

College of Agriculture

UNIVERSITY OF MINNESOTA

BULLETIN

1993 - 1994



On the cover:

**Makeba Tate is a
senior in the College
of Agriculture
majoring in applied
economics.**

**The College of
Agriculture develops
leaders for tomorrow
with extensive and
active learning
experiences in:**

- ❖ Communication**
- ❖ Critical Thinking**
- ❖ Disciplinary
Knowledge**
- ❖ International
Perspective**
- ❖ Ethics and Values**

College of Agriculture

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Introduction

Resources

This annual bulletin, the official source of information about the College of Agriculture, should be kept handy for repeated reference. Its contents and the contents of other University bulletins, publications, or announcements are subject to change without notice. University offices can provide current information about possible changes.

In addition, students are expected to be aware of the following resources:

College Office—For more information about policies and program requirements, check with the College of Agriculture Office, 277 Coffey Hall, 1420 Eckles Avenue, St. Paul, MN 55108 (612/624-3009).

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

Class Schedule—Each quarter you may pick up a *Class Schedule* with other registration materials in the College of Agriculture Office. This publication lists University day school courses complete with hours, rooms, instructors, prerequisites, registration instructions, fees, maps, final exam schedules, grading definitions, and other valuable information.

Other Bulletins—Evening and summer courses are featured in the *Continuing Education and Extension Classes Bulletin* and *Summer Session Bulletin*, respectively. Separate bulletins are also published for other University colleges. Most may be obtained from the Office of the Registrar—St. Paul, 130 Coffey Hall.

Policies

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, 420 S.C. 20000e; by the requirements of Title IX of the Education Amendments of 1972; by Sections 503 and 504 of the Rehabilitation Act of 1973; 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).

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.

Postal Statement

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Directory

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

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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
197 Coffey Hall
1420 Eckles Avenue
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612/624-1665

Major Program Coordinators

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Introduction

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Agronomy and Plant Genetics

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Entomology

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Food Science and Nutrition

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St. Paul, MN 55108
612/624-3086

Horticultural Science

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1970 Folwell Avenue
St. Paul, MN 55108
612/624-3606

Plant Pathology

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495 Borlaug Hall
1991 Upper Buford Circle
St. Paul, MN 55108
612/625-8200

Rhetoric

Billie J. Wahlstrom, head
202 Haecker Hall
1364 Eckles Avenue
St. Paul, MN 55108
612/624-7750

Soil Science

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439 Borlaug Hall
1991 Upper Buford Circle
St. Paul, MN 55108
612/625-9734

General Information



General Information



Program Offerings

The College of Agriculture offers 10 major programs taught and administered cooperatively by the faculty and staff of its 11 academic departments.

The goal of COA 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.

The major programs offered are interdisciplinary and prepare students graduating from COA to be:

- proficient and competent in a major and capable of making sound professional analyses, judgments, and decisions.
- able to communicate effectively.
- aware of contemporary and historical issues and able to relate these to agriculture and the use of natural resources.
- able to discern relationships among current issues and be capable of participating constructively in discussion and resolution of these issues.

- able to appreciate and understand creative expressions through literature and the arts.
- motivated and equipped to continue to learn and to provide professional leadership for the benefit of agriculture and society.

Undergraduate programs are offered in the following areas:

- **Agricultural Business Management** is offered jointly with the Carlson School of Management for students interested in management, marketing, and sales with food, chemical, pharmaceutical, grain merchandising, or financial institutions. Students are admitted to this major in their junior year.

- **Agricultural Education** is offered jointly with the College of Education for students interested in agricultural teaching, extension and human resource occupations, or domestic or international agriculture development.

- **Agricultural Industries and Marketing** is for students interested in sales, public relations, marketing and sales, production management, or purchasing management in food, horticultural, and agricultural production industries. The curriculum is a balance of agriculture, business, and communication.

• **Animal and Plant Systems** is for students who want careers in bachelor's-degree level professional positions requiring a thorough understanding of the production aspects of agriculture. Students may choose an emphasis in: animal production, crops, soils, and horticultural food production; environmental horticulture; or integrated pest management.

• **Applied Economics** is for students who want a broad, liberal education and preparation for work in business or public service. This major offers study in economic principles.

• **Food Science** is for students who want to become involved in aspects of the food industry that include processing, quality assurance, and consumer issues.

• **Natural Resources and Environmental Studies** is offered jointly with the College of Natural Resources for students interested in an interdisciplinary approach to the identification and management of natural resources. Career options include working for organizations responsible for the use, protection, and management of natural resources.

• **Nutrition** is for students interested in the field of nutrition and its applications in dietetics, public health, and nutrition science. Students in this major may become qualified to become Registered Dietitians.

• **Science in Agriculture** is for students who want a postbaccalaureate degree in agricultural, veterinary, or medical science; it is also for students interested in scientific careers in industry, government, or academia requiring only a baccalaureate degree.

• **Scientific and Technical Communication** is for students interested in pursuing careers in scientific or technical writing, editing, and other communication positions. Students may specialize in agricultural writing or other technical or scientific field.

Students with an interest in one of four additional areas listed below may begin their study in COA, complete prerequisites, and apply for admission to the college offering the program:

- agricultural engineering major (Institute of Technology)
- College of Biological Sciences majors
- landscape architecture major (College of Architecture and Landscape Architecture)
- College of Veterinary Medicine program (Students complete CVM prerequisites while pursuing one of the COA majors listed above.)

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, contact Prospective Student Services (612/624-3045).

Deadlines—The Office of Admissions will accept applications for fall quarter 1994 **beginning October 1, 1993** and will admit students as long as space is available. Students who meet the admission requirements and apply by December 15, 1993 will be guaranteed space in the fall quarter 1994 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 generally accepted from transfer students only.

High School Graduates—High school graduates planning to begin their studies as freshmen fall quarter 1993 or later will be expected to have completed as a minimum the following courses while in grades 9-12:

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- *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:

<i>Formula</i>	<i>Minimum Score</i>
HSR Percentile + (2 x ACT Composite score)	110
HSR Percentile + (SAT Verbal / 10) + (SAT Math / 10)	150

Applicants with at least one of the minimum scores will be admitted routinely, provided they meet the course requirements. Others will be reviewed on an individual basis.

Freshmen applicants from Minnesota, Wisconsin, North Dakota, and South Dakota must submit ACT scores.

Tuition Deposit—If you are admitted to the 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 within four 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 in 1987 or later and wish to be admitted must have:

- *Passed intermediate algebra with a grade of C or better*

- *At least a C average in transfer coursework*

- *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 high school, 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, you must have:

- *Passed intermediate algebra with a grade of C or better*

- *At least a C average in 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 Programs section and take special note of the Distribution Requirements section. 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 COA entrance requirements. 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.

Students of Color Admission—The COA seeks applications from students of color.

Adult Special Students—If you wish to register for courses to meet particular needs and are not interested in working toward a degree, you may enter the college as an adult special. College approval is required. Normally, adult special students are not enrolled for an extended period, but only as necessary to acquire the specific training desired. You must register for COA courses to be admitted as an adult special student.

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 your adviser.
- 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.

General Information

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 University Office of Admissions (612/625-2008) 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 should contact the admissions officer in the college of transfer for information about how appeals can be made.

- At your request, a review of your eligibility for financial aid or scholarships.

For help with your transfer questions or problems, see your adviser.

Financial Aid

Student financial aid 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 (FAFSA) 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 returned to OSFA by April. Exact deadlines are in the application packet.

For an application packet and more information, contact OSFA. 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

Full-time students pursuing a degree in COA who are in good academic standing may apply for the scholarships listed below. These scholarships are awarded on the basis of scholastic achievement, financial need, professional goals, participation in school or community activities, and other criteria. To be considered for scholarships based on financial need, students must have an FAFSA statement on file in OSFA. Incoming students should apply for financial aid when they apply for admission to the college.

Scholarship awards may vary depending on earnings and availability of funds. Those available to incoming freshmen and/or transfer students are normally notified of scholarships awarded the spring before the academic year of their use. Contact the COA Office for application information. Scholarships presently offered include:

African Women Technical Training Fund—designed to fund costs (exclusive of tuition) of sponsoring African women in pursuit of an undergraduate degree in agriculture and/or natural resource management.

Agricultural Merit Scholars Program—designed to seek out and nurture outstanding students interested in pursuing a career in agriculture. It supports new freshmen and transfer students who demonstrate both

academic achievement and leadership qualities. Depending on availability of funds, continuing students will be also be invited to apply. Approximately 50 awards of \$1,500 to \$3,000 are given. Corporate sponsors include:

*American Dairy Association of Minnesota
Cenex/Land O'Lakes Agricultural Services
The Dow Chemical Company Foundation
Farm Credit Services of St. Paul
Farmers Elevator Association of Minnesota
Freeborn Foods Company
Harvest States Foundation
George A. Hormel and Company
Keltgen Seed Company
LeSueur Cheese Company
Marigold Foods, Inc.
Monsanto Agricultural Products Company
Northwest Agri-Dealers Association, Inc.
Old Dutch, Inc.
Rahr Malting Company
Schwan's Sales Enterprises*

Additional awards are provided from the following bequests, memorial gifts, and endowments honoring Fordyce Ely, Helen Spinks Henton, Esther E. Johnson, Harry Kay, Herman H. Jolosky, Andreas H. Ostlie, the Robinson brothers, and the Eberle Scholarship Award of the St. Paul Foundation.

Thomas H. Canfield Memorial Scholarships—for students in good standing with a demonstrated financial need.

Cenex Foundation Cooperative Studies Scholarships—for upper division students with coursework in cooperative principles and cooperative business practices, excellent academic record, and demonstrated leadership qualities.

A.F. Crow Hybrid Corn Agricultural Scholarships—for outstanding undergraduate students in COA.

Austin and Isabell Dowell Scholarships—for deserving students in COA.

Farm Credit Services Scholarships—for upper division students with an expressed interest in cooperative agri-business or agricultural finance. Based on scholastic

General Information

excellence, leadership activities, and community involvement.

James L. and Laura R. Garvey Scholarships—for deserving men (James L. Garvey Scholarship) and women (Laura R. Garvey Scholarship) students in COA.

John and Caroline Gluck Scholarships—for a sophomore with an interest in problems and issues of rural life.

Axel Hansen Memorial Scholarships—to assist students from Denmark or other Scandinavian countries to study agriculture in the college.

Kenneth Lee Sophomore Scholarship—for a sophomore male student pursuing a degree in agriculture.

Students of Color Merit Scholars Program—for African American, Chicano Latino, Native American, or Asian American students on the basis of academic achievement and leadership potential.

Moorman Manufacturing Company Scholarships—for undergraduates who show special promise for professional work in agriculture based on past record, record of participation in extracurricular activities, demonstrated leadership qualities, and financial need.

Northwest Feed Manufacturers Association Scholarships—for upper division students showing promise in contributing to improvement of nutrition of livestock and/or poultry, participating in extracurricular activities, and exhibiting leadership qualities and financial need.

William H. and Georgia B. Olson Scholarship—for students in COA with criteria determined by the Scholarship Committee.

Orscheln Farm and Home Supply-Minnesota FFA Scholarships—for entering freshmen from Chippewa, Kandiyohi, Steele, Swift, or surrounding counties, who have been a member of Minnesota FFA for four years.

Augustus L. Searle Scholarships—for women in the college with preference given to Minnesota residents.

Myrtle V. Shisler Agricultural Scholarship—for students who have been members of the Cedar Brook 4-H Club or residents of Aitkin County, Minnesota.

Elizabeth B. Ukkelberg Scholarships—for children of employees of John Deere Company or its independent agricultural, industrial or consumer products dealers in the United States.

John Williams Memorial Scholarships—for upper division students in COA.

Handicapped Students

Wherever possible, special consideration is given to handicapped 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, 12 Johnston Hall (612/624-4037).

Orientation-Registration

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

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 Request for Special Examination applications.

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 or the COA Office, to change registration. Make all such changes as early as possible in the quarter. *Note:* Cancel/adds are official only if you use course request forms from the Office of the Registrar.

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 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 honor point deficiency incurred with cancellation.) If a cancellation is approved, a W is assigned.

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.*

General Information

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, 240 Williamson Hall, 231 Pillsbury Drive S.E., University of Minnesota, 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 GPA of not less than 2.00) is required. To carry more than 21 credits, a B average (3.00 GPA) in work of the previous quarter and permission from the Scholastic Standing Committee are required. Undergraduates must carry at least 12 credits each quarter to be considered full-time students.

Class Attendance—Attendance for certain classes in the 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 the University 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, 316 Johnston Hall, University of Minnesota, 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 gives 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 deepen and enrich their backgrounds through a COA Honors Experience Course (AGRI 3100H) that is student-designed to meet their special interests and 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.

Overseas Study-Travel—Students are encouraged to include a foreign study-travel experience in their undergraduate curriculum. Scholarships are available to help defray costs. A written report is required. Preference is given to proposals for overseas study-travel in non-English speaking countries. Check with the COA Office for more information.

Study-Travel Opportunity Program—This program offers financial assistance to undergraduate agriculture students. If you plan a study-travel project, it should complement your academic program but provide a different experience from course field trips. You must initiate and plan the project yourself with the aid of a faculty sponsor. For more information, check with the COA Office.

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 for students who wish to reinforce their academic experience by working in an area related to their course of

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study. Students work full time either fall, winter, or spring quarter or during the summer. They earn four credits for satisfactory completion of a PEP program and may enroll in two PEP programs for a total of eight 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 four minor concentrations that enhance the major programs of students in agriculture or non-agriculture areas.

Agriculture Minor 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 helps 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.

Minor in Agricultural Issues and Values—The minor in agricultural issues and values is a multidisciplinary program based in the humanities. It both complements professional and scientific major degree programs in agriculture and serves 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.)

For assistance in planning a minor in agricultural issues and values, see the faculty adviser in the Department of Rhetoric.

Students must complete 26 credits.

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 Policy (4)

AgEc 5710—Agricultural: Farm, Food, and Environmental Policy (3)

AgEd 5010—Rural Education: Philosophy and Leadership (3)

Agro 5200—World Food Problems (3)

AnSc 3113—Animal Welfare (4)

CAPS 3502—Animal Health and Disease (5)

Ent 1001—Insects and Society (3)

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 Minor—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 Minor—

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 socioeconomic 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 the 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 (3)
 PIPa 5002—Introductory Plant Pathology for Advanced Students (5)

Crops, Soils, and Water

AgET 5410—Hydrology and Water Quality (5)
 Agro 3010—Adaptation, Distribution, and Ecology of Field Crops (4)
 Soil 3416, 3417—Soil Fertility and Laboratory (4,1)
 Soil 5610—Soil Biology (4)

Agricultural Economics

AgEc 3420—Grain Marketing Economics (4)
 AgEc 3430—Dairy Marketing Economics (3)
 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/Agro 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)

30 total credits required for sustainable agriculture minor

The college also offers minor concentrations in eight 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, Soil Science, and Sustainable Agriculture.

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.

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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 in the second section.

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

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

The following principles have been adopted as a guide for 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% 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 requires adviser, instructor, and Scholastic Standing Committee approval. It is rarely permitted unless extenuating circumstances exist.

