cultural practices will be emphasized. Lecture, laboratories and field trips will illustrate commercial production techniques and provide opportunities for application of these methods to bedding plant crops.

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

- * Courses in which graduate students may prepare Plan B projects.
- † All courses preceding this symbol must be completed before credit will be granted for any quarter of the sequence.
- § Credit will not be granted if credit has been received for the course listed after this symbol.
- ‡ Concurrent registration is required (or allowed) in the course listed after this symbol.
- # Registration Override Permit, completed and signed by the instructor, is required for registration.
- Δ Registration Override Permit, completed and signed by the department offering the course, is required for registration.
- H Honors course (follows the course number).
- f,w,s,su Following a course number, indicates fall, winter, spring, or summer terms.
- x Course may require more than one quarter to complete.

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

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

A comma between course numbers (e.g., 1234, 1235, 1236) indicates a series of courses that may be entered any quarter. In prerequisite listings, comma means "and" (e.g., "prereq 1101, 1102 or 1103" means the prerequisites are 1101 and either 1102 or 1103).

A prerequisite course listed by number only (e.g., prereq 5246) is in the same department as the course being described.

5055. COMMERCIAL FLORICULTURE PRODUCTION SYSTEMS. (5 cr; prereq 1036, 3002, PBio 3131 or #)
Emphasis on problem-solving and management practices in floriculture crop production. Topics include cultural practices, diagnosis of problems, interpretation of soil/leaf analyses, scheduling crop production, and mechanization and computerization of greenhouse operations. Lecture, lab, field trips.

5091. DIRECTED STUDIES. (2-6 cr; prereq 8 cr upper div hort course, Δ)
Opportunities for in-depth exploration of concepts, technology, materials, or programs in specific area to expand professional competency and self-confidence. Planning, organizing, implementing, and evaluating knowledge obtained from formal education and experience.

For Graduate Students Only

(For descriptions, see *Graduate School Bulletin*)

Agro 5020. INTRODUCTION TO PLANT BREEDING

Agro 8200. PLANT BREEDING PRINCIPLES AND METHODS I

Agro 8210. PLANT BREEDING PRINCIPLES AND METHODS II

PBio 5183. WATER, MINERALS, AND TRANSLOCATION

PBio 5723. PLANT HORMONES AND TISSUE CULTURE

PBio 8281. GROWTH AND DIFFERENTIATION OF PLANTS

Hort 8022. BREEDING ASEXUALLY PROPAGATED CROPS

Hort 8023. EVOLUTION OF CROP PLANTS

Hort 8041. DISCUSSIONS IN ADMINISTRATIVE ORGANIZATION

Hort 8042. HORTICULTURAL SEMINAR

Hort 8045. * PLANT HARDINESS

Hort 8051x. * ADVANCED PROBLEMS IN HORTICULTURAL CROP BREEDING

Hort 8052x. * ADVANCED PROBLEMS IN PHYSIOLOGY OF HORTICULTURAL CROPS

Hort 8060. DISCUSSIONS IN POTATO RESEARCH

Hort 8061. * DISCUSSIONS IN INCOMPATIBILITY

Hort 8062. * DISCUSSIONS IN PLANT HARDINESS

Hort 8063. * DISCUSSIONS IN HORTICULTURAL PLANT BREEDING

Hort 8064. * DISCUSSIONS IN FLORICULTURAL SCIENCE

Hort 8065. * DISCUSSIONS IN POSTHARVEST PHYSIOLOGY

Hort 8066. DISCUSSIONS IN HORTICULTURAL RESEARCH

Hort 8090. GRADUATE HORTICULTURAL RESEARCH

Landscape Architecture (LA)

The courses listed below are the landscape architecture courses most frequently required for pre-landscape architecture students. A complete list of landscape architecture courses is published in the *College of Architecture and Landscape Architecture Bulletin*.

1024. LANDSCAPE THEORY. (4 cr; CEE only)
Analysis of design elements and forms involving direction, shape, proportion and color with emphasis on their function in design; perception and our relationship to the environment: social effects of and psychological basis for design.

1301. INTRODUCTION TO LANDSCAPE ARCHITECTURAL DRAWING. (4 cr; Same as Arch 1301; A-F only)
Visualization and drawing for form and space in the physical environment. Basic elements of form using design drawing systems conventions. Development of skills in visual literacy and expression through drawing.

1401. THE DESIGNED ENVIRONMENT. (4 cr)
Principles and traditions in architecture, landscape architecture, and urban design, with references in the arts, sciences, and literature explored in this review of formal constructs of the designed environment.

3411. HISTORY OF ARCHITECTURE TO 1750. (4 cr)
History of architecture and city planning from antiquity to 1750, as illustrated by major monuments from Western and non-Western cultures.

3412. HISTORY OF ARCHITECTURE SINCE 1750. (4 cr)
A history of the major monuments, concepts, and theories of urbanism and architecture since 1750.

3413. HISTORY OF LANDSCAPE ARCHITECTURE. (4 cr)
History and theoretical issues of landscape architecture in topologically based survey format. Landscape design from the ancient to the modern period.

Natural Resources and Environmental Studies (NRES)

1001. ORIENTATION TO NATURAL RESOURCES AND ENVIRONMENTAL STUDIES. (1 cr; S-N only)
Information about NRES major. Discussions with faculty adviser. Employment information. Current topics in NRES. Information about facilities. Discussions with alumni.

1010. ISSUES IN THE ENVIRONMENT. (3 cr)
Interdisciplinary offerings exploring five areas of environmental concern: aspects of environmental design providing maximum compatibility of human beings with their environment, sources of water pollution and their control, disposal and control of solid wastes from agriculture, minimization of pesticide pollution of the environment, and managed use of forest resources to maintain environmental quality. Televised course involving 20 taped lectures and 10 discussion periods.

1040. NATURAL RESOURCES AS RAW MATERIALS. (3 cr)
Role of natural resources as raw materials for industry and economic development. Environmental and economic trade-offs associated with raw material gathering, processing and use. Implications of processing technologies, energy considerations.

3001. COLLOQUIUM IN NATURAL RESOURCES AND ENVIRONMENTAL STUDIES. (1 cr)
Roundtable discussions of current topics in NRES.

3010. ETHICS AND VALUES IN RESOURCE MANAGEMENT. (3 cr)
Formulating a natural resources philosophy based on ethical behavior. Ethical dilemmas inherent in managing natural resources.

3020. PLANT RESOURCE MANAGEMENT AND THE ENVIRONMENT. (4 cr; prereq 15020, Biol 1009 or Biol 1201, Biol 1202, soph standing)
Same as 5020. World vegetation management practices, extent. Emphasis on forest management; agriculture and agro-forestry; historical, current, and prospective practices and environmental and societal implications.

3050. EXPERIENCE AND TRAINING IN A FIELD SETTING. (1-4 cr; prereq #)
Students are required to obtain professional experience in a field setting by attending field sessions, completing a Professional Experience Program, or volunteering for various natural resource and/or environmental programs through local state or federal agencies. Approval by instructor required.

3051. FROM TALL-GRASS PRAIRIES TO BOREAL FORESTS. (4 cr)
Two-week field course on ecology of the Upper Midwest and teaching methods of ecological research using experts in ornithology, ichthyology, herpetology, community ecology, ecosystems, ecology, mammalogy, paleoecology, archeology, and limnology. Designing and implementing field experiments.

3060. WATER QUALITY IN NATURAL RESOURCE MANAGEMENT. (3 cr)
Same as 5060. Global and ecological perspective on managing surface and groundwater resources. Water quality concerns.

3100. CONSERVATION OF BIODIVERSITY. (4 cr)
Biological and social principles underlying biodiversity conservation. Management and policy alternatives for maintaining biodiversity.

3201. FIELD ASSESSMENT TECHNIQUES. (1 cr; at Itasca)
Land survey and mapping; measurement and sampling methods for forest vegetation, wildlife, and other resources.

3225. DIRECTED STUDY EXPERIENCE. (1-5 cr; prereq fr or soph standing; #, Δ)
Opportunity to pursue experiences not available under independent or extra credit registration. The student develops, in consultation with the adviser for the project, a prospectus and completes progress reports and a final report on his or her project.

3800. NATURAL RESOURCES INTERPRETATION AND COMMUNICATION. (3 cr)
Environmental education in the context of natural resource agencies.

5001. COLLOQUIUM IN NATURAL RESOURCES AND ENVIRONMENTAL STUDIES. (1 cr)

Key concepts and techniques in restoration; common factors in restoration projects; threats to health of aquatic ecosystems.

5020. PLANT RESOURCE MANAGEMENT AND THE ENVIRONMENT. (4 cr; prereq 13020)

Same as NRES 3020. Discussion period; term paper.

5060. WATER QUALITY IN NATURAL RESOURCE MANAGEMENT. (3 cr; prereq 3060)

Same as 3060. Weekly discussion session; integrative paper on a water quality problem.

5100. PROBLEM SOLVING IN NATURAL RESOURCES AND ENVIRONMENTAL STUDIES. (5 cr; prereq sr)

Solving a real-world natural resources and/or environmental problem. Discussions and assignments reflect diverse aspects of the problem. Oral and written presentations. Students participate as a member of a team.

5210. SURVEY, MEASUREMENT, AND MODELING METHODS FOR NATURAL RESOURCES I. (4 cr; prereq Math 1142, Stat 3011, AgEt 3030 or GC 1571 or equiv computer competency)

Introduction to survey design, measurement concepts, and modeling methods useful in studying natural resources and environmental issues. Emphasis on data collection and analysis.

5220. SURVEY, MEASUREMENT, AND MODELING METHODS FOR NATURAL RESOURCES II. (4 cr; prereq 5210 or FR 5212 or equiv; offered alt yrs)

Advanced survey design, measurement concepts, and modeling methods for studying natural resources and environmental problems.

5225. DIRECTED STUDY EXPERIENCE. (1-5 cr; prereq jr or sr or grad standing, #, Δ)

Opportunity to pursue experiences not available under independent study or extra credit registration. The student develops, in consultation with the adviser for the project, a prospectus and completes progress reports and a final report on his or her project.

Plant Pathology (PIPa)

1001. THE GOOD, BAD AND UGLY EFFECTS OF MICROORGANISMS ON PLANTS AND HUMAN SOCIETY. (2 cr)

Positive or negative effects of microorganisms on plants and the ultimate effect on human history and society.

1002. PLANT DISEASES AND YOUR GARDEN. (2 cr)

Characteristics of causes of plant diseases that can affect the growth of flowers, small fruits, and vegetables in Upper Midwestern gardens. Diseases that may appear in your garden, why they can occur and how to avoid them.

1003. DISEASES OF TREES. (2 cr)

Tree diseases with emphasis on diseases in the Upper Midwest. Labs emphasize disease diagnosis.

1004. DISEASES OF TURFGRASS. (2 cr)

Turf diseases with emphasis on diseases in the Upper Midwest. Labs emphasize disease diagnosis.

3001. MANAGEMENT AND CONTROL OF FIELD CROP DISEASES. (4 cr; prereq Biol 1009 or #)

Crop pathology in selected cropping rotations and procedures used to identify plant diseases and appropriate control measures. Field level problem solving using integrated pest management.

3002. MANAGEMENT OF HORTICULTURAL CROP DISEASES. (4 cr; prereq Biol 1009 or equiv)

Characteristics of pathogens and incitants that cause horticultural crop diseases. Biological principles that affect disease incidence, and severity.

3004. AIR POLLUTION, PEOPLE AND PLANTS. (3 cr; prereq Chem 1052; Biol 1009 or equiv, or #)

History of air pollution, its sources and types; global climate change; air pollution effects on human health, crops and forests; air pollution control and international perspective.

3090. RESEARCH IN PLANT PATHOLOGY. (Cr ar; prereq 1001 or equiv or #)

Assignment of special problems to undergraduates desiring opportunity for independent research in plant pathology.

5000. PROFESSIONAL EXPERIENCE PROGRAM. (4 cr; prereq 15 cr plant path, #; not for grad cr; CEE only)

Open to advanced students in integrated pest management. Up to 12 weeks of experience in a selected agricultural industry; evaluative reports and consultations with faculty advisers and employers.

5102. ECOLOGY OF FUNGI. (3 cr; prereq 6 cr bot or #; limited to 20 students; offered at Lake Itasca in alt yrs)

Ecological studies and identification of fungi. Fungal symbioses, morphology, coevolution, and applicable ecological theory. Student teams determine species richness in aquatic, grassland, and forest habitats.

5109. MOLECULAR GENETICS AND BIOCHEMISTRY OF YEASTS AND FILAMENTOUS FUNGI. (4 cr; prereq one course each in gen and biochem or #; offered alt yrs)

Chromosome structure and function, regulation of nuclear gene expression, mitochondrial gene organization and expression, membrane and organelle biogenesis, cell cycle regulation, morphogenesis, mating and reproduction, recombination and gene switching, spore formation and germination, viruses, plasmids and toxins. Offered alternate years.

5201. BIOLOGY OF PLANT DISEASES. (3 cr; prereq Biol 3012 or equiv)

Principles and concepts of plant disease caused by selected bacteria, fungi, viruses and nematodes. Pathogen biology, factors that cause disease and interaction of pathogens with plants. Epidemiology and control measures for appropriate plant diseases.

5202. BIOLOGY OF PLANT DISEASES LABORATORY. (2 cr; PIPa 5201 may be taken concurrently)

Plant pathogen isolation, culture, and inoculation. Selected bacteria, fungi, viruses and nematodes and the diseases they cause.

5203. PHYSIOLOGY AND MOLECULAR PLANT-MICROBE INTERACTIONS. (3 cr; prereq intro course in biochemistry or plant physiology or #)

A course for upper division undergraduates or graduate students covering the genetics, physiology, and molecular biology of plant-microbe interactions. Major topics include: communication between plants and microbes, signal transduction, control of gene expression, symbiosis and parasitism, plant host response mechanisms and plant disease physiology.

5204. FIELD PLANT PATHOLOGY. (2 cr; prereq PIPa 3001 or 3002 or 5201, 5202)

Characteristics and management of plant diseases in the field, forest, golf course, greenhouse, and urban environment.

5205. PLANT DISEASE DIAGNOSIS. (2 cr; prereq intro plant pathology course or #)

Principles and methodology of diagnosing plant diseases. Biotic and abiotic disease agents, disease diagnosis at both field and lab level, and current detection methods utilizing immunological and electrophoretic techniques.

5206. BIOLOGY OF FUNGI. (4 cr; prereq Biol 1009 or #)

Major groups of fungi, their roles in ecosystems and human society, environmental and nutritional needs, and their modes of dissemination and survival. Representative species of fungi will be observed and manipulated.

5209. BIOCHEMISTRY OF PLANT DISEASE. (3 cr; prereq organic chemistry, biochemistry or equiv)

Biochemistry of metabolic reactions in diseased plants; phytoalexins, phytotoxins, induced resistance mechanisms, carbon metabolism, metabolic sinks.

5211. FUNGAL GENETICS. (4 cr; prereq intro genetics; offered alt yrs)

Attributes of the genetics of fungi using classical approaches, including Mendelian and quantitative traits, ecological and population genetics, incompatibility systems, tetrad analysis, heterokaryosis, somatic recombination, plasmids, genetics of parasitism, and molecular genetics techniques.

5212. DISEASES OF FOREST AND SHADE TREES. (4 cr)

Tree diseases and ecological relationships among trees, microbes and the environment.

5213. PLANT NEMATOLOGY. (4 cr; prereq PIPa 3002 or PIPa 5200, 5201 or 3001)

Modified case study approach to evaluation of significance of plant parasitic nematodes in upper midwest field, garden, turfgrass, and greenhouse situations.

5214. PLANT VIROLOGY. (4 cr; prereq PBio 3012 or equiv)

Importance, symptomatology, transmission and identification of viroid, virus and virus-like diseases of plants. Epidemiology and principles of control. Biological and biochemical properties of virus, viroid and virus-like pathogens. Techniques for plant virus identification and characterization using transmission, immunodiagnosis, electron microscopy, and other experimental manipulation.

5215. INSECTS IN RELATION TO PLANT DISEASES. (3 cr; prereq one ent course, one plant path course or #; offered alt yrs)

Insect transmission and dissemination of plant pathogens; development of plant-insect relationships; habits of principal insect vectors.

5500. EPIDEMIOLOGY AND ECOLOGY OF PLANT DISEASE. (3 cr; prereq 5002 or 5050 or #)

Concepts and methodology in the quantitative study of plant disease epidemics emphasizing the ecology of interacting host and microbial populations. Includes discussion of disease forecasting, disease in natural (non-agricultural) systems, and biological and chemical approaches to disease control.