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, probation contract, and suspension. 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*.

A student is also 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 received. If the contract goals are met, and 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*.

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 circumstance 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 subcommittees of the college Scholastic Standing Committee may be appealed to the college Scholastic Standing Committee, whose decisions in turn may be appealed to the COA dean.

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

When a case of scholastic dishonesty arises, the 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 Standing Committee for disposition. In any case, the instructor must report the incident and the action taken by the instructor to the college Scholastic Standing Committee. At the time of the action, the student is informed by the instructor of his or her right to ask for a hearing by the Scholastic Standing Committee. Information on this process is available from the COA Office.

The Scholastic Standing Committee reviews all reports of academic dishonesty

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

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

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

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 grade point average 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.

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 and fee 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*—3.40 GPA for all coursework in COA plus honors requirements.

- *Magna Cum Laude*—3.60 GPA for all coursework in COA plus honors requirements.

- *Summa Cum Laude*—3.80 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

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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 COA student, 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.

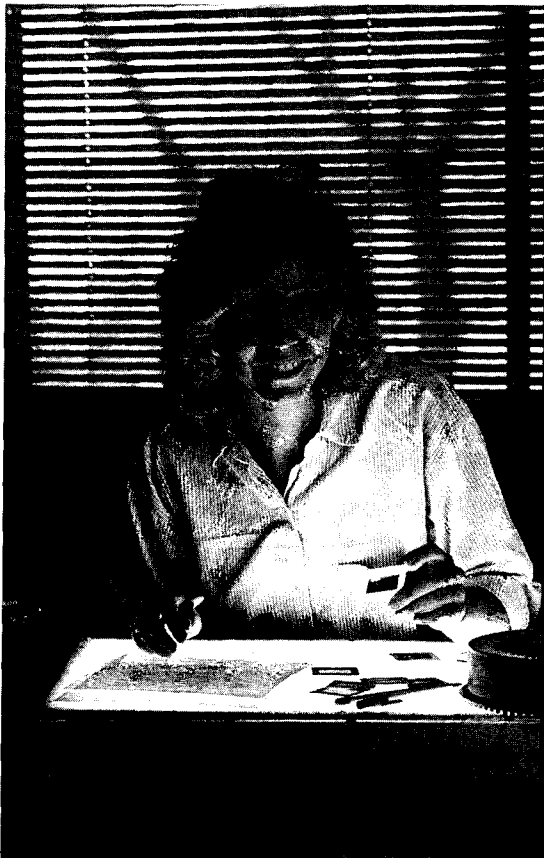
Agricultural Ambassadors—This group of selected undergraduate COA students volunteer their time to serve as goodwill ambassadors for the college and its students. They foster communications among the college, prospective students, and the community at large. Each ambassador gains experience in public 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.

College of Agriculture

Distribution Requirements



Distribution Requirements

All-College Requirements

(These requirements apply to all COA 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, COA 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 *you should not expect to petition out of even 1 credit in any category.*

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 many 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 COA Office, 277 Coffey Hall (612/624-3009).

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

To graduate from COA, 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 COA student, 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—14 credits (A-F)

To graduate from COA, you must complete a minimum of 14 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 COA, 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 COA Office, 277 Coffey Hall (612/624-3009).

(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 1313, 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



Distribution Requirements

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

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 dealing 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

D. Literature, Humanities, and Fine

Arts—8 credits (may be taken S-N)

To graduate from COA, 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.

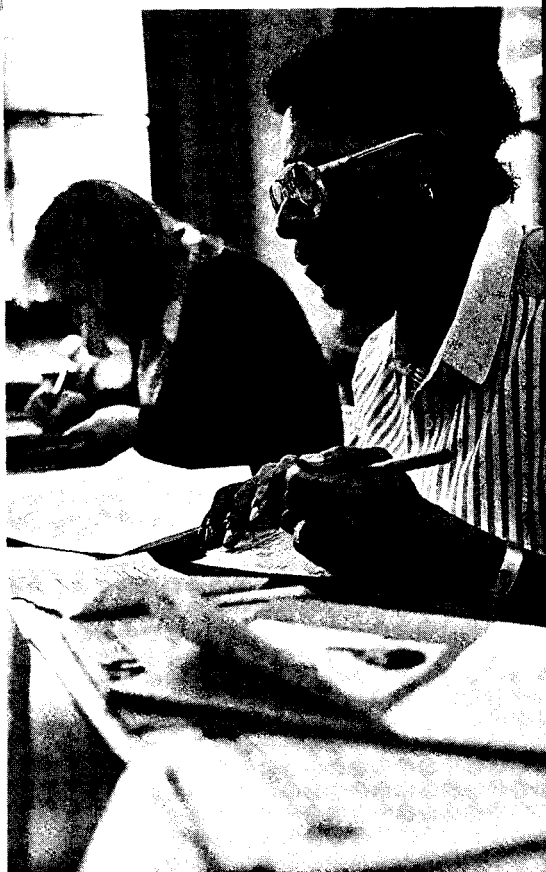
Therefore, you may not apply such courses as Fundamentals of Music; Voice; Class Lessons; Band; Basic Visualization; Drawing; Design; or Introduction to Creative Writing.

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 COA Office, 277 Coffey Hall (612/624-3009).

Afro 1301, 3105, 3108, 3591, 3592, 3601, 3701, 3702,
5181, 5182, 5201, 5301, 5341, 5593, 5595, 5596,
5597
AmIn 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

College of Agriculture

Programs



Programs

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

The preceding Distribution Requirements section contains information on *All-College Requirements*.

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

IDSs: 1010 and OMS 1020

Math 1142 or 1251

- (3) Earn a minimum GPA of 2.80 in all coursework. *Note:* Although you only need a 2.00 GPA to be admitted to COA, a 2.80 GPA is required for acceptance to the major.

Students will retain pre-major status until they are formally accepted into the major program. It is important to keep in mind that you cannot graduate from COA unless you are officially enrolled in a major in the college.

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 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 COA 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 the 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 24.
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 24.

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)

Programs

- AgEc 3002—Applied Microeconomics: Managerial Economics (4)
AgEc 3003—Applied Microeconomics: Markets and Prices (4)
AgEc 3006—Applied Macroeconomics: Government and the Economy (4)
AgEc 3007—Applied Macroeconomics: Policy, Trade, and Development (4)
AgEc 3240—Farm and Agribusiness Strategic Management (4)
AgEc 3260—Agribusiness Operations Management (4)
AgEc 3500—Agribusiness Finance (4)
Three 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)
OMS 3000—Introduction to Operations 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 (3)

- 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)
OMS 3000—Introduction to Operations 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 at the 3xxx or 5xxx level. 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
1954 Buford Avenue
St. Paul, MN 55108
612/624-2221

The undergraduate major in agricultural education, offered jointly by COA and the College of Education, is for students who plan to teach agriculture, horticulture, agribusiness, food systems, natural resources, 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. It also, in the education specialization, 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 in the Division of Agricultural Education, 320 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 Agricultural Education Specialization. Students in this option 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 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 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), a test of basic reading, writing, and mathematics knowledge.

The Agricultural Development Specialization. Students in this option 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 option 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, 130 Coffey Hall, University of Minnesota, 1420 Eckles Avenue, St. Paul, MN 55108. COA will review the application

Programs

and evaluate the credits earned. During the first quarter of enrollment in COA, students apply for admission to the College of Education.

Clinical Experience

In 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 agricultural education specialization. They must have an overall GPA of 2.30 to graduate from the agricultural development specialization.

Work Experience

Students applying for agricultural education licensure must have satisfactory work experience in agriculture production and agribusiness. The Division of Agricultural Education's Occupational Experience Committee evaluates student experiences. 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 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 categories E and F require the approval of the adviser and the College of Education. Changes in category G and H may be made with the adviser's recommendation and approval of the Division of Agricultural Education head.

Agricultural Education Specialization and Agricultural Development Specialization Options

A. Communication, Language, Symbolic Systems—25 credits

Agri 1200—Computer Applications in Your Profession (3)

Math 1031—College Algebra and Probability (4)

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)

Plus one from 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)

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:

Psy 1001—General Psychology (5)

Soc 1001—Introduction to Sociology (4)

or Anth 1102—Introduction to Social and Cultural Anthropology (5)

Recommended additional courses:

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 and 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 for additional suggestions.)

Agricultural Education Specialization

Professional Supporting Courses in the Major—48 credits minimum

E. General Education and Related Courses—15 credits minimum*

- EPsy 5139—Interpersonal and Personality Effects on Learning (4)
- EPsy 5229—Classroom Assessment Methods (4)
- EdPA 5090—School and Society (3)
- EPsy 5119—Learning and Cognitive Foundations of Education (2)
- PubH 3004—Basic Concepts in Personal and Community Health (5)

F. Agricultural Education—33 credits minimum

- AgEd 1001—Introduction to Agricultural Education (1)
- AgEd 1002—Principles of Career Planning in Agriculture (1)
- AgEd 1003—Personal Agriculture Career Planning (1)
- AgEd 3029—Directed Experience in Agricultural Education (1)
- AgEd 5031—Clinical Experience in Teaching Agriculture (10)
- AgEd 5010—Rural Education: Philosophy and Leadership (3)
- AgEd 5028—Teaching Methods in Agricultural Education (5)
- AgEd 5049—Agricultural Education for Adults (3)
- AgEd 5061—Program Planning and Evaluation (3)
- AgEd 5071—S.O.E. in Agriculture (3)
- AgEd 5078—F.F.A. Organization and Management (2)

Major Courses

G. Technical Agriculture—65 credits minimum

14 credits in soil science, plant science, plant pathology, or entomology
10 credits in animal science

- Agricultural Economics/Business—22 credits
 - AgEc 1101—Principles of Microeconomics (4)
 - AgEc 1102—Principles of Macroeconomics (4)
 - BME 3260—Professional Sales Education (3)

At least two from the following:

- AgEc 3420—Grain Marketing Economics (4)
- AgEc 3430—Dairy Marketing Economics (3)
- 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)

At least one from the following:

- AgEc 1250—Principles of Accounting (4)
- AgEc 3500—Agribusiness Finance (4)
- AgEc 3810—Principles of Farm Management (4)

- Ag Engineering Technology—10 credits minimum
 - AgET 1020—Agricultural Shop Metalwork (4)
 - AgET 5020—Program Planning and Instructional Methods in Agricultural Mechanics (3)
- 6 credits in Natural Resources and Environment
 - Agricultural Education Practicum—3 credits
 - AgEd 5072—Practicum: Agricultural Business and Industry (3)

Agricultural Development Specialization

Professional Supporting Courses in the Major—32 credits minimum

E. General Education—3 credits minimum*

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

F. Agricultural Education—29 credits minimum

Professional—19 credits

- AgEd 1001—Introduction to Agricultural Education (1)
- AgEd 1002—Principles of Career Planning in Agriculture (1)
- AgEd 1003—Personal Agriculture Career Planning (1)
- AgEd 3029—Directed Experience in Agricultural Education (1)
- AgEd 5010—Rural Education: Philosophy and Leadership (3)
- AgEd 5021—Education Through Extension Methods (3)
- AgEd 5023—Extension Methods for Developing Countries (3)
- AgEd 5025—Extension Program Planning (3)
- AgEd 5055—Methods in Farming Systems Research and Extension (3)

Experiential—10 credits minimum, 20 credits maximum

- *AgEd 3001—Experiential Learning: Production Agriculture (2-8)
- *AgEd 3002—Experiential Learning: Agricultural Business (2-8)

**Amount of credit registered for in each course depends on prior experience and the results of diagnostic competency testing. Under some circumstances, additional credits in technical agriculture may be used to substitute for some or all of the experiential learning credits.*

G. Development—16 credits minimum

At least two from the following:

- AgEc 3070—Agriculture and Economic Growth in Developing Countries (4)
- AgEc 5790—World Food Problems (3)
- AgEd 3041—Practicum: Agricultural Education Technology (3) (Workshop: Applied International Development Technologies)
- Econ 5401—International Economics (4)
- Pol 3477—Political Development (4)
- Pol 3835—The International System (4)

At least two from the following:

- AgEc 3006—Applied Macroeconomics: Government and the Economy (4)
- AgEc 3007—Applied Macroeconomics: Policy, Trade, and Development (4)

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- 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)

H. Technical Agriculture—55 credits minimum

- 12 credits in plant science, plant pathology, or entomology
- 4 credits in soil science
- 7 credits in animal science
- Agricultural Economics—8 credits
 - AgEc 1101—Principles of Microeconomics (4)
 - AgEc 1102—Principles of Macroeconomics (4)
- Agricultural Business—13 credits
 - BME 3260—Professional Sales Education (3)
- At least two from the following:
 - AgEc 3420—Grain Marketing Economics (4)
 - AgEc 3430—Dairy Marketing Economics (3)
 - AgEc 3440—Livestock and Meat Marketing Economics (3)
 - AgEc 3450—Agricultural Input Marketing Economics (4)
 - AgEc 5440—Cooperatives and Agribusiness Organization (4)
 - AgEc 5480—Futures, Markets, and Prices (4)
- At least one from the following:
 - AgEc 1250—Principles of Accounting (4)
 - AgEc 3500—Agribusiness Finance (4)
 - AgEc 3810—Principles of Farm Management (4)
- 5 credits in agricultural Engineering
- 6 credits in natural resource management

I. General Electives

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

Postbaccalaureate: Agricultural Education Teaching Specialization

General Features

This program provides an alternative teacher education experience. The program is for *students with baccalaureate degrees in agriculture, forestry, 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, natural resources, 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 will 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.

Pre-Agricultural Engineering

(College of Agriculture)

Freshmen and sophomores interested in earning a bachelor of agricultural engineering degree (BAG.E.), offered by the Department of Agricultural Engineering through the Institute of Technology (IT), may complete prerequisite work (pre-agricultural engineering) in COA. Students transfer to IT after completing required work in mathematics, physics, and chemistry. Pre-agricultural engineering students have an adviser in the Department of Agricultural Engineering.

Agricultural Engineering

(Institute of Technology)

*Department of Agricultural Engineering
213 Agricultural Engineering
612/625-7733*

Agricultural engineering is the application of engineering principles to biological and environmental systems involving soil, water, and air in the production and processing of plant, animal, food, and related biological materials. Agricultural engineers use their knowledge and skills to enhance environmental quality while improving the efficiency and profitability of agricultural production systems; the quality of biological, agricultural, and food 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 production, use, 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 and 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 for the world.

The agricultural engineering curriculum can be completed in four years by earning 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 provides students with a fundamental background for continued professional growth and prepares them to contribute to an ever-changing society.

The curriculum centers around environmental and natural resource management. Students, with the assistance of an adviser, plan a curriculum tailored to their individual interests. Students can choose additional courses in interest areas including land, soil, and water resources; waste management; food engineering; bioprocessing; environmental control of animal buildings; agricultural structures; greenhouse 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 education 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 Commission of the Accreditation Board for Engineering and Technology (ABET).