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- H Honors course (follows the course number).
- f,w,s,au Following a course number, indicates fall, winter, spring, or summer terms.
- x Course may require more than one quarter to complete.

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

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

A comma between course numbers (e.g., 1234, 1235, 1236) indicates a series of courses that may be entered any quarter. In prerequisite listings, comma means "and" (e.g., "prereq 1101, 1102 or 1103" means the prerequisites are 1101 and either 1102 or 1103).

A prerequisite course listed by number only (e.g., prereq 5246) is in the same department as the course being described.

For Graduate Students Only

(For descriptions, see *Graduate School Bulletin*)

8000. SUPERVISED TEACHING EXPERIENCE

8090. ADVANCED PROCEDURES AND RESEARCH IN PLANT PATHOLOGY

8200. CURRENT TOPICS IN PLANT PATHOLOGY

8201. SEMINAR

8500. RESEARCH IN PLANT PATHOLOGY

Rhetoric (Rhet)

1101. WRITING TO INFORM AND PERSUADE. (4 cr, §Comp 1011; A-F only)

Relationship of thesis construction and clear thinking to informative and persuasive writing. Importance of thesis sentence, evidence, coherence, clarity, and correctness. Emphasis on the writing process in producing several short papers (250-750 words).

1104. LIBRARY RESEARCH METHODS. (1 cr; S-N only)

On-site and interactive video instruction in information retrieval techniques to strengthen skills in using the library. Students work independently to satisfactorily complete all exercises and problem-solving assignments. Students must attend an orientation session. Computer-assisted instruction.

1151. WRITING IN YOUR MAJOR. (4 cr; prereq Rhet 1104, fr comm req, soph status; A-F only)

Students investigate and write about subjects related to their majors. Emphasis on gathering, evaluating, synthesizing, and summarizing information; adapting it for various audiences. Assignments include literature review, abstract, fact sheet, instructions, and feature article.

1200. INFORMATION TECHNOLOGY IN SCIENTIFIC AND TECHNICAL PROFESSIONS. (3 cr; A-F only, prereq COA undergrad)

How to use computers to communicate, gather, analyze, manage, and store information in scientific and technical professions. Main functions of and integration of data from word processing, telecommunications, database, and spreadsheet applications.

1220. PRINCIPLES OF HUMAN COMMUNICATION. (4 cr)

Elements and contexts of human communication. Readings, discussions, lectures, and experiential assignments; focus on communication that affects interpersonal gatherings and entertains, persuades, and instructs public audiences.

1222. PUBLIC SPEAKING. (4 cr; prereq fr comm req; A-F only)

Practical course in fundamentals of effective speechmaking. Emphasis on researching and organizing a speech and communicating with an audience.

1301. HUMANITIES: MODERN THOUGHT AND THE ENLIGHTENMENT. (4 cr)

Tracing the impact of the scientific revolution on human thought. Emphasis on scientific and religious movements and countermovements as they influence modern thinking.

1302. HUMANITIES: MODERN THOUGHT AND THE INDUSTRIAL REVOLUTION. (4 cr)

The industrial transformation of Europe; rise of laissez-faire capitalism, socialism, Marxism; modern "individualism" and traditional views of community; utilitarianism and deontological approaches to ethics.

1303. HUMANITIES: SCIENCE, RELIGION, AND THE SEARCH FOR HUMAN NATURE. (4 cr)

Investigation of Darwin's theory of evolution and its effect on 19th- and 20th-century institutions. Emphasis on attempts of social philosophers to extrapolate from biological theory to political, cultural, and religious life; scientific and religious ways of knowing; rise of existentialism.

1310. HUMANITIES: THE LAND IN AMERICAN EXPERIENCE. (4 cr)

American attitudes toward the land from colonial times to the present as expressed in social history, literature, and the fine arts. Social thought and the relationship between farm and city, wilderness and countryside. The changing appearance of America.

1311. HUMANITIES: THE FAMILY IN AMERICAN EXPERIENCE. (4 cr)

American attitudes toward family life from colonial times to the present as expressed in literature, the fine arts, and social history. Impact of Protestantism, democracy, capitalism, and reform movements, including women's rights, on the family ideal.

1376. SPECIAL TOPICS IN HUMANITIES. (4 cr)

Topics vary quarterly and are listed in *Class Schedule*. For full details, inquire at the department office before registration.

1380. FICTIONAL HISTORY: TWENTIETH CENTURY THROUGH THE EYES OF NOVELISTS. (3 cr; prereq fr comm req)

Reading of 20th-century documentary novels; the nature of artistic/historical truth; rhetoric of novels; cross cultural comparisons. Typical reading: novels about colonialism in Africa; partition of India; the Holocaust; Palestinian-Israeli conflict.

1441. COLLEGE READING AND LEARNING SKILLS. (4 cr)

Lecture and individual and small group practice in developing speed, comprehension, retention and flexibility in reading college assignments; clarity and precision in written expression; accurate and effective listening; control of communication related anxiety, including test-taking; vocabulary power.

3101. FUNCTIONAL PHOTOGRAPHY. (4 cr; prereq DHA 1300 or Rhet 3562)

Practical course in basic photographic communication. Techniques of producing 35mm color transparencies for use in group presentations, teaching, publications, and audiovisual productions.

3105. CORPORATE VIDEO FOR TECHNICAL COMMUNICATORS. (4 cr; prereq Rhet 3562 or equiv)

Video production including video team roles, production technology, and the development process. Students will apply rhetorical principles in analyzing video, develop a treatment, and write a script. Meets concurrently with Rhet 5105.

3254. ADVANCED PUBLIC SPEAKING. (4 cr; prereq 1222)

Training for specific speech situations most likely to be encountered professionally. Emphasis on analysis, design, preparation, and delivery of presentations to provide greater flexibility within a variety of speech environments.

3266. COMMUNICATION, DISCUSSION IN SMALL GROUP DECISION MAKING. (4 cr; prereq Rhet 1222 or #)

Role of communication techniques in the small group decision making process. Emphasis on problem-solving discussion requiring some kind of formal outcome.

3270. SPEECH: SPECIAL PROBLEMS. (1-5 cr; prereq #, Δ)

Supervised reading and research on advanced speech-communication topics not covered in regularly scheduled speech offerings. Because of the advanced and independent nature of this course, the primary burden of development usually rests with the student.

3276. SPECIAL TOPICS IN RHETORIC AND COMMUNICATION. (4 cr; prereq #, Δ)

Supervised reading and research on advanced rhetoric, communication, speech topics not covered in regularly scheduled offerings.

3370. AMERICAN HUMANITIES. (4 cr)

Examination of the American character and changes it has undergone in the 19th and 20th centuries as exemplified by social, artistic, literary, and architectural records.

3374. HUMANITIES: SPECIAL PROBLEMS. (1-2 cr; prereq #, Δ)

Primarily for supervised reading and research on topics not covered in regularly scheduled humanities offerings.

3375. HUMANITIES: AGRICULTURAL HERITAGE. (4 cr)

Examination and analysis of significant events or periods affecting rural agricultural peoples as expressed in historical, cultural, and literary documents. Understanding of major values, attitudes, and philosophies related to agricultural change and development.

3380. HUMANITIES: THE LITERATURE OF SOCIAL REFLECTION. (2 cr)

Brief examination of contemporary social issues as reflected in cultural documents. Use of imaginative literature as a forum where social questions are discussed, evaluated, and resolved.

3381. HUMANITIES: 20TH-CENTURY CULTURE. (4 cr)

The changing structure of 20th-century culture from World War I to the present. Communism, fascism, and democracy. Modern movements in literature, the visual arts, and architecture.

3382. HUMANITIES: ETHICS OF TOTAL WAR. (3 cr)

World War II included combatants and noncombatants in the ethical dilemmas of total war: the holocaust, unrestricted submarine warfare, indiscriminate bombing, the atomic bomb. These dilemmas are experienced through works of art: films, novels, music, painting.

3390. HUMANITIES: TECHNOLOGY, SELF, AND SOCIETY. (4 cr; prereq jr, STC major or preSTC or Δ)

Major shifts in technology from 19th century to the present in the United States, especially in relation to capitalism. Technology and the concepts of nature, work, political and social organization, and self. Interdisciplinary materials used.

3395. IN SEARCH OF NATURE. (4 cr)

The human need for a relationship with nature, images of nature developed from this and the ways humans organize their surroundings to reflect this need. Contemporary American response.

3562. WRITING IN YOUR PROFESSION. (4 cr; prereq fr comm req, 1151, jr or sr status; A-F only)

Projects in writing professional reports. Analyses of audience and situation; writing effectively to meet the needs of particular readers. Assignments include writing instructions, feasibility report, proposal, memorandum, letter of application, and résumé.

3565. WRITING FOR PUBLICATION. (4 cr; prereq 3562, #)

Writing and preparing manuscripts for publication; adaptation to specialized and general reader; professional, trade, and general publications; information sources and topic selection; marketing techniques.

3574. PUBLICATIONS MANAGEMENT. (3 cr; prereq 3562; A-F only)

Management of publications from initial receipt of manuscript to first publication. Scheduling, layout and design, liaisons with printers or authors, typography, processing illustration.

3582. SENIOR SEMINAR. (3 cr; prereq sr)

Discussions of professional and ethical issues and problems related to technical communication. A capstone course, integrating oral, written, visual, organizational, and theoretical competencies.

3670. VISUAL RHETORIC: THEORIES AND APPLICATIONS.

(4 cr; prereq 1200 or equiv, 3562 or equiv)

Theoretical and practical aspects of visual rhetoric in scientific and technical communication. Develops visual literacy by introducing terms, rhetorical considerations, design principles, tools and applications, and ethical and social responsibilities. Lecture and lab.

3690. SOCIAL SCIENTIFIC CONTROVERSY. (3 cr; prereq 1101 or equiv)

Personal, social, and political challenges created by science and technology. Controversies include animal experimentation, organ transplants, frozen embryos, ozone depletion, pollution, and nuclear waste. Public discourse on these issues examined from a rhetorical point of view.

3700. RHETORICAL THEORY: PERSUASION AND THE LITERATURE OF SCIENCE. (3 cr; prereq fr comm req)

Principles and history of rhetorical theory and criticism. Emphasis on classical theories, especially those of Plato and Aristotle. Practice of rhetorical criticism of contemporary communication, including scientific communication. Meets concurrently with 5700.

5100. TECHNICAL COMMUNICATION: SPECIAL PROBLEMS.

(Cr ar; prereq #, Δ)

Supervised reading, research, and work on advanced technical communication projects not covered in regularly scheduled courses.

5105. CORPORATE VIDEO FOR TECHNICAL COMMUNICATORS. (4 cr, §3105)

Video production including video team roles, production technology, and the development process. Students apply rhetorical principles in analyzing video, develop a treatment, write a script, and prepare an annotated bibliography on a video-related topic. (Meets concurrently with Rhet 3105.)

5165. STUDIES IN ORGANIZATIONAL COMMUNICATION, CONFLICT, AND CHANGE. (4 cr; prereq fr comm req or equiv or grad status)

Roles of internal and external organizational communication, conflict-problem identification, and change processes. Contemporary theory and research in organizational development. Methods of problem identification and diagnosis. Change processes and applications to actual organizational settings.

5170. MANAGERIAL COMMUNICATIONS. (4 cr; prereq fr comm req or equiv or grad status)

Analysis of a manager's position in an organizational communication network. Focus on the possible forms, contexts, and functions of a manager's communication. Assessing and developing personal competence and confidence in managerial communication. Lectures, discussions, readings, experiential exercises, field research.

5180. INTERNSHIP IN SCIENTIFIC AND TECHNICAL COMMUNICATION. (2-6 cr; prereq STC major or grad, #, Δ)

On-the-job experience at the University or in industry or government.

5257. SCIENTIFIC AND TECHNICAL PRESENTATIONS.

(4 cr; prereq 1222, 3562 or grad status or #)

Presentations for specific situations related to technical or scientific topics. Audience analysis and adaptation, techniques of support and visualization, organization for clarity and accuracy, and techniques of interpreting and answering questions. Students make and evaluate technical and scientific presentations. Emphasis on seminar reports and professional conference papers.

5258. INTERVIEWING: DYNAMICS OF FACE-TO-FACE COMMUNICATION. (4 cr)

Intrapersonal and interpersonal skills in interviewing situations. Students learn to understand and use appraisal, reprimand, complaint, persuasion, problem solving, and counseling interview techniques, and participate in a research interview project. Equal emphasis on the interviewer and interviewee roles.

5400. COMMUNICATION PROGRAM PLANNING AND EVALUATION. (4 cr; prereq jr, sr or grad status and/or comm work exper)

Methods and process for planning and evaluating communication and information activities in organizations. Study of examples, materials and resources for planning, budgeting, and assessing organizational communication programs.

5500. RESEARCH IN COMMUNICATION STRATEGIES.

(4 cr)

Fundamental terminology of descriptive and experimental research, communication research, questionnaire techniques, interviewing techniques, survey and experimental designs, the steps in organizing and conducting field and empirical research, and basic statistical and computer techniques. Emphasis on application of various research methods to particular communication strategies or settings.

5531. SCIENTIFIC AND TECHNICAL COMMUNICATION COURSE DEVELOPMENT: PHILOSOPHY AND METHODOLOGY. (4 cr; prereq 3562, STC sr or RSTC grad or #; A-F only)

Reading, observation, and discussion of teaching theories and methodologies as they relate to composition and to scientific and technical communication. Emphasis on learning to teach first-year college students written or oral persuasive strategies. Students practice assignment and course development, justification and evaluation.

5532. SCIENTIFIC AND TECHNICAL COMMUNICATION COURSE DEVELOPMENT: MENTORED TEACHING. (2 cr; prereq 5531, STC or RSTC grad or #; A-F only)

With faculty mentor students teach course units, prepare and evaluate course assignments, conduct conferences with student writers or speakers, and through observations and practice, help oversee the educational process within an actual course.

5533. SCIENTIFIC AND TECHNICAL COMMUNICATION COURSE DEVELOPMENT: TEACHING SEMINAR. (1 cr; prereq 5532, STC or RSTC grad or #; A-F only)

Usually concurrently with their first teaching assignments, students share observations and solve teaching problems within the seminar setting.

5540. TOPICS IN SCIENTIFIC AND TECHNICAL COMMUNICATION. (cr ar; prereq #)

Topics announced in *Class Schedule*.

5560. EDITING FOR TECHNICAL COMMUNICATION. (4 cr; prereq STC premajor or major or grad; A-F only)

Editorial process; editor-writer relationship; copyediting; preparing scientific and technical documents; handling format, visuals, and quantitative materials.

5572. PROCEDURES AND POLICIES MANUAL. (3 cr; prereq STC major or preSTC, comm req, 3562 or grad status or #)

Problem analysis, process management, gathering information, writing procedures, verification, constructing the finished manual.

5573. GRANT PROPOSAL. (3 cr; prereq STC major or preSTC, fr comm req, 3562 or grad status or #)

Writing the grant proposal, including establishing credibility, problem statement, program objectives, plan of action, evaluation, budget presentations, and proposal summary. Both real and hypothetical situations.

5575. NEWSLETTER. (3 cr; prereq STC major or preSTC, fr comm req, 3562 or grad status or #)

Newsletter design and production. Students learn to write and edit newsletter articles and gain hands-on experience in typography, graphic design, formatting, layout, and distribution procedures. They produce a newsletter using Macintosh desktop publishing.

5581. DOCUMENT DESIGN. (4 cr; prereq 3562, STC sr or grad; A-F only)

Designing document to meet user's need, completing draft, and evaluating effectiveness. Forms and software documentation (user guides, reference manuals, tutorials, and input sheets) for databases, decision aids, computer-aided instruction, on-line programs, or visual displays. Mandatory lab time as part of project team of programmers, subject matter specialists, and communication specialists.

5600. TRANSFER OF TECHNOLOGY. (4 cr; prereq sci comm work exper or #)

Methods of transferring scientific and technical knowledge and practice. Review of research in diffusion and transfer methods at different technical levels. Tools, methodologies, and assessment procedures for managing a program. Assessment and design plan.

5680. GENDER AND THE RHETORIC OF SCIENCE AND TECHNOLOGY. (4 cr; prereq 1101 or equiv)

How cultural gender roles and biological sex influence communication within scientific and technical communities. Communication strategies of professional writers, scientists, and technologists.

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A prerequisite course listed by number only (e.g., prereq 5246) is in the same department as the course being described.