Lower Division

	Credits
Comp 1011—Writing Practice I or Rhet 1101—Writing to Inform and Persuade	4-5
Math 1251-1252—Differential and Integral Calculus	8
Math 1261—Algebra and Geometry of Euclidean Space	4
Math 3261—Differential Equations with Linear Algebra	4
Math 3251—Vector Differential Calculus	4
Math 3252—Multivariable Integral Calculus	4
Phys 1251-1252-1253—General Physics I-II-III	12
Chem 1051-1052—Chemical Principles I-II	8
Biological science electives (4 cr at 3xxx or 5xxx level; including agricultural science courses with significant biological content)	8
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, CSci 3102 or AgET 3030—Computer Programming	4
Liberal education electives	16
	97-98

Upper Division

	Credits
Comp 3031—Technical Writing for Engineers or Rhet 3562—Writing in Your Profession	4
EE 3009-1400—Linear Circuits I, Circuits Laboratory	5
AEM 3036—Dynamics	4
ME 3301-5342—Thermodynamics, Heat Transfer	8
ME 3900—Introduction to Engineering Statistics	4
Biological science elective (at 3xxx or 5xxx level; including agricultural science courses with significant biological content)	4
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 Must include:	
a) Two courses from:	8
AgEn 5070—Automatic Controls and Instrumentation	
AgEn 5072—Finite Element Methods	
AgEn 5074—Microcomputer Interfacing	
b) One course from:	4
AgEn 5550—Water Management Engineering	
AgEn 5910—Agricultural Waste Management Engineering	
c) Agricultural engineering elective	4

Programs

Engineering electives to satisfy ABET requirements of 48 engineering science credits and	
24 engineering design credits	12
Liberal education electives	11-12
Electives to consider student interest and to meet graduation requirements of 190 credits	11
	92-93

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.

Agricultural Industries and Marketing

Dr. Vernon B. Cardwell, Major Coordinator
309 Agronomy
1991 Upper Buford Circle
St. Paul, MN 55108
612/625-6754

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% 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:

- (1) provides a broad-based educational program reflecting the academic strengths of COA and the University at large, and
- (2) 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 192 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

- 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)

- GC 1537—Professional Selling (4)
 or BME 3260—Professional Sales Education (3)
 One additional communications elective from the following:
 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—17 credits minimum

- 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 from the following:

- AnPl 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 24.

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

One from 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)

List 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 24.

List 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 Courses—31 credits minimum

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—28 credits minimum

- AgEc 1101—Principles of Microeconomics (4)
 AgEc 3001—Applied Microeconomics: Consumers and Markets (4)
 AgEc 3002—Applied Microeconomics: Managerial Economics (4)
 AgEc 3003—Applied Microeconomics: Markets and Prices (4)
 AgEc 3920—Agricultural Law (4)
 One from the following:

- AgEc 3420—Grain Marketing Economics (4)
 AgEc 3430—Dairy Marketing Economics (3)
 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 from the following:

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

F. Agricultural Sciences—33 credits minimum

- 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—17 credits minimum

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 (3)

One from the following:

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

Recommended electives:

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

Programs

- 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*—16 credits minimum
Contact: Vernon B. Cardwell, Crops/Soils, 309 Agronomy
- Agro 3020—Growth, Development, and Culture of Field Crops (5)
Soil 3416—Soil Fertility (4)
Plus at least 7 credits from the following:
- Agro 1100—Morphology and Identification of Crops and Weeds (4)
Agro 3030—Maturation, Harvest, and Storage of Field Crops (4)
Agro 3060—Field Plot Design in Agronomy (4)
Agro 3120—Grain Grading and Utilization (2)
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)
AnPl 3010—Environment and World Food Production (4)
AnPl 5060—Integrated Management of Cropping Systems (4)
Ent 1005—Economic Entomology (4)
PIPa 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—Soil Fertility Laboratory (1)
Soil 5104—Computer Applications in Soil Science (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)
- Horticultural Industries*—23 credits minimum
Contact: Bert Swanson, Horticulture, 164 Alderman Hall
- 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 3072—Turf Management (4)
Hort 5026—Landscape Management (5)
Hort 5032—Tree Fruit Production (4)
Hort 5033—Small Fruit Production (3)
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—Physiological Manipulation of Flowering Plants (4)

- Hort 5054—Commercial Floriculture Production Practices (4)
Hort 5055—Commercial Floriculture Production Systems (5)

- Food Industries*—16 credits minimum
Contact: Elaine Asp, Food Science and Nutrition, 261 Food Science and Nutrition
- AgEc 5550—Food Marketing Economics (4)
or FScN 5474 Food Marketing Economics (4) (if not used under category E)
- BioC 3021—Introduction to Biochemistry (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. Lawrence H. Smith, major coordinator
411 Borlaug Hall
1991 Upper Buford Circle
St. Paul, MN 55108
612/625-2778

The animal and plant systems major prepares students to work as managers and technical advisers for animal and plant production systems. This curriculum provides a science-based agricultural education with a principles emphasis. Students majoring in animal and plant systems may prepare to pursue graduate studies in production-related specialties by choosing higher level courses and using electives to increase their understanding of science, mathematics, and statistics.

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, Soils, and 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 aspects of environmental horticulture. Career opportunities include floriculture, urban horticulture, turf management, landscape horticulture, and nursery management 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. Some IPM students pursue graduate studies as well.

Major Requirements

All students in animal and plant systems must complete the requirements listed below. Course substitutions in categories A, B, C, and D may be made only with the approval of the COA Office, and in E and F with the approval of the student's adviser and the Coordinating Committee for Animal and Plant Systems.

A. Communications, Language, Symbolic Systems—26 credits minimum

Math 1031—College Algebra and Probability (5)
 or Math 1051—Pre-Calculus I (5)
 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 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 COA student, 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.

Programs

B. Physical and Biological Sciences—35 credits minimum

Biol 1009—General Biology (5)

At least one from 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:

BioC 1401—Survey of Biochemistry (4)

Chem 1001—General Principles of Chemistry (4)

Chem 1002—Elementary Organic Chemistry (4)

or

BioC 1401—Survey of Biochemistry (4)

Chem 1002—Elementary Organic Chemistry (4)

Chem 1051—Chemical Principles I (4)

Chem 1052—Chemical Principles II (4)

or

Suggested for students planning on graduate study:

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)

Phys 1041—Introductory Physics (5)

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

*GCB 3022—Genetics (4)

or Biol 5003—Genetics (4)

or Hort 3003—Plant Genetics and Improvement (4)

*Note: Required of all students except those in environmental horticulture.

At least one from the following:

Bot 3109—Plant Anatomy (5)

EEB 3001—Introduction to Ecology (4)

EEB 3111—Vertebrate Behavior (4)

or AnSc 3111—Introduction to Animal Behavior (4)

Ent 5320—Ecology of Agriculture (4)

Geo 1001, 1021—Introduction to Geology and Laboratory (4,1)

Geo 1002—Historical Geology (4)

Geo 1005—Geologic Perspectives on Energy (4)

Math 1142—Short Calculus (5)

MicB 3103—General Microbiology (5)

or VPB 3103—General Microbiology (5)

or Hort 3004—Applications of Plant Biotechnology (4)

Phys 1042—Introductory Physics (5)

Phys 1071, 1075—Introductory Meteorology and Laboratory (4,1)

or Soil 1262—Introduction to Meteorology (4)

Soil 5240—Microclimatology Soils (3)

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 24.

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

See All-College Requirements, page 24.

E. General Requirements in the Major—minimum 16 credits

AgET 3025—Engineering, Principles and Applications (4)

AnPI 1001—Orientation to Animal and Plant Systems (1)

Ent 1005—Economic Entomology (4)

or Ent 5250—Forest Entomology (4)

or Ent 5280—Livestock Entomology (3)

Soil 1020—Soil Resource (5)

or Soil 3125—Basic Soil Science (5)

Undergraduate Project—Students must have at least junior status and should consult their adviser on selecting an appropriate undergraduate project. (4 credits)

F. Area of Emphasis—45 credits minimum

Students must complete at least one area of emphasis.

Animal Production—45 credits minimum

Required courses:

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 (3)

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)

At least two from the following:

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

AgEc 3002—Applied Microeconomics: Managerial Economics (4)

AgEc 3003—Applied Microeconomics: Markets and Prices (4)

AgEc 3430—Dairy Marketing Economics (3)

AgEc 3440—Livestock and Meat Marketing Economics (3)

AgEc 3810—Principles of Farm Management (4)

GC 1513—Principles of Small Business Operations (5)

GC 1537—Professional Selling (4)

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)

Technical electives:

Students in the animal production area of emphasis are encouraged to choose their elective courses to complete their 192 credits from the following list. Students should consult their adviser for further suggestions.

AgEc 3500—Agribusiness Finance (5)

AgEc 3810—Principles of Farm Management (4)

AgEc 3920—Agricultural Law (4)

AgEc 5020—Applied Linear Programming (4)

- AgEc 5440—Cooperatives and Agribusiness Organization (4)
- AgET 3030—Introduction to Problem Solving with Computers (4)
- AgET 3606—Farm Building Design, Layout, Systems (4)
- Agro 3020—Growth, Development, and Culture of Field Crops (5)
- Agro 3030—Maturation, Harvest, and Storage of Field Crops (4)
- Agro 5010—Forage Production and Utilization (4)
- AnSc 1120—Livestock and Meat Evaluation (4)
- AnSc 1520—Milk Production (3)
- AnSc 3113—Animal Welfare (4)
- AnSc 3305—Reproductive Physiology, Artificial Insemination, and Lactation (5)
- AnSc 3510—Growth and Development of Animal Tissues (3)
- AnSc 5231—Dairy Cattle Breeding (4)
- AnSc 5609—Principles of Farm Animal Environment (3)
- FR 5231—Range Management (3)
- GC 1534—Practical Law (5)
- GC 1551—Marketing: Introduction (5)
- GC 1552—Marketing: Sales Promotion (4)
- Mgmt 3001—Fundamentals of Management (4)
- Mgmt 3002—Psychology in Management (4)

Electives to complete 192 credits

Crops, Soils, and Horticultural Food Production—64 credits minimum

Required courses:

- Agro 1100—Morphology and Identification of Crops and Weeds (4)
- Agro 3020—Crop Growth and Culture (5) or Hort 3002—Horticultural Cropping Systems (5)
- Agro 5030—Weed Control (5)
- AnPl 5060—Integrated Management of Cropping Systems (4)
- Hort 1036—Plant Propagation (5) or Agro 3130—Seed Technology (2)
- PBio 3131—Survey of Plant Physiology (4)
- PIPa 3002—Management of Horticultural Crop Diseases (4)
- Soil 3416, 3417—Soil Fertility and Lab (4,1)

One course in animal science (3-5)

One from the following:

- Agro 3030—Maturation, Harvest, and Storage of Field Crops (4)
- Agro 5020—Introduction to Plant Breeding (4)
- Hort 3001—Growth Regulation of Horticultural Plants (5)

One from the following:

- AgEc 3420—Grain Marketing Economics (4)
- AgEc 3810—Principles of Farm Management (4)
- GC 1513—Principles of Small Business Operations (5)
- GC 1537—Professional Selling (3)

Students in the crops, soils, and horticultural food Production area of emphasis complete their technical courses in *either* crops and soils *or* horticultural food production.

Technical courses in crops and soils—20 credits Required:

- Agro 3200—Seminar (1)
- Soil 3220—Soil Conservation and Land Use Management (4) or Soil 5510—Field Study of Soils for Environmental Assessment (4)

Additional electives to be selected from:

- Agro 3010—Adaptation, Distribution, and Ecology of Field Crops (4)
- Agro 3030—Maturation, Harvest, and Storage of Field Crops (4)
- Agro 3120—Grain Grading and Utilization (2)
- Agro 3150—Advanced Seed and Grain Evaluation (4)
- Agro 5010—Forage Production and Utilization (4)
- Agro 5020—Introduction to Plant Breeding (4)
- Agro 5040—Corn and Soybean Management (3)
- Agro 5070—Ecology of Field Crops (3)
- Soil 5240—Microclimatology-Soils (3)
- Soil 5610—Soil Biology (4)

Horticultural food production technical courses—16 credits

Required courses:

- Hort 3099—Seminar (1)
- Hort 5001—Harvest to Market of Horticultural Crops (3)
- Hort 5032—Tree Fruit Production (4)
- Hort 5033—Small Fruit Production (3)
- Hort 5034—Commercial Vegetable Agriculture (5)

Environmental Horticulture—82 credits minimum

Required courses:

- AgEc 1102—Macroeconomics (4)
- Agro 3020—Growth, Development, and Culture of Field Crops (5) or Hort 3002—Horticultural Cropping Systems (5)
- GC 1513—Principles of Small Business Operations (5)
- Hort 1021—Woody Plant Materials (5)
- Hort 1022—Herbaceous Plant Materials (5)
- Hort 1036—Plant Propagation (5)
- Hort 3001—Growth Regulation of Horticultural Plants (5)
- PBio 3131—Survey of Plant Physiology (4)
- PIPa 3001—Management and Control of Field Crop Diseases (4)
- Soil 3416, 3417—Soil Fertility and Laboratory (4,1)

Additional 12 credits from the following:

- Acct 1050—Introduction to Financial Reporting (4) or AgEc 1250—Principles Accounting (4)
- Acct 3001—Introduction to Management Accounting (4)
- AgEc 3001—Applied Microeconomics: Consumers and Markets (4)
- AgEc 3002—Applied Microeconomics: Managerial Economics (4)
- AgEc 3003—Applied Microeconomics: Markets and Prices (4)
- AgEc 3006—Applied Macroeconomics: Government and the Economy (4)
- AgEc 3260—Agribusiness Operations Management (4)
- AgEc 3500—Agribusiness Finance (4)
- AgEc 3920—Agricultural Law (4)

Programs

- AgET 3030—Introduction to Problem Solving with Computers (4)
or GC 1571—Introduction to Basic Programming and Microcomputers (5)
- GC 1575—Introduction to Computers (4)
- GC 3571—Computer Approach: Problem Solving (5)
- GC 3560—Personnel Administration (4)
or GC 3602—Applied Supervision (4)
- IDSc 1010—Fundamentals of Information Development and Use (4)
- IDSc 3030—Information Systems and Information Management (4)
- Jour 3201—Principles of Advertising (4)
- Mktg 3000—Principles of Marketing (4)
- Mktg 3010—Buyer Behavior and Market Analysis (4)
- OMS 1020—Data Analysis Statistical Inference for Managers (4)
- OMS 3000—Introduction to Operations Management (4)
- Rhet 5170—Managerial Communications (4)

Technical course requirements:

Students in the environmental horticulture area of emphasis complete their technical courses in *either* landscape, nursery, and turf or floriculture.