5700. RHETORICAL THEORY: PERSUASION AND THE LITERATURE OF SCIENCE. (4 cr, §3700; prereq grad; A-F only) Principles and history of rhetorical theory and criticism. Classical theories, especially those of Plato and Aristotle. Practice of rhetorical criticism of contemporary communication, including scientific communication. Study of contemporary scholarship in the rhetoric of science and technical communication. (Meets concurrently with 3700.)

For Graduate Students Only

(For descriptions, see Rhetoric in the *Graduate School Bulletin*)

8100. RESEARCH METHODS IN RHETORIC AND SCIENTIFIC AND TECHNICAL COMMUNICATION

8110. THEORY AND RESEARCH IN AUDIENCE ANALYSIS

8120. READING AND WRITING PROCESSES AND THE TECHNICAL COMMUNICATOR

8180. DESIGN PROJECT

8181. STC CAPSTONE PROJECT

8210. THEORY AND RESEARCH IN MEDIA SELECTION

8258. INFORMATIONAL RESEARCH INTERVIEWING IN SCIENTIFIC AND TECHNICAL COMMUNICATION

8500. QUALITATIVE RESEARCH: STRATEGIES IN TECHNICAL COMMUNICATION

8510. THEORY AND PRACTICE IN DESIGNING MESSAGES

8515. TOPICS IN THE RHETORIC OF SCIENCE AND TECHNOLOGY: THEORY, HISTORY, CRITICISM

8525. TOPICS IN CULTURE AND COMMUNICATION

8556 SEMINAR IN SCIENTIFIC AND TECHNICAL COMMUNICATION PEDAGOGY THEORY AND RESEARCH

8777. THESIS CREDITS: MASTER'S

8888. THESIS CREDITS: DOCTORAL

Rural Sociology (Soc)

Offered by the College of Liberal Arts

1651. RURAL SOCIOLOGY. (4 cr)

Factual data necessary to understand problems of rural social life.

3315. LATIN AMERICAN SOCIETIES IN TRANSITION.

(4 cr; prereq 8 cr soc or econ or anth or pol sci or #)

Relationship of population, technology, and organization structure to levels of modernization among Latin American nations. Differentiation, diffusion, innovation, and social conflict as precipitants of social change.

3671. COMPARATIVE RURAL SOCIETIES: LATIN AMERICAN.

(4 cr; prereq 8 cr soc or anth or econ or pol sci or #)

Social and cultural change in Latin America. Demographic and ecological characteristics, institutional structure and its accompanying associations; linkages with outside and world views.

5651. RURAL SOCIAL INSTITUTIONS. (4 cr; prereq any 3xxx soc course or equiv or #; offered alt yrs)

Factors in the rural environment that condition the functioning of rural social institutions—family, school, church, local government, health, welfare.

5661. RURAL COMMUNITY ANALYSIS. (4 cr; intended for persons in rural community organization, rural teaching, extension work, and related fields; prereq any 3xxx soc course or equiv or #; offered alt yrs)

Tools, techniques, and methods of making community field studies.

For Graduate Students Only

(For descriptions, see *Graduate School Bulletin*)

8651, 8652, 8653. SEMINAR: RURAL SOCIOLOGY. (3 cr per qtr; offered when feasible)

8661. SEMINAR: RESEARCH METHODS IN RURAL SOCIOLOGY. (3 cr; offered when feasible)

Science in Agriculture (ScAg)

1001f. ORIENTATION TO SCIENCE IN AGRICULTURE. (1 cr; S-N only)

Introduction to the Science in Agriculture major. Discussion of program and career planning and professional development. Interviews with faculty and other resource persons. Current issues concerning science in agriculture.

1500. BIOTECHNOLOGY: BASIC CONCEPTS AND APPLICATIONS. (3 cr)

Biotechnology as part of a liberal education or as preparation for careers in science. Genetic engineering, applications of biotechnology to microbes, plants and animals, and legal and ethical issues.

5009f, w, s. UNDERGRADUATE SENIOR THESIS: SCIENCE IN AGRICULTURE. (1-5 cr)

In-depth undergraduate research and thesis experience for senior students (9 credits total required for Science in Agriculture major). Research conducted under the supervision of a COA faculty member; recommended course length is one full academic year. The research experience culminates with a written, bound thesis and oral presentation of research results.

Soil Science (Soil)

1020. THE SOIL RESOURCE. (5 cr, §3125)

Physical, chemical, and biological aspects of soils. Use of the soil classification system to understand the use of soil survey information for land-use planning. Concepts of soil fertility for understanding plant growth requirements. Introduction to urban soils and their management. Understanding soil's role in environmental planning and conservation decisions.

1425. INTRODUCTION TO METEOROLOGY. (4 cr)

(Same as Geog 1425) Pre-calculus introduction to nature of atmosphere and its behavior. Atmospheric composition, structure, stability, and motion; precipitation processes, air masses, fronts, cyclones and anticyclones; general weather patterns; meteorological instruments and observations; plotting and analysis of maps; forecasting.

3125. BASIC SOIL SCIENCE. (5 cr, §1020; prereq Chem 1001 or 1051)

Basic physical, chemical, and biological properties of soil. Soil genesis, classification, and principles of soil fertility. Lecture, lab, recitation.

3220. SOIL CONSERVATION AND LAND-USE MANAGEMENT. (4 cr; prereq 1020 or 3125 or #)

Soil erosion and land degradation processes on rural and urban landscapes. Technical, historical, economic, social, and international considerations of soil conservation. Land-use management practices for soil conservation and methods of natural resource assessment. Lecture, field trips, computer lab.

3416. PLANT NUTRIENTS IN THE ENVIRONMENT. (4 cr; prereq 3125)

Fundamental concepts in soil fertility evaluation. Emphasis on dynamics of mineral elements in soil and evaluation and interpretation of plant and soil relationships. Lecture and recitation.

3417. PLANT NUTRIENTS IN THE ENVIRONMENT LABORATORY. (1 cr; §Soil 3416)

Diagnostic techniques by measuring specific soil fertility parameters. Lab and recitation.

3521. COLLEGIATE SOIL JUDGING. (1 cr; may enroll for max 3 cr; prereq 5510)

Methods of collegiate soil judging. Participation on soil judging team during regional or national contests required.

5000. PROFESSIONAL EXPERIENCE PROGRAM. (4 cr; prereq 12 cr soil, #; not for grad cr; CEE only)

Up to 12 weeks of experience in a position related to soil science. Evaluation of work experience by employer and faculty adviser in consultation with student and employer.

5020. ENVIRONMENTAL IMPACT ASSESSMENT. (3 cr; prereq jr or sr, 16 cr sci, AgEc 3610 or #)

Roles of governmental agencies, consultants, and private citizens. Steps needed to write an environmental impact statement (EIS). Examining case studies, writing additional components of EIS, and preparing an EIS for a small local project.

5022. INTRODUCTORY SOIL SCIENCE FOR TEACHERS. (4 cr, §1020; prereq 1 college chemistry course, ed degree, #; limited to 10)

Physical, chemical, and microbiological properties of soil. Soil classification system used to understand soil survey information for land use planning. Soil fertility as it relates to environmental planning and conservation decisions. Qualified students may register for graduate credit at the University of Minnesota. Meets concurrently with 1020.

5104. COMPUTER APPLICATIONS IN SOIL SCIENCE. (2 cr; prereq 1020/3125 or equiv, #)

Problem-solving methods in soil science. Applications in soil climatology, chemistry-fertility-microbiology, genesis-inventory, and physics. Use of spreadsheets, relational databases, geographic information systems, and simulation models. Hands-on experience in computer lab. Computer programming experience not required.

5110. PRACTICUM INTERNSHIP IN PRECISION AGRICULTURE. (2-4 cr; prereq sr or grad, #)

Precision agriculture internship in agri-industry or a governmental agency.

5114. SPECIAL PROBLEMS IN SOILS. (1-7 credits per qtr; prereq 3125 or #, Δ)

Research, readings, and instruction.

5183. WATER RELATIONS, MINERAL NUTRITION, AND TRANSLLOCATION IN HIGHER PLANTS. (4 cr; prereq PBio 3131 or equiv)

Transport processes in plants, including water and nutrient absorption and distribution, effects of and adaptations to water and nutrient stress, functions of mineral nutrients, translocation of photosynthesis.

5210. ENVIRONMENTAL BIOPHYSICS. (3 cr; prereq Math 1251, Phys 1041 or #)

Physical microenvironment and energy/mass exchange processes among soils, plants, animals, and atmosphere. Energy transfer (sensible, latent, radiation, mass [H₂O, CO₂, trace gases]) calculation using mathematical models and energy budget analyses. Lecture and recitation.

5211. ENVIRONMENTAL INSTRUMENTATION. (2 cr; prereq 5210, 5240 or #)

Measuring environmental variables and analyzing energy and mass exchange based on such measurements. Operating environmental instruments and finding sources of error in measurements. Lecture, recitation, and instrumentation lab.

5232. SOIL PHYSICS: TRANSPORT PROCESSES IN SOIL. (4 cr; prereq Math 1142, 2 qtrs physics or #)

Fundamentals of soil physical properties and processes. Physical laws governing transport of water, chemicals, air, and heat in soils. Lecture, lab, problem-solving sessions.

5241. MICROCLIMATOLOGY. (3 cr; prereq Math 1031 or 10 cr physics or #)

Meteorology and climatology in relation to the soil-atmosphere interface with emphasis on the microclimate, physical processes taking place within the microclimate, modification of the microclimate description of meteorological instruments, and use of weather data.

5310. SOIL CHEMISTRY. (3 cr; prereq Chem 3100 or #)

Chemical processes in soil; composition of soil minerals and organic matter, solubility equilibria, adsorption/desorption, ion exchange, formation of soluble complexes, oxidation/reduction, acidity, alkalinity. Discuss solution of problems related to environmental degradation, plant nutrition, and soil genesis.

5311. SOIL CHEMISTRY LAB. (2 cr; §5310)

Lab exercises illustrate principles of soil chemistry discussed in 5310. Lab techniques used include pH, atomic adsorption spectrophotometry, ion specific electrodes, colorimetry, redox potential, and titration.

5360. SOIL CLAY MINERALOGY. (3 cr; prereq sr or grad)

Structural chemistry, origin, and identification of crystalline and noncrystalline soil clay materials. Extent, importance, and pedologic implications.

5361. SOIL CLAY MINERALOGY LABORATORY. (1-4 cr; prereq §5360, #)

Individual lab assignments emphasizing techniques of clay mineral identification and analysis. X-ray diffraction, electron optical, thermal, selective dissolution, FTIR spectroscopic, and other methods of analysis.

5424. APPLIED CLIMATOLOGY. (3 cr; prereq 5240 or Geog 3421 or #)

For advanced undergraduates and beginning graduate students who have a background in climatology or microclimatology principles. Sources of climatic data, methods of analysis, and selected set of specific applications focusing on agricultural and environmental management problems.

5510. FIELD STUDY OF SOILS FOR ENVIRONMENTAL ASSESSMENT. (4 cr; prereq 1020 or 3125 or #)

Field observation and identification of the morphological characteristics of soils. Interpretation of soil profiles for environmental assessment. Identification of soil landscapes and the influence of soil-forming factors on soil morphology. Lecture and field lab.

5515. SOIL DEVELOPMENT, CLASSIFICATION, AND GEOGRAPHY. (4 cr; prereq 3125 or #)

Soil profile characteristics; influence of parent material, climate, topography, vegetation, and time on soil development; system of soil classification and geographical distribution of soil orders.

5550. PEATLANDS: FORMATION, CLASSIFICATION, AND UTILIZATION. (3 cr; prereq 1020 or 3125 or #)

Formation, properties, and management of peatlands important to crop, forestry, and energy production in this state and worldwide. Lecture.

5555. WETLAND SOILS. (4 cr; prereq 1020 or 3125 or #)

Morphology, chemistry, hydrology and formation of mineral and organic soils in wet environments. Soil indicators of wet conditions and techniques for identifying hydric soils for wetland delineations. Field trips and delineation exercise; emphasis on peatlands; wetland benefits, preservation, regulation, and mitigation.

5560. INTERPRETATION OF LAND RESOURCES. (3 cr; prereq 5510 or #)

Techniques used in preparing soil maps of varying scales. Information available from soil maps and accompanying reports evaluated for use in agriculture, engineering waste treatment, forestry, and land planning. How soil survey and geographic information systems can be used to the fullest extent in land resource interpretation.

5600. PRINCIPLES OF WASTE MANAGEMENT. (4 cr; prereq Biol 1009 or Chem 1051, Stat 3011 or #)

Issues, problems, and solutions in remediating waste. Waste stream dynamics, municipal solid waste and yard waste composting, waste to energy incineration operation, ash disposal, recycling, landfill and direct land disposal requirements, regulatory trends, case studies.

5605. MICROBIAL ECOLOGY. (3 cr; prereq 5610 or Biol 5013 or MicB 5105 or #)

Interrelationship of microorganisms with terrestrial, aquatic, and organismal environments; survey of bacterial, fungal, and algal components of ecosystems; evolution and structure of microbial communities; population interactions within ecosystems; quantitative and habitat ecology; biogeochemical cycling; biotechnological approaches to studying microbial ecology.

5610. SOIL BIOLOGY. (4 cr; prereq sr or grad)

Soil environment and its biological population. Role of living organisms in soil-plant environment and mineral transformations of agronomic importance (carbon, nitrogen, phosphorus, sulfur, and heavy metals). Effects of soil microflora on soil fertility and plant nutrition. Lecture, lab, weekly discussion.

5611. SOIL BIOLOGY LABORATORY. (1 cr; §5610)

Lab exercises demonstrating principles discussed in 5610. Techniques include counting microbes in the soil, purification and classification of soil microorganisms, the role of earthworms in nutrient cycling, nodulation and N₂ fixation, serology.

5710. FOREST SOILS. (3 cr; prereq 1020 or 3125)

Factors affecting tree growth; estimation, modification, and management effects on site productivity; regeneration.

For Graduate Students Only

(For descriptions, see *Graduate School Bulletin*)

8000. SUPERVISED TEACHING EXPERIENCE**8111. COLLOQUIA IN SOIL SCIENCE****8112. COLLOQUIA IN SOIL SCIENCE II****8124. RESEARCH PROBLEMS IN SOILS****8128. SEMINAR****8250. ADVANCED SOIL PHYSICS****8330. ADVANCED SOIL CHEMISTRY****8400. ADVANCED TOPICS IN SOIL FERTILITY PLANT NUTRITION****8630. CURRENT TOPICS IN BIOLOGICAL NITROGEN FIXATION**

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

- * Courses in which graduate students may prepare Plan B projects.
- † All courses preceding this symbol must be completed before credit will be granted for any quarter of the sequence.
- § Credit will not be granted if credit has been received for the course listed after this symbol.
- ¶ Concurrent registration is required (or allowed) in the course listed after this symbol.
- # Registration Override Permit, completed and signed by the instructor, is required for registration.
- Δ Registration Override Permit, completed and signed by the department offering the course, is required for registration.
- H Honors course (follows the course number).
- f,w,s,su Following a course number, indicates fall, winter, spring, or summer terms.
- x Course may require more than one quarter to complete.

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

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

A comma between course numbers (e.g., 1234, 1235, 1236) indicates a series of courses that may be entered any quarter. In prerequisite listings, comma means "and" (e.g., "prereq 1101, 1102 or 1103" means the prerequisites are 1101 and either 1102 or 1103).

A prerequisite course listed by number only (e.g., prereq 5246) is in the same department as the course being described.

Statistics (Stat)

Offered by the College of Liberal Arts

1001f,w,s. INTRODUCTION TO IDEAS OF STATISTICS.

(4 cr; prereq high school higher algebra)
Controlled vs. observational studies; presentation and description of data; correlation and causality; sampling; accuracy of estimates; tests.

3011-3012f,w,s. STATISTICAL ANALYSIS.

(4 cr per qtr; prereq college algebra)
Descriptive statistics; elementary probability; estimation; one- and two-sample tests; correlation; regression. ANOVA; randomized blocks; multiple comparisons; factorial experiments; multiple regression; goodness of fit; nonparametric methods; contingency tables; selected topics.

3091f,w,s. INTRODUCTION TO PROBABILITY AND STATISTICS.

(4 cr, §5121, §5131; prereq differential and integral calculus)
Elementary probability and probability distributions, sampling and elements of statistical inference.

5021f,w,s. STATISTICAL ANALYSIS.