Landscape, Nursery, and Turf Sequence

At least 23 credits from the following:

- Hort 3004—Applications of Plant Biotechnology (4)
or Hort 5001—Harvest to Market of Horticultural Crops (3)
- Hort 3030—Landscape Design of Residential and Small Commercial Sites (4)
- Hort 3040—Landscape Design and Implementation (5)
- Hort 3072—Turf Management (4)
- Hort 3099—Seminar (1)
- Hort 5026—Landscape Management (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)
- LA 1025—Basic Visualization I (4)

Floriculture Sequence

Required courses:

- 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)

Integrated Pest Management—53 credits minimum

Required courses:

- Agro 1100—Morphology and Identification of Crops and Weeds (4)
- Agro 3020—Growth, Development, and Culture of Field Crops (5)
or Hort 1036—Plant Propagation (4)
- Agro 5030—Weed Control (5)
- AnPl 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 5000—Professional Experience Program in Integrated Pest Management (4)
- One course in animal science
- One from the following:
- AgEc 3002—Applied Economics: Managerial Economics (4)
- AgEc 3450—Agricultural Input Marketing Economics (4)
- AgEc 3810—Principles of Farm Management (4)

Technical courses:

At least three from the following:

- Agro 3010—Adaptation, Distribution, and Ecology of Field Crops (4)
- Agro 3020—Growth, Development, and Culture of Field Crops (5)
- Agro 3030—Maturation, Harvest, and Storage of Field Crops (4)
- Agro 5040—Corn and Soybean Management (3)
- Ent 5020—Insect Taxonomy (5)
- Ent 5040—Insect Ecology (4)
- Ent 5220—Stored Product Pest Management (4)
- Ent 5250—Forest Entomology (4)
- Ent 5280—Livestock Entomology (3)
- Hort 1036—Plant Propagation (4)
- Hort 1100—Biology of Horticultural Production (4)
- Hort 3001—Growth Regulation of Horticultural Plants (5)
- Hort 3002—Horticultural Cropping Systems (5)
- Hort 3003—Plant Genetics and Improvement (4)
- Hort 5032—Tree Fruit Production (4)
- Hort 5033—Small Fruit Production (3)
- Hort 5034—Commercial Vegetable Agriculture (5)
- Hort 5042—Turf Grass Science (5)
- PIPa 5201—Biology of Plant Diseases (3)
- PIPa 5202—Biology of Plant Diseases Laboratory (2)
- PIPa 5203—Physiology 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)
- Soil 3416—Soil Fertility (4)
- Soil 5610—Soil Biology (4)

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

Applied Economics

Dr. Kent D. Olson, major coordinator
316 Classroom Office Building
1994 Buford Avenue
St. Paul, MN 55108
612/625-7723

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, as well as individualized areas of emphasis that students may design in consultation with their adviser. This curriculum emphasizes on fundamental written and oral communication skills and develops 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.

Note: A total of 65 credits in the entire program must be 3xxx level 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 Math 1251-1252 (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 1002—Elementary Organic Chemistry (4)
if pass proficiency exam
or Chem 1051—Chemical Principles I (4)
Plus one additional 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 24.

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

See All-College Requirements, page 24.

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 3003—Applied Microeconomics: Markets and Prices (4)
AgEc 3006—Applied Macroeconomics: Government and the Economy (4)
AgEc 3007—Applied Macroeconomics: Policy, Trade, and Development (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 in Agricultural Economics or Economics Students may apply 12 or more of these credits towards one of the following areas of emphasis.

Areas of Emphasis

Management and Finance

- AgEc 3240—Farm and Agribusiness Strategic Management (4)
AgEc 3260—Agribusiness Operations Management (4)
AgEc 3500—Agribusiness Finance (4)
AgEc 3860—Farm Operations Management (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 (3)
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)

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- 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 5740—Agricultural Policy in Planned Economies (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 Economics (3)
AgEc 5620—Regional Economic Analysis (3)
AgEc 5630—Regional Development Systems (3)
AgEc 5640—Financing State and Local Governments (4)
AgEc 5650—Economics of Natural Resource Policy (4)

Individualized Emphasis

Students have the option of designing an individualized area of emphasis, such as preparation for graduate school. Students should consult with their adviser in developing such a program.

F. Technical Applications—16 credits minimum

A combination of four courses from two departments form an area of technical expertise. At least one of the courses must be at the 3xxx or 5xxx level. Areas of expertise that might be considered include animal production, crop production, food processing, soils and soil conservation, forestry, water quality, health, and energy. Suggested courses that will meet the intent of this category are listed below. Students should consult with their adviser in selecting other courses.

- Agro 1010—Principles of Agronomy (5)
Agro 3030—Maturation, Harvest, and Storage of Field Crops (4)
Agro 3120—Grain Grading and Utilization (2)
Agro 3130—Seed Technology (2)
AgET 3025—Engineering Principles and Applications (4)
AgET 5027—Appropriate Technology for International Development (4)
AnSc 1100—Introductory Animal Science (5)
AnSc 1120—Livestock and Meat Evaluation (4)
AnSc 1510—Consumer Meat Science (2)
AnSc 3410—Principles of Animal Nutrition (3)
Ent 1005—Economic Entomology (4)
FScN 1102—Technology of Food Processing (4)
FScN 1612—Principles of Nutrition (4)
FScN 3102—Introduction to Food Science (4)
FScN 3472—Food Selection Principles (4)
Hort 1010—Home Horticulture (4)
Hort 1036—Plant Propagation (5)
NRES 1010—Issues in the Environment (3)
NRES 3060—Water Quality in Natural Resource Management (3)
NRES 5600—Principles of Waste Management (4)
ScAg 1500—Biotechnology: Basic Concepts and Applications (3)
Soil 1020—The Soil Resource (5)
Soil 3125—Basic Soil Science (5)
Soil 3220—Soil Conservation and Land Use Management (4)
Soil 3416—Soil Fertility (4)

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

Biological Sciences

Freshmen and sophomores interested in earning a degree in the biological sciences may complete their prerequisite work in COA (the College of Biological Sciences [CBS] does not admit freshmen). They will be assisted in program planning by a CBS adviser and can transfer to CBS when they have met the requirements for entry. Pre-CBS students are encouraged to participate fully in the specialized activities and opportunities for students organized by the College of Biological Sciences. Pre-CBS students may apply directly to COA for admission.

For further information about biological sciences programs, see the *College of Biological Sciences Bulletin* or contact the College of Biological Sciences, 223 Snyder Hall, University of Minnesota, 1475 Gortner Avenue, St. Paul, MN 55108 (612/624-9717).

Food Science

Dr. Sita Tatini, major coordinator
225 Food Science and Nutrition
1334 Eckles Avenue
St. Paul, MN 55108
612/624-7412

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.

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

- Math 1251, 1252—One-Variable Differential and Integral Calculus I-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—Introduction to Biochemistry (4)
- 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)
- 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 24. 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 24.

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)

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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 emphases are available. Consult with the program coordinator or department head.

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

Landscape Architecture

*Department of Landscape Architecture
125 Architecture Building
89 Church Street S.E.
Minneapolis, MN 55455
612/625-6860*

Freshmen and sophomores interested in earning a degree in landscape architecture may complete their prerequisite work in COA. Students can transfer to the College of Architecture and Landscape Architecture (CALA) when they have met the requirements for entry at the upper division level.

Pre-landscape architecture (pre-LA) 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 CALA 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 allows 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 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 15 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.

The procedure and requirements are as follows:

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

2. Before an application will be considered, a student must have completed a minimum of 90 credits of required pre-LA 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 available from the Department of Landscape Architecture, 125 Architecture, 89 Church Street S.E., University of Minnesota, 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 8½ 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

Programs

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

A. Communication, Language, Symbolic Systems—

26 credits

Math 1201—College Algebra and Analytical Geometry (5)

or Math 1142—Short Calculus (5)

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:

College-level math (1008 or higher)

College-level statistics

College-level computer programming

IDSc 3131—Database Management Systems (4)

Phil 1001—Introduction to Logic (5)

or Phil 3231—Introduction to the Philosophy of Language (4)

B. Physical and Biological Sciences—20 credits minimum

5 credits Ixxx geology (recommended)

Geol 1001, 1021—Introduction to Geology and Laboratory (4,1)

or Geol 1111—Introductory Physical Geology (5)

10 credits of Ixxx Biology (recommended)

Biol 1009—General Biology (5)

Biol 1103—General Botany (5)

C. The Individual and Society—16 credits minimum

4 credits 13xx- or 15xx-level geography

4 credits 3xxx-level geography

8 credits 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 24.

E. Preparation for the Major—20 credits

LA 3413—History of Landscape Architecture (4)

Soil 1020—The Soil Resource (5)

4 credits studio arts

LA 1401—The Designed Environment (4)

LA 1301—Introduction to Drawing (4)

8 credits other electives

F. Post-admission Requirements—86 total credits

LANDSCAPE ARCHITECTURE—43 credits

LA 3311—Drawing for Design (4)

Two from the following:

LA 5309—Advanced Graphics (4)

LA 5381—Advanced Graphics (4)

LA 5342—Advanced Graphics (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)

ECOLOGICAL—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.

Natural Resources and Environmental Studies

This program is jointly administered by COA and the College of Natural Resources.

College of Agriculture

Terence H. Cooper, major coordinator

439 Borlaug Hall

1991 Upper Buford Circle

St. Paul, MN 55108

612/625-7747

Participating Departments:

COA—Agricultural Engineering, Agricultural and Applied Economics, and Soil Science; College of Natural Resources—Forest Resources, Fisheries and Wildlife.

The natural resources and environmental studies curriculum is intended for students interested in an interdisciplinary education focusing on the use and management of natural resources and the study of the environment. The curriculum enables students to become knowledgeable and articulate about natural resource and environmental issues and to be sensitive to the many interrelationships that exist between

human and natural systems. Students completing the curriculum will gain an appreciation of the important and evolving role of natural resource and environmental management in local, regional, national, and international communities.

Students are given considerable flexibility in designing their program of study. Programs can be designed to achieve one or more of the following objectives:

- Gain an understanding of the interaction between natural resources and the functioning of modern society. Learn about the significant social and environmental roles that can be played by natural resources located throughout the nation and the world.
- Prepare for careers in public and private organizations that are responsible for planning the use and management of natural resources and protection of the environment. Learn about subjects that will prepare you for positions in fields such as environmental assessment, resource inventory, natural resource planning, environmental protection, sustainable development, policy analysis, and waste management.
- Develop appropriate background for the pursuit of graduate study.

Major Requirements

Students majoring in natural resources and environmental studies must complete the requirements listed below. Faculty academic advisers will assist students in selecting suitable courses for completion of electives.

A. Communication, Language, Symbolic Systems—26 credits minimum

- Math 1142—Short Calculus (5)
- 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)

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.

B. Physical and Biological Sciences—24 credits minimum

- Biol 1009—General Biology (5)
- Biol 1103—Botany (5)
 - or Biol 1106—Zoology (5)
- Chem 1001—General Principles of Chemistry (4)
- Chem 1002—Elementary Organic Chemistry (4) (recommended)
- Chem 1051—Chemical Principles I (4)
- Chem 1052—Chemical Principles II (4)
- Phys 1001, 1005—The Physical World (4,1)
 - or Phys 1041—Introductory Physics (5)
- Geo 1001—Introduction to Geology (4)
 - or Geo 1111—Introductory Physical Geology (5)

C. The Individual and Society—22 credits minimum

Required:

- AgEc 1101—Principles of Microeconomics (4)
- AgEc 1102—Principles of Macroeconomics (4)
- Pol 1001—American Government and Politics (5)

Suggested courses:

- HSci 1711—Technology and Western Civilization (4)
- Pol 3307—The American Bureaucracy (4)
- Soc 1001—Introduction to Sociology (4)
- Soc 1002—American Community (4)

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

Suggested courses:

- Hum 1005—Humanities in the Modern World (4)
- Rhet 1301—Modern Thought and the Enlightenment (4)
 - Rhet 1302—Modern Thought and the Industrial Revolution (4)
 - Rhet 1303—Modern Thought and the Impact of Evolution (4)
 - Rhet 1310—Humanities: The Land in American Experience (4)

E. Core Courses for Natural Resources and Environmental Studies—44 credits minimum

Required courses:

- NRES 1001—Orientation to Natural Resources and Environmental Studies (1)
- NRES 1010—Issues in the Environment (3)
 - or NRES 1040—Natural Resources as Raw Materials (2)
 - or FR 3250—Role of Renewable Natural Resources in Developing Countries (2)
 - or FW 1101—Ethics and Values in Resource Management (3)
- NRES 3001—Colloquium in Natural Resources and Environmental Studies (1) (Students should take two colloquia)
- NRES 3050—Experience and Training in a Field Setting (1-4)
- NRES 5100—Problem Solving in Natural Resources (5)
- FR 1201—Conservation of Natural Resources (3)

Programs

Physical and Biological Fields

- AgET 5410—Hydrology and Water Quality (5)
or FR 5114—Forest Hydrology (3)
or NRES 3060—Water Quality in Natural Resource Management (3)
- FR 3104—Forest Ecology (3)
or EEB 3001—Introduction to Ecology (4)
- Soil 1020—The Soil Resource (5)
or Soil 3125—Basic Soil Science (5)
- Soil 1262—Introduction to Meteorology (4)
or FR 3103—Meteorology and Climatology for Natural Resource Managers (2)

Managerial and Assessment Fields

- AgEc 3610—Resource Development and Environmental Economics (4)
or FR 5226—Forest Economics and Planning (5)
- NRES 5210—Survey, Measurement and Modeling Methods for Natural Resources Analysis (3)
- FR 5240—Natural Resource Policy and Administration (3)

Resource Management Fields

- Soil 3220—Soil Conservation and Land Use Management (4)
or Soil 5210—Soil Physical Properties and the Environment (4)
or Soil 5510—Field Study of Soils for Environmental Assessment
- FR 5100—Silviculture (3)
or Soil 5560—Interpretation of Land Resources (3)
- FW 3052—Introduction of Fisheries and Wildlife (3)

F. Area of Concentration Requirements—24 credits minimum

Students will select an area of concentration within the field of natural resources and environmental studies. Areas of concentration enable students to prepare for specific jobs, explore areas of interest, and prepare for graduate school. Suggestions for coursework for various student objectives will be available from advisers. Some positions require that individuals are certified or meet certain minimal requirements for job placement. Students should check with their advisers to determine specific certification requirements (i.e., soil scientist, soil conservationist, hydrologist, environmental planner). Areas of concentration should be designed with faculty assistance and approval of the major committee and major coordinators. Suggested lists of courses are available upon request.

Some possible areas of concentration are:

Environmental Issues and Planning—Focus on major issues in natural resources and the environment at local, national, and worldwide levels. Special emphasis on understanding, analysis, planning, and decision making required to address these problems.

- AgEc 5650—Economics of Natural Resources (4)
PA 5721—Environmental Process (3)
Pol 5523—The Politics of the Regulatory Process (4)
Anth 5117—Anthropology of Resource Management (4)
AgEc 5600—Land Economics (4)
Geog 5444—Geography of Water (4)
FR 3232—Management of Recreational Land (4)
FR 5200—Aerial Photo Interpretation (3)

- FR 5212—Natural Resources Inventory (3)
Soil 3220—Soil Conservation and Land Use Management (4)
Soil 5560—Interpretation of Land Resources (3)
- Resources and Environmental Protection*—Focus on understanding major environmental protection issues and the approaches available for their resolution. Topical concerns include sanitary waste disposal, air and water pollution, and protection of plant and animal resources.
- Anth 5117—Anthropology of Resource Management (4)
Econ 5611—Resource and Environmental Economics (4)
FR 5153—Advanced Forest Hydrology (4)
Geo 5611—Ground Water Geology (4)
LA 5227—Impact Assessment and Environmental Mediation (5)
PA 5102—Legal Environment of Public Affairs (3)
PA 5721—Environmental Policy (3)
PIPa 3004—Air Pollution, People and Plants (3)
Pol 5523—The Politics of the Regulatory Process (4)
PubH 5181—Air Pollution (3)
PubH 5242—Environmental Aspects of Ground Water (2)
PubH 5253—Hazardous Waste Management (3)
Soil 3220—Soil Conservation and Land Use Management (4)

Resource Assessment—Focus on developing skills for assessing the magnitude and quality of various natural and environmental resources with techniques such as remote sensing, quantitative analysis, and geographic information systems.