(5 cr, §3012; prereq college algebra or #)
Intensive version of 3011-3012. Primarily for graduate students needing statistics as a research technique.

5121-5122. THEORY OF STATISTICS.

(5 cr per qtr, §5131-5132-5133; prereq Math 1252)
Univariate and multivariate distributions, law of large numbers, sampling, likelihood methods, estimation and hypothesis testing, regression and analysis of variance, confidence intervals, distribution-free methods.

5131f-5132w-5133s. THEORY OF STATISTICS.

(4 cr per qtr, §5121-5122; prereq Math 3252)
5131: Probability models, univariate and bivariate distributions, independence, basic limit theorems. 5132-5133: Statistical decision theory, sampling, estimation, testing hypotheses, parametric and nonparametric procedures for one-sample and two-sample problems, regression, analysis of variance. Treatment more mathematical than that in 5121-5122.

5201w. SAMPLING METHODOLOGY IN FINITE POPULATIONS.

(4 cr; prereq 3091 or 5021 or 5121 or #)
Simple random, systematic, stratified, and unequal probability sampling. Ratio and regression estimation. Multistage and cluster sampling.

5211. THEORY OF SAMPLE SURVEYS.

(4 cr; prereq 5122 or 5133 or 5153)
Mathematical treatment of survey sampling, including stratified and multistage sampling; models for nonsampling errors.

5271. BAYESIAN DECISION MAKING.

(4 cr, prereq ¶5122 or ¶5132 or ¶5152)
Axioms for personal probability and utility. Elements of statistical decision theory. Bayesian analysis of linear models.

5301. DESIGNING EXPERIMENTS.

(5 cr, §5163; prereq 3012 or 5021 or 5133 or 5153 or #)
Control of variation, construction, and analysis of complete and incomplete block, split plot, factorial, and groups of similar experiments. Confounding, crossover, and optimum-seeking designs.

5302. APPLIED REGRESSION ANALYSIS.

(5 cr, §5161; prereq 3012 or 5021 or 5133 or #)
Simple, multiple, and polynomial regression. Estimation, testing, and prediction. Stepwise and other numerical methods; examination of residuals; weighted least squares; nonlinear models; response surface. Experimental research and economic applications.

5401. INTRODUCTION TO MULTIVARIATE METHODS.

(4 cr; prereq 5133, 5153 or 5302)
Bivariate and multivariate distributions. Inference based on multivariate normal distributions. Discrimination and classification. Multivariate analysis of variance. Partial, canonical correlation and independence. Principal component analysis, factor analysis, analysis of repeated measurements, cluster analysis, profile analysis.

5421. ANALYSIS OF CATEGORICAL DATA.

(4 cr, §5162; prereq 3012 or 5021 or 5133 or #)
Varieties of categorical data, cross-classifications and contingency tables, tests for independence. Multidimensional tables and log-linear models, maximum-likelihood estimation, tests of goodness of fit. Analysis of Markov chain data. Smoothing counts.

5601. NONPARAMETRIC METHODS.

(4 cr; prereq 5021 or 5122 or 5132 or 5152 or #)
Survey of necessary discrete and continuous probability distributions. Goodness of fit, sign tests, order statistics, rank tests for location and for scale, two-sample and k-sample comparisons, association. Emphasis on methods and applications.

5900. TUTORIAL COURSE.

(Cr ar; prereq #)
Study in areas not covered by regular offerings. Directed study.

5911-5912-5913. TOPICS IN STATISTICS.

(3 cr per qtr [may be repeated for cr with Δ]; prereq 3091 or 5021, #)
Topics vary.

Veterinary Medicine, College of (CVM)

Offered by the College of Veterinary Medicine

1100. ORIENTATION TO VETERINARY MEDICINE.

(1 cr)
History of the veterinary profession, careers within the profession, employment trends. Resources available to those interested in a career in the profession, including the College of Veterinary Medicine and animal health technology courses offered in Minnesota.

3100. PERSPECTIVES: INTERRELATIONSHIPS OF PEOPLE AND ANIMALS IN SOCIETY TODAY.

(2 cr)
(Same as PubH 3301 and 5301) Interrelationships of people and animals from several viewpoints. The social, economic, and health consequences of these relationships, including issues such as pets and people sharing an urban environment, animal rights, and the influence of cultural differences on animal-human relationships.

Veterinary Pathobiology (VPB)

Offered by the College of Veterinary Medicine

3103. GENERAL MICROBIOLOGY.

(3-5 cr; prereq 4 cr biol sci, 10 cr chem; not open to vet med students)
Lectures and lab exercises on the morphology, taxonomy, genetics, physiology, and ecology of microorganisms. Practical application of fundamental principles of microbiology to other phases of science and industry.

5140. (VB) VERTEBRATE MICROANATOMY.

(1-6 cr; prereq 5120 or #)
Microscopic structure and cytochemical and functional aspects of cells, tissues, and organs of representative examples of vertebrates. Four units: basic tissues (2 cr); gastrointestinal tract (1 cr); respiratory and integumentary systems (1 cr); and excretory, reproductive, and endocrine systems (2 cr). Depending on background and interest, students may register for any or all units.

5320. (VB) AVIAN PHYSIOLOGY.

(5 cr; prereq AnSc 3301 or 6 cr systemic phys or equiv, #; offered even yrs)

Physiology of wild and domestic birds.
5603. PARASITES OF WILDLIFE. (2 cr; prereq 5601, 5602 or #; offered odd yrs)
In-depth examination of the epidemiology and disease potential of some of the more significant helminth, arthropod, and protozoan parasites of regional wild mammals and birds. Term paper required.

5707. POULTRY DISEASE CONTROL.

(3 cr; prereq AnSc 1100, Biol 1106, VPB 3103 or equiv; not open to vet med students)
General anatomy; physiology of digestion and reproduction; prevention and control of the more important diseases affecting poultry.



Directory

Equal Opportunity—The University of Minnesota is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, color, creed, religion, national origin, sex, age, marital status, disability, public assistance status, veteran status, or sexual orientation.

In adhering to this policy, the University abides by the Minnesota Human Rights Act, Minnesota Statute Ch. 363; by the Federal Civil Rights Act, 42 U.S.C. 2000e; by the requirements of Title IX of the Education Amendments of 1972; by Sections 503 and 504 of the Rehabilitation Act of 1973; by the Americans With Disabilities Act of 1990; by Executive Order 11246, as amended; by 38 U.S.C. 2012, the Vietnam Era Veterans Readjustment Assistance Act of 1972, as amended; and by other applicable statutes and regulations relating to equality of opportunity.

Inquiries regarding compliance may be directed to Patricia A. Mullen, Director, Office of Equal Opportunity and Affirmative Action, University of Minnesota, 419 Morrill Hall, 100 Church Street S.E., Minneapolis, MN 55455 (612/624-9547).

Bulletin Use—The information in this bulletin and other University bulletins, publications, or announcements is subject to change without notice. University offices can provide current information about possible changes.

This publication is available in alternative formats upon request. Please contact the Office of Admissions, University of Minnesota, 240 Williamson Hall, 231 Pillsbury Drive S.E., Minneapolis, MN 55455 (612/625-2008).

This bulletin also is available in electronic format on Internet and may be accessed via Gopher.

Immunization—Students born after 1956 who take more than one University class are required under Minnesota law to submit an Immunization Record form.

The form, which is sent along with the official University admission letter, must be filled out and returned to Boynton Health Service within 45 days of the first term of enrollment in order for students to continue registering for classes at the University. Complete instructions accompany the form.

Extracurricular Events—No extracurricular events requiring student participation may be scheduled from the beginning of study day to the end of finals week. Exceptions to this policy may be granted by the Senate Committee on Educational Policy. The Senate advises all faculty that any exemption granted pursuant to this policy shall be honored and that students who are unable to complete course requirements during finals week shall be provided an alternative and timely opportunity to do so.

Smoke-Free Campus Policy—Smoking is prohibited in all facilities of the University of Minnesota, Twin Cities campus except for designated private residence hall rooms.

Departments

The College of Agriculture is organized by academic departments. Each department is made up of faculty with teaching, research, and extension interests that correspond with the department's academic discipline(s). Following is a list of departments in the College of Agriculture. Several departments and units also have formal affiliations or administrative links to colleges outside of Agriculture: Agricultural Education with the College of Education(COE), Agricultural Engineering with the Institute of Technology (IT), Food Science and Nutrition with the College of Human Ecology (CHE).