- FR 3300—Elements of Surveying (2)
FR 5130—Geographic Information Systems (2)
FR 5200—Aerial Photo Interpretation (3)
FR 5226—Forest Economics and Planning (5)
FR 5231—Range Management (3)
FR 5233—Principles of Outdoor Recreational Design (4)
FR 5241—Natural Resource Management: Political and Administration (3)
FR 5257—Recreation Land Policy (3)
FR 5262—Remote Sensing of Natural Resources (4)
FR 5412—Advanced Remote Sensing (4)
Geog 5562—Introduction to Geographic Information Systems (4)
Soil 3220—Soil Conservation and Land Use Management (4)
Soil 5510—Field Study of Soils for Environmental Assessment (4)
Soil 5560—Interpretation of Land Resources (3)
- Soil Resources*—Focus on the management, interpretation, and inventory of soil resources. Emphasis on preventing soil erosion and reducing land degradation and the adverse impacts of erosion on water and air quality.
- Soil 3220—Soil Conservation and Land Use Management
Soil 3416, 3417—Soil Fertility and Lab (4,1)
Soil 5210—Soil Physical Properties and the Environment (4)
Soil 5510—Field Study of Soils for Environmental Assessment (4)
Soil 5710—Forest Soils (3)
Soil 5550—Peatlands (3)
Soil 5560—Interpretation of Land Resources (3)
Soil 5610—Soil Biology (4)

Water Resources (Hydrology and Climatology)—Focus on the management of water resources to prevent reductions in water quantity and quality. Special emphasis on water movement, storage, and hydrologic and climatologic cycles.

(Students should take Math 1251-1252 instead of Math 1142 in Category A)

FR 5153—Advanced Forest Hydrology (4)

Geo 5108—Advanced Environmental Geology (4)

Geo 5601—Limnology (4)

Geo 5611—Groundwater Geology (4)

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

Soil 5232—Soil Physics (4)

Soil 5240—Microclimatology (3)

Soil 5424—Applied Climatology (3)

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

Soil 5550—Peatlands (3)

Waste Management—Focus on the issues and practices that are involved in abatement of the waste stream.

CE 5510—Solid and Hazardous Waste Management (4)

Econ 5611—Resource and Environmental Economics (4)

NRES 5600—Principles of Waste Management (4)

PA 5001—Policy Process (3)

PA 5721—Environmental Policy (4)

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

Pol 5523—Politics of the Regulatory Process (4)

PubH 5242—Hazardous Waste Management (3)

Soil 5610—Soil Biology (4)

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

Nutrition

Linda Brady, coordinator
225 Food Science and Nutrition
1334 Eckles Avenue
St. Paul, MN 55108
612/624-9211

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 higher (a cumulative GPA of 3.00 or higher is recommended). Registered dietitians work in a wide variety of health care, community, educational, and corporate positions relating to food and health.

The *nutrition 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)

Biol 3021—Introduction to Biochemistry (4)

CBN 3001—Elementary Anatomy (4 or 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)

Phsl 3051—Human Physiology (5)

or Phsl 1001—Human Physiology: Introductory Survey for Allied Health Sciences (4)

VPB 3103—General Microbiology (5)

or MicB 5105—Biology of Microorganisms (5)

Programs

C. The Individual and Society—21 credits minimum

See All-College Requirements, page 24. One course required in the area of Development of Civilization.
AgEc or Econ 1101—Principles of Microeconomics (4)
AgEc or Econ 1102—Principles of Macroeconomics (4,5)

Psy 1001—Introduction to Psychology (5)

Soc 1001—Introduction to Sociology (4)

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

See All-College Requirements, page 24.

E. Professional Courses in the Major—68 credits minimum (Students may not apply technical, performance, 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 5110—Food Chemistry (4)

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)

3-4 credits in psychology of learning 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)

4-5 credits in statistics chosen from the following or in consultation with adviser:

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 planning a nutritional science emphasis substitute the following courses for FScN 3112, 3472, 3610, 3730, 3732, 5620, 5665, 5666, 5667, 5750, LaMP 5177, Mgmt 3001, and 3-4 credits in psychology of learning:

BioC 3021—Introduction to Biochemistry (4)

BioC 5025—Biochemistry Laboratory (2)

Biol 3011—Animal Biology (5)

or Biol 1106—General Zoology (5)

Biol 5003 or GCB 3022—Genetics (4)

FScN 3610—Community Nutrition (3)

or FScN 5665—Applied Clinical Nutrition (3)

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) for Math 1031

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

Phys 1104, 1105, 1106 with labs 1107, 1108,

1109—General Physics (15)

One course in civilization for AgEc 1102

Ten credits in Group D instead of 9 credits

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/Veterinary 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 COA 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-II (4,4)
 One additional communications course (4-5)

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 proficiency will be assessed in the advising process. If you lack these skills, take Rhet 1200—Information Technology (3).

B. Physical and Biological Sciences—63 credits minimum

Required courses:

BioC 3021—Introduction to Biochemistry (4)
 Biol 1009—General Biology (5)
 One from 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-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 Phys 1104, 1107 and 1105, 1108 and 1106, 1109—General Physics and Lab (4,1) (4,1) (4,1)
 or Phys 1271, 1275 and 1281, 1285 and 1291, 1295—General Physics and Lab (4,1) (4,1) (4,1)
 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.
 AnPl 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)

Programs

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 1262—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 24. 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-II (4,4)

Area of emphasis requirements

Students must complete one of the area of emphasis programs listed below.

Animal Science—31 credits minimum

AnSc 1100—Introductory Animal Science (5)
AnSc 3220—Principles of Animal Breeding (5)
AnSc 3301—Systemic Physiology (6)
AnSc 3401—Principles of Animal Nutrition (3)
A minimum of 12 additional credits selected from:
AnSc 3111—Introduction to Animal Behavior (4)
AnSc 3305—Reproduction and Lactation (5)
AnSc 3510—Growth and Development of Animal Tissues (3)
AnSc 3730H—Honors Seminar in Animal Science (1)
AnSc 5240—Animal Cytogenetics (4)
AnSc 5327—General Endocrine Physiology (3)
AnSc 5328—General Endocrine Physiology Lab (2)
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 (3)

Climatology—31 credits minimum

AgET 5410—Hydrology and Water Quality (5)
Agro 3020—Growth, Development, and Culture of Field Crops (5)
or Hort 1100—Biology of Horticultural Production (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)

Food Science—31 credits minimum

FScN 1612—Principles of Nutrition (4)
FScN 3102—Introduction to Food Science (4)
FScN 5120—Food Microbiology (5)
A minimum of 18 additional credits selected 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 (4)
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)

Nutrition—31 credits minimum

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 selected 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)

Plant Sciences—Credit minimum depends on specialization chosen

Required courses:

Agro 3020—Growth, Development, and Culture of Field Crops (5)
or Hort 3002—Horticultural Cropping Systems (5)
Agro 5030—Weed Control (5)
Ent 1005—Economic Entomology (4)
or Ent 3005—Introductory Entomology (5)

- PIPa 3001—Management and Control of Field Crop Diseases (4)
- or PIPa 3002—Management of Horticultural Crop Diseases (4)
- or PIPa 5200—Poisonous Plants (2) and PIPa 5201—Biology of Plant Diseases (3)
- Soil 3125—Basic Soil Science (5)

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

Agronomy

Required courses:

- Agro 5020—Introduction to Plant Breeding (4)
- Soil 3416—Soil Fertility (4)
- Soil 3417—Soil Fertility Laboratory (1)

One from the following:

- Agro 5010—Forage Production and Utilization (4)
- Agro 5040—Corn and Soybean Management (3)
- AnPI 5060—Integrated Management of Cropping Systems (4)

Entomology:

Required course:

- Ent 5020—Insect Taxonomy (5)

Remaining credits selected from:

- 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)

Horticultural Science:

Required courses:

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

At least one from the following:

- Hort 3004—Applications of Plant Biotechnology (4)
- Hort 3072—Turf Management (4)
- Hort 5001—Harvest to Market of Horticultural Crops (3)
- Hort 5032—Tree Fruit Production (4)
- Hort 5033—Small Fruit Production (3)
- 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 5052—Physiological Manipulation of Flowering Plants (4)
- Hort 5054—Commercial Floriculture Production Practices (4)
- Hort 5055—Commercial Floriculture Production Systems (5)

Plant Pathology:

Three from the following:

- PIPa 5201—Biology of Plant Diseases (3)
- PIPa 5202—Biology of Plant Diseases Laboratory (2)
- PIPa 5203—Physiology 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)

Soil Science—31 credits minimum

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

or Hort 1100—Biology of Horticultural Production (4)

Soil 3125—Basic Soil Science (5)

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

Soil 3416—Soil Fertility (4)

Soil 3417—Soil Fertility Laboratory (1)

Soil 5240—Microclimatology (3)

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

Remaining credits selected from:

Soil 5104—Computer Applications in Soil Science (2)

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)

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.

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

Electives may be used for professional or other courses selected by students in consultation with their adviser. The number of elective credits available will vary depending on the area of emphasis selected. See adviser for a list of suggested technical electives. Students may wish to apply for enrollment in the college honors program, courses for which would be considered as electives.

Scientific and Technical Communication

Dr. Richard W. Ferguson, major coordinator
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 612/624-4761

Technical communicators apply modern techniques to the dissemination of knowledge in industry, business, education, and government. Technical communicators write for audiences ranging from scientists to management to the consumer of products and

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

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

If you plan to pursue a graduate communication program, you should consult with your adviser about selection of appropriate 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):

Scientific and Technical Communication

- 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 24.

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

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

A marketing portfolio consists of class papers that are samples of your best writing, written work you have had published, examples of graphic work (e.g., projects from art, drafting, or design classes, or photographs, slides, or videos), and a résumé (optional).

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. It is important to 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 (612/624-4761).

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 COA 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.

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 3562—Writing in Your Profession (4)

The environment in which scientific and technical communicators work also requires a knowledge and understanding of math and computer science.

Required:

- Rhet 1200—Information Technology (3)
- Math 1051—Precalculus I (4)

And one from 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 3104—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)
- BioC 3021—Introduction to Biochemistry (4)
- BioC 5025—Laboratory in Biochemistry (2)
- 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)
- Geo 1111—Introductory Physical Geology (5)
- MicB 3103—General Microbiology (5) (Extension offering 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 pp. 24-26 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. 24-26 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—18 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)
- Rhet 5581—Document Design (4)

And two from the following:

- Rhet 5572—Procedures and Policies Manual (2)
- Rhet 5573—Grant Proposal (3)
- Rhet 5574—Publications Management (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)
- Comp 3050—Topics in Advanced Composition (4)
- EngW 5401—Introduction to Professional Editing (4)

ORAL COMMUNICATION—12 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 3266—Communication, Discussion in Small Group Decision Making (4)
- Rhet 5257—Scientific and Technical Presentations (4)
- Rhet 5258—Interviewing: Dynamics of Face-to-Face Communication (4)

Programs

Recommended:

- Rhet 3254—Advanced Public Speaking (4)
- Spch 3201—Introduction to Broadcast Production (4)
- Spch 3203—Radio Production (4)
- Spch 3411—Small Group Communication Process (4)

VISUAL COMMUNICATION—7 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 3670—Visual Rhetoric: Theories and Applications (4)

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 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 from 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)
- GC 3464—Communicating in Organizations (4) or Spch 3441—Communicating in Organizations (4)
- Pol 5704—Organization Theory and Behavior (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—8 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)

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 1303—Modern Thought and the Impact of Evolution (4)
- Rhet 3395—In Search of Nature (4)
- Rhet 3690—The Rhetoric of Scientific Controversy (3)
- Rhet 5680—Gender and the Rhetoric of Science and Technology (4)

SCIENCE AND TECHNOLOGY—20 credits minimum

Although 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 3xxx 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 |

CAPSTONE PROJECTS

Rhet 3582—Senior Seminar (2)

As a major, you will participate in a seminar course during your senior year to provide you an opportunity to integrate and apply your educational experiences to your upcoming nonacademic work, to learn how to work with others in a cooperative environment, and to build your self-confidence as you begin your job search. You will discuss ethical issues and problems related to scientific and technical communication and will examine the problem-solving strategies of professional communicators. Several group projects will be completed as well as individual work.

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

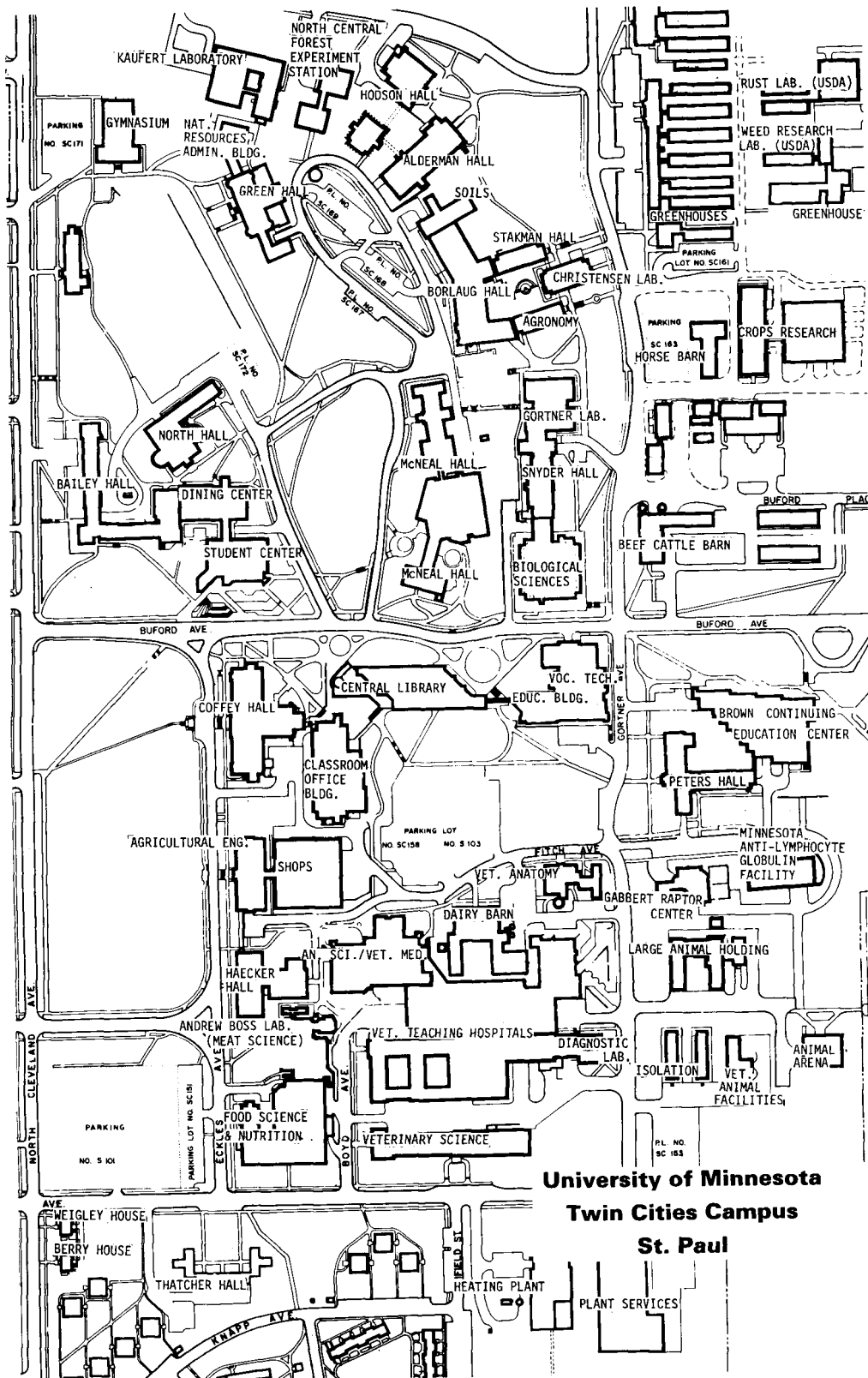
You must complete at least four credits of internship experience. The internship cannot be completed until you are officially enrolled in the major. For specific information about internship requirements and procedures, consult with your adviser and review the *STC Internship Guide*.

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

Veterinary Medicine

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

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



University of Minnesota
Twin Cities Campus
St. Paul

College of Agriculture

Course Descriptions



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 allowed (or required) 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 unit offering the course, is required for registration.

H Honors course.

f,w,s,su Following a course number, indicates fall, winter, spring, or summer terms.

x Course is offered more than one quarter.

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

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

A comma between course numbers (e.g., 1234, 1235, 1236) indicates a series of courses that may be entered any quarter. In prerequisite listings, comma means "and" (e.g., "prereq 1101, 1102 or 1103" means the prerequisites are 1101 and either 1102 or 1103).

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

Agriculture (Agri)

1000H. HONORS COLLOQUIUM. (2 cr; prereq COA Honors Program; A-F only)

Topics change quarterly. Each colloquium introduces a topic related to "Agriculture in the 1990's" and is 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.

1100. ACTIVE LEARNING AND PROBLEM SOLVING. (3 cr; A-F only; prereq Ag Merit Scholar, #)

Orientation to active learning and creative problem-solving strategies. Students will work in groups, under the counseling of faculty members, to solve actual problems in the agricultural disciplines. Orientation to library and computer facilities.

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.

3001. LEADERSHIP DEVELOPMENT: PROJECT LEAD. (2 cr [may be repeated for max 4 cr]; prereq ag major, #; A-F only)

Leadership development seminar for undergraduates. Theories of leadership, leadership styles, leadership skills. Students work with mentors from business, education, and government.

3100H. HONORS EXPERIENCE. (3-4 cr; prereq COA Honors Program, Honors Committee approval)

Individually tailored by student in conjunction with COA faculty supervisor. May include 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)

Introduction to the 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 only; 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.

3003. APPLIED MICROECONOMICS: MARKETS AND PRICES. (4 cr; prereq 3002 or #)
Theory of price and output determination in alternative market settings. Time, form, and spatial aspects of price formation. Institutions and government policies that affect prices and outputs in agriculture.

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. FARM AND AGRIBUSINESS STRATEGIC MANAGEMENT. (4 cr; prereq 3003, 3500 or #)
Identifying and analyzing strategic issues and problems of farm and agribusinesses, establishing business goals and developing realistic plans of action; strategy formulation, implementation and control issues; analysis of case studies.

3260. AGRIBUSINESS OPERATIONS MANAGEMENT. (4 cr; prereq 3240 or #)
Annual planning, implementation, and control in agribusiness firms; design of information systems to support management operations; forecasting; risk management.

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. (3 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; 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.

Course Descriptions

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; introduction to 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)

Introduction to 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.

3860. FARM OPERATIONS MANAGEMENT. (4 cr; prereq 3240 or #)

Annual decision-making issues and procedures for planning implementation and control of the farm business; design of information systems to support management and operations; forecasting; risk management; control system development and use.

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 the *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; Extension regis 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 3003 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 ECONOMICS. (3 cr; prereq 3001, 3006 or Econ 3101, 3102 or #)

Land use as a factor of production; land use, classification, and value; sale and rental markets for land; domestic and foreign land policies.

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 POLICY. (4 cr; prereq 3002 or 3610 or Econ 3101 or #)

Application of economic analysis, including project evaluation, to current natural resource issues. Emphasis on conservation and resource scarcity, environmental quality, population growth, and resource use issues and their implications for public policy.

5660. ECONOMICS OF PUBLIC SERVICES. (3 cr; prereq 3001 or Econ 3101 or #)

Introduction to 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 3003, 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 3003 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 market agreements; agricultural trade policies of common market areas; negotiations and potential trade developments.

5790. WORLD FOOD PROBLEMS. (3 cr. §Agro

5200, §FScN 5643, §LACS 5280, §Soc 5675; 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 3003 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

Course Descriptions

8231. AGRICULTURAL PRICES

8245. AGRICULTURAL MARKETING ECONOMICS

8264. RESOURCE ECONOMICS

8266. APPLIED REGIONAL ECONOMICS

8270. APPLIED WELFARE ECONOMICS AND PUBLIC POLICY

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.

1010. HISTORY AND PHILOSOPHY OF VOCATIONAL AND COMMUNITY EDUCATION. (3 cr)

Analysis and interpretation; alternative value positions involving social, economic, and related community variables.

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 one 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; Extension regis 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 EDUCATION: PHILOSOPHY AND LEADERSHIP. (3 cr, §1010)

Philosophical foundations of the rural school; responsibilities of schools to the local community; development of rural educational systems; responsibility of the school to the individual; current delivery of rural education for developing community leadership programs.

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)

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.

5031. CLINICAL EXPERIENCE IN TEACHING AGRICULTURE. (10 cr; prereq jr. 5028; S-N only)

Instruction in developing individual supervised agriculture experience programs, contacting parents, program analysis of community needs, conducting classes, community activities, FFA, and case studies.

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 varies.

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 varies.

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, §Agro 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.

Course Descriptions

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 laboratory 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 exper as ag tchr 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.

5130. EFFECTIVE TEACHING IN A COLLEGE OF AGRICULTURE. (3 cr; prereq 1 yr grad study in ag or #)

Various approaches to effective college teaching. Development of a personal philosophy of teaching; practice in employing several types of instructional improvement activities. Intended primarily for the graduate student who plans to teach in a college of agriculture.

5200. SEMINAR: WORKING WITH YOUTH THROUGH ADULTS. (1-3 cr per qtr [max 9 cr incl 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 maybe 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.

3030. INTRODUCTION TO PROBLEM SOLVING WITH COMPUTERS. (4 cr; prereq Math 1031 or equiv; 3 lect, 1 rec hrs per wk)

Elementary problem solving using computers. Writing programs in BASIC language. Use of timesharing terminals. Elements of computer hardware and software.

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/Extension)

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. Lecture and lab.

5091-5092. SPECIAL PROBLEMS IN AGRICULTURAL ENGINEERING. (2-5 cr per qtr; prereq #)

Individual study project in agricultural engineering at advanced level. Application of engineering principles to a specific problem.

5400. DRAINAGE AND IRRIGATION. (4 cr, prereq Soil 3210; 3 lect, 2 lab hrs per wk)

Soil moisture excesses and deficiencies. Theory and design of tile drainage, surface drainage, and sprinkler irrigation systems. Development of irrigation water supplies. Selection of pumps and power units for drainage and irrigation. Economic feasibility. Legal problems and procedures.

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.

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.

Course Descriptions

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 3031 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 College of Agriculture 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 utilization/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)

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)**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.

1100. MORPHOLOGY AND IDENTIFICATION OF CROPS AND WEEDS. (4 cr)

Developmental morphology of seeds, seedlings, and plants. Morphological features of seeds and plants as keys to help identify crops and weeds of major economic importance in the world. Lecture and lab.

3030. GROWTH, DEVELOPMENT, AND CULTURE OF FIELD CROPS. (5 cr; prereq Biol 1009, Chem 1052 or equiv)

Principles of growth and development of field crops and their management to achieve maximum crop productivity. Emphasis on seeds and seeding; physiological basis of growth and development; and effects of physical and biological environmental factors on crop growth, development, and culture. Lecture and lab.

3030. MATURATION, HARVEST, AND STORAGE OF FIELD CROPS. (4 cr; prereq Biol 1009, Chem 1052 or equiv)

Development and maturation of grains and forage crops, including the synthesis and accumulation of organic constituents and changes in these constituents as a result of the maturation process. Estimation of crop maturity and development of criteria for crop harvest, role of pre- and post-harvest treatments in preparation for storage, and losses associated with crop harvest. Principles of storage and preservation of crops in moist or dry state. Lecture and 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; concurrent regis 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; prereq 1100 or #; 3120 recommended)

Laboratory practice in identification of crops, weeds, and diseases and in grain grading and seed analysis. Members of the Intercollegiate Crops Team are selected from this class.

Course Descriptions

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; Extension regis 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. (4 cr; prereq 1010 or #; offered 1995 and alt yrs)

Interrelationships between plants and animals as they relate to the selection, production, and use of forage crops. Crop management practices including establishment, maintenance, and harvesting of forages as pasture, hay, or silage. Physiological basis of forage management of various species. Forage quality and use as related to livestock feeding with emphasis on ruminant nutrition. Lecture and lab.

5020. INTRODUCTION TO PLANT BREEDING.

(4 cr; prereq GCB 3022 or equiv)

Applying genetic principles to improve crop plants. Includes self-pollinated, cross-pollinated, and asexually propagated crops.

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 1122 or #)

Discussion and case-study approach to corn and soybean management in Minnesota, based on an integration of agronomic principles.

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.

5120. GROWTH, DEVELOPMENT, AND CULTURE OF FIELD CROPS. (5 cr, §3020; prereq Biol 1009, Chem 1052 or equiv)

Principles of growth and development of field crops and their management to achieve maximum crop productivity. Emphasis on seeds and seeding; physiological basis of growth and development; and effects of physical and biological environmental factors on crop growth, development, and culture. Lecture, laboratory, and discussion.

5130. MATURATION, HARVEST, AND STORAGE OF FIELD CROPS. (4 cr, §3030; prereq Biol 1009, Chem 1052 or equiv)

Development and maturation of grains and forage crops, including the synthesis and accumulation of organic constituents and changes in these constituents as a result of the maturation process. Estimation of crop maturity and development of criteria for crop harvest, role of pre- and post-harvest treatments in preparation for storage, and preservation of crops in moist or dry state. Lecture, laboratory, discussion.

5200. WORLD FOOD PROBLEMS. (3 cr, §AgEc 5790, §CAPS 5280, §FScN 5643, §Soe 5675; 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.

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

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

8320. ORIENTATION TO AGRONOMY AND SOILS FIELD RESEARCH TECHNIQUES

8330.* RESEARCH IN PLANT GENETICS

Animal and Plant Systems (AnPl)

1001. ORIENTATION TO ANIMAL AND PLANT SYSTEMS (1 cr)

History and role of 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 biodiversity, soil conservation, agricultural pollution, water quality, waste management.

5060s. INTEGRATED MANAGEMENT OF CROPPING SYSTEMS. (4 cr)

Case study/simulation and discussions considering integrated production management of selected agronomic and horticultural cropping systems in Minnesota. 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.

Course Descriptions

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. Introduction to quantitative genetics. Concepts of livestock improvements through breeding and selection systems.

3301. SYSTEMIC PHYSIOLOGY. (6 cr; prereq Biol 1009, BioC 1401)

Introduction to animal physiology, emphasizing the function of the organ systems.

3305. REPRODUCTIVE PHYSIOLOGY, ARTIFICIAL INSEMINATION, AND LACTATION. (5 cr; prereq 3301)

Functions of the reproductive organs, fertilization, the estrous cycle and its endocrine control, reproductive efficiency, and problems and principles of artificial insemination. Anatomy, physiology, and biochemistry of the mammary gland. Mammary growth, initiation and maintenance of lactation, milk synthesis, and factors influencing the lactation curve.

3401. PRINCIPLES OF ANIMAL NUTRITION. (3 cr, §1401; prereq BioC 1401 or 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. GROWTH AND DEVELOPMENT OF ANIMAL TISSUES. (3 cr; prereq 3301, BioC 1401)

Growth and structure of muscle, bone, and adipose tissue; whole animal growth; factors influencing rate and efficiency of muscle growth; influence of postmortem factors on fresh meat properties.

5000. PROFESSIONAL EXPERIENCE PROGRAM.

(4 cr; prereq #; S-N only; free elective for animal sci undergrads; not for grad cr; Extension regis 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)

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 1401 or 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 1401 or 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. (3 cr; prereq jr, 3301 or #)

Biological processes involved in the adjustment of animals to ambient environments, 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.

5190. ANALYTICAL TECHNIQUES IN VETERINARY MEDICINE I. (4 cr; prereq vet med or grad or #)

Principles and practice of developing and using computer systems for processing, analyzing, and interpreting various categories of animal health data. Acquisition of resources necessary to undertake a research program. Development of a critical approach to reading veterinary medical literature.

5191. ANALYTICAL TECHNIQUES IN VETERINARY MEDICINE II. (4 cr; prereq 5190, regis vet med, 3rd- or 4th-yr or grad student or #)

Evaluation of strengths and limitations of statistical methodologies used in veterinary medicine and epidemiology. Design of a feasible research program given the constraints on funding, time, and facilities. Preparation of a detailed research proposal suitable for submission for competitive funding.

5280. WORLD FOOD PROBLEMS. (3 cr. §AgEc 5790, §FScN 5643, §Soc 5675; prereq major in ag or vet med or nutr sci or social sci field or #; grad 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.

5330. WILD BIRD MEDICINE. (2 cr; prereq regis vet med, 3rd- or 4th-yr or grad student or #) Diseases common to wild birds and surgical repair of common injuries and fractures.

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)

1001s. INSECTS AND SOCIETY. (3 cr) Nontechnical discussion of the relations between insects and human society. Insect behavior and natural history. Involvement of insects in human health and food production; biological, chemical, and genetic approaches to pest management; presence of insects in human history, literature, and art. Lectures, demonstrations, field trips.

1005f. ECONOMIC ENTOMOLOGY. (4 cr; prereq Biol 1009 or #) Brief introduction to structure and classification of insects; management of insect populations; life histories, habits, and recognition of insect pests of livestock, orchards, field crops, vegetables, and ornamentals.

3005f. INTRODUCTORY ENTOMOLOGY. (5 cr; prereq Biol 1009 or equiv) General morphology, life histories, habits, and classification of insects.