Each of the Departments in COA offers courses and most have ties with several of the undergraduate majors offered by the college. If you are interested in a major with ties to a specific department or academic discipline, you will find a reference list below along with the department location.

Department Directory

Agricultural and Applied Economics

James Houck, head
231 Classroom Office Building
1994 Buford Avenue
St. Paul, MN 55108
612/625-0231

Affiliated majors

- Applied Economics (pp. 19, 42)
- Agricultural Business Management (pp. 9, 32)
- Agricultural Industries and Marketing (pp. 14, 37)

Agricultural Education

Edgar A. Persons, head
320 Vocational-Technical Education Building
1954 Buford Avenue
St. Paul, MN 55108
612/624-2221

Affiliated majors

- Agricultural Education (COE) (pp. 11, 34)
- Agricultural Development (COE) (pp. 11, 34)
- Natural and Managed Environmental Systems (COE) (pp. 11, 34)

Agricultural Engineering

R. Vance Morey, head
213 Agricultural Engineering
1390 Eckles Avenue
St. Paul, MN 55108
612/625-7733

Affiliated majors

- Agricultural Engineering (IT) (pp. 54)
- Environmental Science (pp. 20, 43)
- Food Science (pp. 22, 44)

Agronomy and Plant Genetics

Kent Crookston, head
411 Borlaug Hall
1991 Upper Buford Circle
St. Paul, MN 55108
612/625-8761

Affiliated majors

- Agricultural Industries and Marketing (pp. 14, 37)
- Animal and Plant Systems (pp. 16, 39)
- Science in Agriculture (pp. 24, 47)

Animal Science

Richard D. Goodrich, head
122 Peters Hall
1404 Gortner Avenue
St. Paul, MN 55108
612/624-1205

Affiliated majors

- Agricultural Industries and Marketing (pp. 14, 37)
- Animal and Plant Systems (pp. 16, 39)
- Science in Agriculture (pp. 24, 47)

Entomology

Mark Ascerno, head
219 Hodson Hall
1980 Folwell Avenue
St. Paul, MN 55108
612/624-3278

Affiliated majors

- Agricultural Industries and Marketing (pp. 14, 37)
- Animal and Plant Systems (pp. 16, 39)
- Science in Agriculture (pp. 24, 47)

Food Science and Nutrition

Francis F. Busta, head
225 Food Science and Nutrition
1334 Eckles Avenue
St. Paul, MN 55108
612/624-3086

Affiliated majors

- Agricultural Industries and Marketing (pp. 14, 37)
- Food Science (pp. 22, 44)
- Nutrition (pp. 23, 45)

Horticultural Science

Gary Gardner, head
305 Alderman Hall
1970 Folwell Avenue
St. Paul, MN 55108
612/624-3606

Affiliated majors

- Agricultural Industries and Marketing (pp. 14, 37)
- Animal and Plant Systems (pp. 16, 39)
- Science in Agriculture (pp. 24, 47)

Plant Pathology

Neil A. Anderson
495 Borlaug Hall
1991 Upper Buford Circle
St. Paul, MN 55108
612/625-8200

Affiliated majors

- Agricultural Industries and Marketing (pp. 14, 37)
- Animal and Plant Systems (pp. 16, 39)
- Science in Agriculture (pp. 24, 47)

Rhetoric

Billie J. Wahlstrom, head
202 Haecker Hall
1364 Eckles Avenue
St. Paul, MN 55108
612/624-7750

Affiliated majors

- Agricultural Industries and Marketing (pp. 14, 37)
- Scientific and Technical Communication (pp. 27, 50)

Soil Science

H.H. Cheng, head
439 Borlaug Hall
1991 Upper Buford Circle
St. Paul, MN 55108
612/625-9734

Affiliated majors

- Agricultural Industries and Marketing (pp. 14, 37)
- Animal and Plant Systems (pp. 16, 39)
- Environmental Science (pp. 20, 43)
- Science in Agriculture (pp. 24, 47)

University Regents

Jean B. Keffeler, Minneapolis, Chair
 Thomas R. Reagan, Gilbert, Vice Chair
 Wendell R. Anderson, Wayzata
 Julie A. Bleyhl, Madison
 William E. Hogan II, Minnetonka
 Hyon T. Kim, St. Anthony
 H. Bryan Neel III, Rochester
 Mary J. Page, Olivia
 Lawrence J. Perlman, Minneapolis
 William R. Peterson, Eagan
 Darrin M. Rosha, Owatonna
 Stanley D. Sahlstrom, St. Cloud

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Nils Hasselmo, President
 Robert O. Erickson, Senior Vice President for Finance and Operations
 Ettore F. Infante, Senior Vice President for Academic Affairs and Provost
 C. Eugene Allen, Vice President for Agriculture, Forestry, and Home Economics
 William R. Brody, Provost for the Academic Health Center
 Melvin George, Vice President for Institutional Relations
 Anne H. Hopkins, Vice Provost for Arts, Sciences, and Engineering
 To be announced, Vice President for Student Affairs
 Mark Brenner, Acting Vice President for Research and Acting Dean of the Graduate School
 Mark B. Rotenberg, General Counsel

College of Agriculture Administrators

Richard L. Jones, Dean
 Laurie Hayes, Associate Dean, Curricular and Student Affairs
 Michael Martin, Associate Dean for Research, Asst. Director, MAES
 Gerald Miller, Associate Dean, Extension
 Jean Underwood, Director, Career Services
 Annette Day, Director, Prospective Student Services
 Mark Bultmann, Director, Student Services

Administrative Offices

College of Agriculture Office

University of Minnesota
 277 Coffey Hall
 1420 Eckles Avenue
 St. Paul, MN 55108

Student Services

612/624-3009

Career Services

612/624-2710

Prospective Student Services

General Information

612/624-3045

Transfer Students

Annette Day
 612/624-4748

High School Students

Gina Bari
 612/624-4755

Office of Admissions

University of Minnesota
 240 Williamson Hall
 231 Pillsbury Drive S.E.
 Minneapolis, MN 55455
 612/625-2008

Office of Student Financial Aid

University of Minnesota
 199 Coffey Hall
 1420 Eckles Avenue
 St. Paul, MN 55108
 612/624-1665

Major Program Coordinators

Agricultural Business Management

Vernon Eidman, Coordinator
 316 Classroom Office Building
 1994 Buford Avenue
 St. Paul, MN 55108
 612/625-5229

Agricultural Education

Roland Peterson, Coordinator
 320m Vocational-Technical Education Building
 1954 Buford Avenue
 St. Paul, MN 55108
 612/624-2221

Agricultural Industries and Marketing

Delane Welsch, Coordinator
 130 Classroom Office Building
 1994 Buford Avenue
 St. Paul, MN 55108
 612/625-3713

Animal and Plant Systems

Bert T. Swanson, Coordinator
 164 Alderman Hall
 1970 Folwell Avenue
 St. Paul, MN 55108
 612/624-7432

Applied Economics

Kent Olson, Coordinator
 316 Classroom Office Building
 1994 Buford Avenue
 St. Paul, MN 55108
 612/625-7723

Environmental Science

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 439 Borlaug Hall
 1991 Upper Buford Circle
 St. Paul, MN 55108
 612/625-7747
 E-mail: terry.cooper@soils.umn.edu

Food Science

Zata M. Vickers, Coordinator
 225 Food Science and Nutrition
 1334 Eckles Avenue
 St. Paul, MN 55108
 612/624-2257

Nutrition

Linda Brady, Coordinator
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 612/624-7455

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 202 Haecker Hall
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College of Agriculture Faculty

Agricultural and Applied Economics Professor Emeritus

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Associate Professor Emeritus

Carl Borgeson, M.S.

Professor

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Maria Gallo-Meagher, Ph.D.
Jeffery L. Gunsolus, Ph.D.

Adjunct Associate Professor

Frank Forcella, Ph.D.

Adjunct Assistant Professor

Mark Westgate, Ph.D.

Animal Science

Professor Emeritus

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Charles W. Young, Ph.D.

Professor

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Bo G. Crabo, Ph.D.
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Richard J. Epley, Ph.D.
Melvin L. Hamre, Ph.D.
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Jerry D. Hawton, Ph.D.
‡Alan G. Hunter, Ph.D.
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Jay C. Meiske, Ph.D.
Sally L. Noll, Ph.D.
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Richard E. Phillips, Ph.D.
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