3020s. PRINCIPLES OF BEEKEEPING. (4 cr; prereq Biol 1009 or #)

Lecture and laboratory demonstrations. History of beekeeping; life history and behavior of honey bees; colony and apiary management; pollination and hive products; honey bee diseases and their control.

5000f,w,s. PROFESSIONAL EXPERIENCE PROGRAM. (4 cr; prereq #: S-N only; free elective for ag undergrads; not for grad cr; Extension regis 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 #)

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 1401, 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.

5200w. APICULTURE. (4 cr; prereq 9 cr ent or biol)

Characteristics and social behavior of honey bees; colony development and management; diseases and their control; hive products; pollination. Lectures and laboratory demonstrations.

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 #)

(Same as PIPa 5215) Insect transmission and dissemination of plant pathogens; development of plant-insect relationships and habits of principal insect vectors.

5250w. FOREST ENTOMOLOGY. (4 cr; prereq any two courses among the forestry, zoological, botanical, biological, or agricultural sciences)

Lectures and laboratory concerning ecology and population management of forest insects, with heavy emphasis on tree factors and biological control.

5275f. MEDICAL ENTOMOLOGY. (3 cr; prereq 3005 or #; offered 1994 and alt yrs)

Biology of arthropod vectors of human disease. Emphasis on disease transmission and host, vector, and pathogen interactions.

5280w. LIVESTOCK ENTOMOLOGY. (3 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 laboratory 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; prereq one 3xxx course in agro or hort or an sci, one 3xxx 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, ecol course)

Principles of biological control: history, ecological basis, classical biological control, augmentation, analysis of selected projects.

5350f. INSECT PATHOLOGY. (3 cr; prereq 5030; offered 1993 and alt yrs)

Survey of the major pathogenic microorganisms that cause diseases in insects; routes of infection of insects; laboratory propagation of disease agents; factors involved in application of disease to control of pest insects with safety considerations.

5360s. AQUATIC ENTOMOLOGY. (3 cr; prereq 3005 or equiv or #; offered SSI 1994 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, 5020; offered 1994 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.

Course Descriptions

5480w. INVERTEBRATE NEUROBIOLOGY. (2 cr; §Nsc 5480)

Introduction to fundamental principles and concepts underlying cellular bases of behavior and "systems" neuroscience. Particular invertebrate preparations discussed.

5600. FIELD ENTOMOLOGY AT ITASCA. (5 cr; prereq intro biol; offered SSI at Itasca)

Insect fauna in various natural habitats of the park and surrounding areas. Includes field trips and collection and identification of insects, as well as studies of general morphology, life histories, and habitats of local species.

5610. AQUATIC ENTOMOLOGY AT ITASCA.

(5 cr; prereq 3005 or 5600 or equiv or #; offered at Itasca)

Identification and biology of aquatic and littoral insects in all stages.

5620. RESEARCH PROBLEMS AT ITASCA IN ENTOMOLOGY. (Cr ar; prereq #)

Undergraduates develop short-term research project during one or both summer terms.

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 labs 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*)

8040w. ADVANCED INSECT GENETICS

8050w. TOXICOLOGY

8200w. 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

Food Science and Nutrition (FScN)

1020. INTRODUCTORY MICROBIOLOGY. (4 cr; prereq 3rd-4th yr or #; esp 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) Introduction to the technology of processing foods with special reference to the prevention of biological, microbiological, physical, and chemical deterioration. Changes in food composition; microbiological safety; food laws and regulations; technologies of major food processes such as canning, freezing, and drying.

1500. BIOTECHNOLOGY: BASIC CONCEPTS AND APPLICATIONS. (3 cr; §Agro 1500, §AnSci 1500, §PIPa 1500, §ScAg 1500, §Soil 1500; prereq high school biol, high school chem or #)

Introduction to biotechnology for students interested in this field as part of a liberal education, as well as those contemplating careers in science. Genetic engineering; applications of biotechnology to microbes, plants, and animals; legal and ethical issues.

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)

Introduction to the 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.

3602. NUTRITION IN PROFESSIONAL HEALTH CARE. (4 cr, §3600; prereq chem, human phys, pharmacology, pathophys, regis professional health discipline)
 General principles of nutrition in professional health care. Nutrition as a factor in attaining and maintaining health. Role of the health practitioner in nutrition education.

3610. COMMUNITY NUTRITION. (3 cr; prereq 1612 or equiv, 5 cr anth or psych or soc)
 Focus on nutritional health services and education in the United States and worldwide for various age groups, as well as techniques for providing these in local communities.

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 food sci and nutr, regis 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 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)
 Up to 12 weeks of planned experience in a selected position in the food industry; evaluative reports and consultations with faculty advisers and employers. (Extension only)

5100. GENERAL SEMINAR. (1 cr; prereq sr or #; A-F only)
 Literature review and presentation of papers in selected areas of food science and nutrition.

5110. FOOD CHEMISTRY. (4 cr; prereq 3102, BioC 3021)
 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 laboratory 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. (4 cr; prereq 5120, 5122)
 Characteristics of microorganisms involved in dairy and food fermentations and factors that influence their activity; natural and controlled fermentations; lactic bacteriophages and their control; application of biotechnology to food grade microorganisms; rapid detection systems; regulation of biotechnology-derived microbial products.

5135. FOOD ENGINEERING UNIT OPERATIONS. (5 cr; prereq 1102 or ¶1102, 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).

5136. UNIT OPERATIONS LABORATORY. (2 cr; prereq 5135)
 Applications of food engineering unit operations; experiments involving fluid flow, heat and mass transfer.

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.

5320. FOOD BIOTECHNOLOGY. (3 cr; prereq 5123, BioC 3021)
 Impact of biotechnology in agriculture, nutrition, and food processing. Discussion of recombinant DNA and related technologies, bioprocess engineering, and fermentation technology.

Course Descriptions

5350. APPLICATION OF EXPERIMENTAL DESIGN IN THE FOOD INDUSTRY. (4 cr; prereq stat course; lab hrs ar)

Applying concepts and techniques of experimental design to the solution of food science problems. Case studies, computer programming and use emphasized.

5360. SENSORY EVALUATION OF FOOD QUALITY. (4 cr; prereq 3102, Stat 3012 or Stat 5021)
Fundamentals of sensory perception. Test designs and methods used in studying sensory quality of foods.

5380. FOOD PACKAGING. (3 cr; prereq 3110, Phys 1042 or equiv)

Lectures on and demonstrations of packaging principles as applied to food and the food industry.

5390. INTRODUCTION TO FOOD LAW. (4 cr; prereq 1002 or #)

Federal and state legal requirements and case law history affecting production, processing, packaging, marketing, and distribution of food and food products.

5403. EXPERIMENTAL STUDY OF FOODS. (5 cr; prereq 3102, 5110, 5360)

Individual laboratory experimentation and comprehensive literature search on a problem in foods. Statistics and computers as research tools. Data analysis and interpretation for a scientific paper.

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.

5414. INGREDIENT INTERACTIONS. (3 cr; prereq 5110)

Laboratory experimentation for several case studies illustrating the hydration properties of crystalline and macromolecular structures and ways of controlling the properties and functions of ingredients in emulsions, foams, gels, and sols.

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 3101 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.

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)

Laboratory 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, hydrogenization, and other industrial manipulations; handling, storage, analysis and grading of raw materials and finished products.

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 #)

Literature review and presentation of papers in selected areas of nutrition. (Extension only)

5610. HUMAN NUTRITION. (4 cr; prereq 1612, BioC 3021)

Physiological function and metabolic fate of nutrients and factors influencing nutrient use in the body.

5612. EXPERIMENTAL NUTRITION. (2 cr; prereq 3612, ¶BioC 3021)
Lab in chemical and biochemical methods of analysis of nutritional status.

5620. NUTRITION AND METABOLISM. (5 cr; prereq 3612 or #, BioC 3021)
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)
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, 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 intake levels.

5626. CLINICAL NUTRITION SUPPORT SEMINAR. (1 cr; prereq #; S-N only)
Same course as Surg 5526. Presentations on current topic in hospital nutrition support or research.

5627. HOSPITAL NUTRITION SUPPORT. (9 cr; prereq #; S-N only)
Same course as Surg 5527. Clinical experience in hospital nutrition support. Includes rotations in medicine, surgery, pediatrics, and home nutrition support. Principles of parenteral and enteral feeding and nutritional assessment. Includes exposure to clinical nutrition research.

5642. FIELD EXPERIENCE IN COMMUNITY NUTRITION. (3-18 cr; prereq at least one human nutr course, #)
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)
Multi-disciplinary 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.

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 a 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, 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 or ¶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 nutritional considerations in the care of pediatric patients.

5668. ADVANCED CLINICAL NUTRITION. (2 cr; prereq 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. Topic announced.

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 coordinated program in dietetics)
Management of food service personnel, financial control, regulations, related administrative problems.

Course Descriptions

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

8313. TOPICS IN LIPID CHEMISTRY

8315. FOOD PROTEINS

8322. MICROBIOLOGY AND ENGINEERING OF FOOD STERILIZATION PROCESSES

8323. MICROBIAL STARTER CULTURES

8324. MICROBIAL TOXINS AND TOXIC MICROORGANISMS IN FOODS

8401. INDEPENDENT STUDY: FOOD SCIENCE

8403. ADVANCED TOPICS IN FOOD SCIENCE

8412. INTERRELATIONSHIPS AND FUNCTIONS OF FOOD COMPONENTS

8621. INDEPENDENT STUDY: NUTRITION

8622. CARBOHYDRATE AND LIPID METABOLISM

8623. ADVANCED VITAMIN NUTRITION

8624. ADVANCED PROTEIN AND AMINO ACID METABOLISM

8625. ADVANCED MINERAL NUTRITION

8777. THESIS CREDITS: MASTER'S

8888. THESIS CREDITS: DOCTORAL

Nutr 8745. SEMINAR

Nutr 8777. THESIS CREDITS: MASTER'S

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, laboratory, field trips.

1022. HERBACEOUS PLANT MATERIALS. (5 cr)
Taxonomy, ecology, and landscape uses of perennial and annual flowers, tender and hardy bulbs, ground covers, wild flowers. Lecture, laboratory, garden experience.

1023. INDOOR PLANTS AND LANDSCAPES. (3 cr)

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 exercises.

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, Ind 1600 or LA 1025)

Theory and practice of design for home grounds and small commercial sites. Site analysis, needs assessment, space organization, selection of materials, and plan preparation. Lecture and graphics lab.

3040. LANDSCAPE DESIGN AND IMPLEMENTATION. (5 cr; prereq Hort 3030)

Builds on design techniques in 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, Hort 1100 or Agro 3020)

General landscape maintenance and turf culture. Work in areas of industrial grounds maintenance, park and recreation area maintenance, and general lawn care.

3097. HORTICULTURE PRACTICUM. (2-4 cr;

prereq upper div hort emphasis or sequence, Δ) Approved field, laboratory, 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; Extension regis 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.

5026. LANDSCAPE MANAGEMENT. (5 cr; prereq 1100 or 1036, 1021)

Applying basic biological principles to establishing and maintaining horticultural plantings, including commercial, private utility, recreational, highway, and park lands. Techniques and equipment for landscape plantings; adoptive management models for business and institutional organization.

5032. TREE FRUIT PRODUCTION. (4 cr; prereq 1100; PBio 3131 recommended; offered fall of even yrs)

Principles of tree fruit production. Tree fruits of the world, with emphasis on temperate tree fruits. Site selection, cultural and management practices, taxonomic classification, physiological and environmental control of plant development, dwarfing, growth regulating compounds, pest control. Lecture, lab, field trips.

5033. SMALL FRUIT PRODUCTION. (3 cr; prereq 1100; PBio 3131 recommended; offered fall of odd yrs)

Principles of small fruit production. Major small fruit crops of the United States. Site selection, cultural and management practices, systematics, physiological and environmental control of plant development, pest control. Lecture, lab, field trips.

5034. COMMERCIAL VEGETABLE AGRICULTURE. (5 cr; prereq 1100 or Agro 1010, Soil 3125; PBio 3131 recommended)

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 bio)

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. TURF GRASS SCIENCE. (5 cr; prereq 3072, PIPa 1001, 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; prereq 1021, 1100, 5046-5047-5048†)

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; prereq 5046, 5046-5047-5048†)

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; prereq 5047, 5046-5047-5048†)

Pest management and government regulations concerning the nursery industry. Container growing operations and marketing of all products. Specific topic research and nursery operation development by the student. Laboratory includes field trips and greenhouse and field training in nursery operations. *Field trips required.*

5054. COMMERCIAL FLORICULTURAL CROP PRODUCTION. (2 cr; prereq 1036, 3016, PBio 3131)

Laboratory course focusing on commercial floricultural crop production practices. Students produce a variety of crops from propagule to finished product.

5055. COMMERCIAL GLASSHOUSE SYSTEMS, PRACTICES AND PROBLEMS. (5 cr; prereq 1036, 3016, PBio 3131 or #)

Emphasis on problem-solving and management practices in floricultural 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.

Course Descriptions

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*)

8022. BREEDING ASEXUALLY PROPAGATED CROPS

8023. EVOLUTION OF CROP PLANTS

8041. DISCUSSIONS IN ADMINISTRATIVE ORGANIZATION

8042. HORTICULTURAL SEMINAR

8045.* PLANT HARDINESS

8051x.* ADVANCED PROBLEMS IN HORTICULTURAL CROP BREEDING

8052x.* ADVANCED PROBLEMS IN PHYSIOLOGY OF HORTICULTURAL CROPS

8060. DISCUSSIONS IN POTATO RESEARCH

8061.* DISCUSSIONS IN INCOMPATIBILITY

8062.* DISCUSSIONS IN PLANT HARDINESS

8063.* DISCUSSIONS IN HORTICULTURAL PLANT BREEDING

8064.* DISCUSSIONS IN FLORICULTURAL SCIENCE

8065.* DISCUSSIONS IN POSTHARVEST PHYSIOLOGY

8066. DISCUSSIONS IN HORTICULTURAL RESEARCH

8090. GRADUATE HORTICULTURAL RESEARCH

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

Landscape Architecture (LA)

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)

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 ancient to modern period.

5200. DIRECTED STUDIES IN LANDSCAPE ARCHITECTURE DESIGN. (1-6 cr)

Advanced independent study in design.

5211. MAKING LANDSCAPE SPACE. (6 cr; admittance to B.E.D. or B.L.A. degree programs or Δ)

Design exploration using three-dimensional models to make outdoor space for human habitation and use with landforms, structures, and plants. Development of form vocabulary to provide spatial order. Use of metaphorical thinking to imbue design landscape space with meaning.

5212. ECOLOGICAL INFORMANTS OF DESIGN. (6 cr)

Ecological phenomena that influence function and human experience of landscape. Use of fundamental aesthetic principles to portray those phenomena in design.

5213. MAKING LANDSCAPE TYPES. (6 cr)

Design studio, theory, precedents, and practice in making fundamental space types in professional landscape architecture. Order, form, and meaning in the design of discrete landscape types and types in combination.

5221. PLANTING DESIGN: AESTHETIC AND FUNCTIONAL CRITERIA. (4 cr)

Aesthetic and functional design principles related to the use of plants in the landscape. Explores both historic and modern principles through design projects of various scales.

5222. PLANTING DESIGN: ECOLOGICAL PRINCIPLES/LAND USE CONCEPTS AND IMPLEMENTATION OF PLANTING DESIGNS. (4 cr)

Principles and practices of using plant materials in an ecologically sound and environmentally sensitive manner. Principles from prairie, northwoods, riverine, and wetland environments. Integration of naturalized materials in environments of various scales. Planting implementation skills.

5431. HISTORY OF LANDSCAPE ARCHITECTURE: INDIVIDUAL INFLUENCES. (4 cr)

Individual influences on landscape architecture from 1800 to present.

5571. LANDSCAPE CONSTRUCTION: LANDFORM SYSTEMS. (4 cr)

Theory and professional applications of landform systems for design. Landform topology, representation methods, manipulation techniques, use of survey data, earthwork construction issues, landscape integrity assurance, and economic performance.

5572. LANDSCAPE CONSTRUCTION: SPATIAL PERFORMANCES. (4 cr)

Theory and application of appropriate standards, proportions, and dimensions for spatial performance in landscape architecture. Spatial accommodation of people and automobiles in landscape applications, land use, development controls.

Natural Resources and Environmental Studies (NRES)

1001. ORIENTATION TO NATURAL RESOURCES AND ENVIRONMENTAL STUDIES. (1 cr)

Information about NRES major. Discussions with faculty advisers. 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 that provide maximum compatibility of human beings with their environment, sources of water pollution and their control, disposal and control of solid wastes from agriculture, minimization of pesticide pollution of the environment, and managed use of forest resources to maintain environmental quality. A televised course involving 20 taped lectures and 10 discussion periods.

1040. NATURAL RESOURCES AS RAW MATERIALS. (2 cr)

Roles 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 [max 4 cr])

Round-table discussions of current topics in natural resources and environmental studies.

3050. EXPERIENCE AND TRAINING IN A FIELD SETTING. (1-4 cr; prereq jr or sr, #)

Students are required to gain professional experience in a field setting by attending field session; completing a Professional Experience Program; or volunteering for various natural resource and/or environmental programs through local, state, or federal agencies. Adviser approval required.

3060. WATER QUALITY IN NATURAL RESOURCE MANAGEMENT. (3 cr; prereq §NRES 5060)

Water quality issues and concerns in the broader context of natural resource management. Global and ecological perspective toward understanding management of surface and groundwater resources.

3225. NRES-DIRECTED STUDY EXPERIENCE. (1-5 cr; prereq fr or soph)

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.

5060. WATER QUALITY IN NATURAL RESOURCE MANAGEMENT. (3 cr; prereq §NRES 3060)

Water quality issues and concerns in the broader context of natural resource management. Global and ecological perspective toward understanding management of surface and groundwater resources.

5100. PROBLEM SOLVING IN NATURAL RESOURCES AND ENVIRONMENTAL STUDIES. (5 cr)

Solving real-world natural resource and/or environmental problems. Oral and written presentations. Students participate as a team.

5210. SURVEY, MEASUREMENT, AND MODELING METHODS FOR NATURAL RESOURCE ANALYSIS. (3 cr; prereq Math 1142, Stat 3011, computer competency)

Introduction to survey design, measurement concepts, and modeling methods useful in the study of natural resources and environmental issues. Emphasis on data collection and analysis.

5220. SURVEY, MEASUREMENT, AND MODELLING METHODS FOR NATURAL RESOURCES II. (4 cr, prereq FR 5212 or NRES 5210 or equiv; offered alt yrs)

Advanced survey design, measurement concepts, and modelling methods for study of natural resources and environmental problems.

5225. NRES-DIRECTED STUDY EXPERIENCE. (1-5 cr; prereq jr or sr or grad)

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.

5600. PRINCIPLES OF WASTE MANAGEMENT. (4 cr; prereq Soil 1020/3125 or equiv, course in chem and biol, #)

Understanding the issues, problems, and solutions in remediating the waste stream generated by today's society. Topics include waste stream dynamics, MSW and yard waste composting, WTE incineration operation, ash disposal, recycling, landfill requirements, requirements for direct land disposal, regulatory trends, and case studies.

Plant Pathology (PIPa)

1001. THE GOOD, BAD, AND UGLY EFFECT OF MICROORGANISMS ON PLANTS AND HUMAN SOCIETY. (2 cr)

Positive or negative effect 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 affect growth of flowers, small fruits, and vegetables in Upper Midwest gardens. Diseases that may appear in your garden, why they can occur and how to avoid them.

1003. DISEASES OF TREES AND TURFGRASS. (2 cr)

U.S. tree and turf diseases with emphasis on diseases in the Upper Midwest. Plant pathology and commercial/homeowner disease management. 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 incidents 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, and 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; Extension regis 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 permission of instructor; limited to 20 students; offered at Itasca)

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 #)

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.

5200. POISONOUS PLANTS. (2 cr; prereq #)

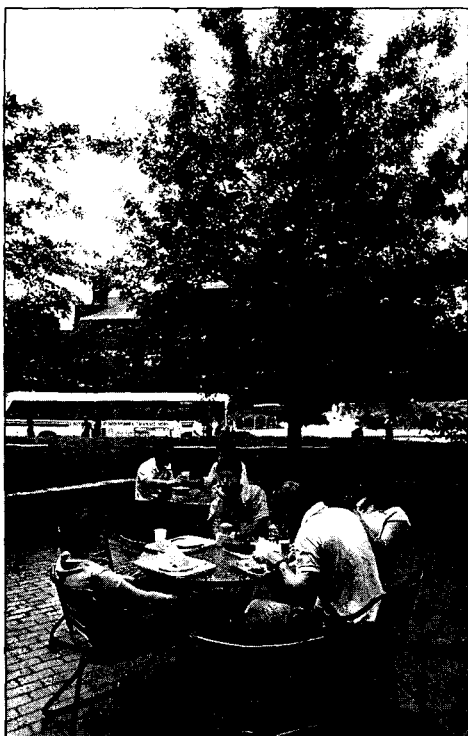
Systemic study of important plants poisonous to animals. Lecture and field trips in field identification.

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)

Plant pathogen isolation, culture, and inoculation. Selected bacteria, fungi, viruses and nematodes and the diseases they cause.



5203. PHYSIOLOGICAL AND MOLECULAR

PLANT-MICROBE INTERACTIONS. (3 cr; prereq intro course in biochem 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, plant disease physiology.

5204. PLANT PATHOLOGY. (2 cr; prereq 3001 or 3002 or 5200, 5201)

Experimental designs and methods of disease assessment and screening for resistance in agronomic and horticultural crops. Characteristics and management of plant diseases in field, forest, golf course, greenhouse, and urban environments.

5205. PLANT DISEASE DIAGNOSIS. (2 cr; prereq intro plant path or #; two 2-hr labs per wk)

Principles and methodology of diagnosing plant diseases. Biotic and abiotic disease agents, disease diagnosis at both field and lab level, current detection methods using immunological and electrophoretic techniques.

5206. BIOLOGY OF FUNGI. (4 cr; prereq Biol 1009 or #)

Major groups of fungi, their roles in ecosystems and in human society, environmental and nutritional needs and modes of dissemination and survival. Representative species of fungi observed and manipulated.

5209. BIOCHEMISTRY OF PLANT DISEASE. (3 cr; prereq BioC 3021 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 gen)

Attributes of fungi genetics 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 NEMATATOLOGY. (4 cr; prereq 3002 or 5200, 3001 or 5201)

Biology, ecology, and economic significance of soil-inhabiting nematodes. Five representative genera of plant-parasitic nematodes studied. Field and lab experiences in sampling, separation of nematodes from plants and soil, identification and use in experiments.

5214. PLANT VIROLOGY. (4 cr; prereq PBio 3012 or equiv)

Importance, symptomatology, transmission, and identification of viroid, virus, and virus-like plant diseases. 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 course in ent, one course in plant path or #)

(Same as Ent 5215) 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.

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. Lab card required.

Course Descriptions

1151. WRITING IN YOUR MAJOR. (4 cr; prereq 1104, fr communication requirement, 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; prereq COA undergrad; A-F only)

How to use computers to communicate, gather, analyze, manage, and store information in scientific and technical professions. Main functions and integration of data from word processing, telecommunications, database, and spreadsheet applications.

1220. PRINCIPLES OF HUMAN COMMUNICATION. (4 cr)

Introduction to 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 communication requirement; A-F only)

Practical course in fundamentals of effective speechmaking. Emphasis on researching and organizing a speech and communicating with an audience.

1251. EFFECTIVE LISTENING. (3 cr)

Increase listening comprehension by developing reading, research, theory, and practice.

1301. HUMANITIES: MODERN THOUGHT AND THE ENLIGHTENMENT. (4 cr)

Introduction to humanities tracing the impact of the scientific revolution on human thought. 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: MODERN THOUGHT AND THE IMPACT OF EVOLUTION. (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 the *Class Schedule*. For full details, inquire at the department office before registration.

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 writing; accuracy and effective listening; control of communication-related anxiety, including test-taking; vocabulary.

3101. FUNCTIONAL PHOTOGRAPHY. (4 cr; prereq 3562 or Dsgn 1501)

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 3562 or equiv)

Video production including video team roles, production technology, and the development process. Students apply rhetorical principles in analyzing video, develop a treatment, and write a script.

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 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, and 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)

Contemporary social issues as reflected in cultural documents. Uses 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.

3390. HUMANITIES: TECHNOLOGY, SELF, AND SOCIETY. (4 cr; prereq jr or sr, STC major or pre-STC 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 communication requirement, 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 resume.

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.

3582. SENIOR SEMINAR. (2 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. THE RHETORIC OF SCIENTIFIC CONTROVERSY. (3 cr; prereq fr communication requirement)

Students explore the personal, social, and political challenges science and technology create. 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 communication requirement)

Introduction to 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.

5000. PROFESSIONAL EXPERIENCE PROGRAM.

(4 cr; prereq #; S-N only; elective for rhetoric undergrads; not for grad cr; Extension regis only) Professional experience in firms or government agencies through supervised practical experience; evaluative reports and consultations with faculty advisers and employers.

5100. TECHNICAL COMMUNICATION: SPECIAL PROBLEMS. (Cr ar; prereq #, Δ)

Supervised reading, research, and work on advanced technical communication projects not covered in regularly scheduled courses.

5160. ADVANCED COLLEGE READING. (4 cr; prereq 1160 or equiv or #, grad status)

Examination and application of adult reading theories and teaching practices. Observe and participate in Rhetoric 1160 class and an additional 10 hours of seminar meetings. Prepare a research paper and a teaching module for college reading.

5165. STUDIES IN ORGANIZATIONAL COMMUNICATION, CONFLICT, AND CHANGE.

(4 cr; prereq fr communication 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.

Course Descriptions

5170. MANAGERIAL COMMUNICATIONS. (4 cr; prereq fr communication 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. Lecture, discussions, readings, experiential exercises, field research.

5180. INTERNSHIP IN SCIENTIFIC AND TECHNICAL COMMUNICATION. (2-6 cr; prereq grad STC major, #, 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)
Improves intrapersonal and interpersonal skills in interviewing situations. Students learn to understand and use appraisal, reprimand, complaint, persuasion, problem solving, and counseling interview techniques, and participate in a research interview project. Equal emphasis on the interviewer and interviewee roles.

5375. SPECIAL PROBLEMS: AGRICULTURE, ISSUES, AND VALUES. (3 cr; prereq sr, #)
A major integrative paper based on the student's academic background and interests in the focus. Some aspect of the student's major field is related to social, cultural, and historical trends in agriculture. Supplementary readings.

5400. COMMUNICATION PROGRAM PLANNING AND EVALUATION. (4 cr; prereq jr or sr or grad status and/or communication 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 STC/tech comm sr or grad status, 3562 or #)
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 STC or grad status, 5531 or #)
With faculty mentor, students teach course units, prepare and evaluate course assignments, conduct conferences with student writers or speakers.

5533. SCIENTIFIC AND TECHNICAL COMMUNICATION COURSE DEVELOPMENT: TEACHING SEMINAR. (1 cr; prereq STC or grad status, 5532 or #)
Usually concurrently with their first teaching assignments, students share observations and solve teaching problems.

5540. TOPICS IN SCIENTIFIC AND TECHNICAL COMMUNICATION. (Cr ar; prereq #)
Topics announced in the *Class Schedule*.

5541. READINGS IN SCIENTIFIC AND TECHNICAL PROSE. (2 cr; prereq sr or grad status, Δ, S-N only)
Tutorial in which students read selected books, essays, and reports exemplifying effective scientific and technical communication (actual scientific and technical discourse as well as philosophical and historical discussions about science and technology).

5551. REPORT AND THESIS WRITING. (3 cr; prereq 3562 or #)
For graduate students and seniors actually working on reports or theses. Organization of reports and theses; library investigation; presentation of data; methods of documentation. Emphasis on revising manuscripts and improving writing style.

5560. EDITING FOR TECHNICAL COMMUNICATION. (4 cr; prereq STC premajor or major or grad status; 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 pre-STC, fr communication requirement, 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 pre-STC, fr communication requirement, 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.

5574. PUBLICATIONS MANAGEMENT. (3 cr; prereq 1200, 3562, 3572 or grad status; A-F only) Management of publications from initial receipt of manuscript to first publication. Scheduling, layout and design, liaisons with printers or authors, desktop publishing options, typography, processing illustration, copy fitting.

5575. NEWSLETTER. (3 cr; prereq STC major or pre-STC, fr communication requirement, 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 the *Tech Communicator* using Macintosh desktop publishing.

5581. DOCUMENT DESIGN. (4 cr; prereq STC major or sr or grad status, 3562, #; 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.

5592. COMMUNICATION IN TECHNOLOGICAL AND ENVIRONMENTAL IMPACT ASSESSMENT.

(4 cr; prereq sr or grad status, one stat course, #) Theories and processes involved in technological assessment and environmental impact statement preparation. Case studies of technology assessments, forecasts, and environmental impact statements. Term project on process planning and project management in an actual impact assessment.

5600. TRANSFER OF TECHNOLOGY. (4 cr; prereq scientific communication 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)

Students explore how cultural gender roles and biological sex influence communication within scientific and technical communities. Communication strategies of professional writers, scientists, and technologists will be studied.

5700. RHETORICAL THEORY: PERSUASION AND THE LITERATURE OF SCIENCE. (4 cr; 3700#; 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 Technical Communication 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

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

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.

Course Descriptions

5661. RURAL COMMUNITY ANALYSIS. (4 cr; 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.

5675. WORLD FOOD SUPPLY PROBLEMS. (4 cr, §AgEc 5790, §CAPS 5280, §FScN 5643, §PIPa 5220; prereq major in ag or vet med or nutr sci or soc sci or #; grads by Δ only)

Multidisciplinary approach to the social, economic, and technical problems of feeding the world's growing population. Principles from the plant, animal, and nutritional sciences and their application to food problems analyzed.

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. Introduction to 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 seniors (9 credits total required for science in agriculture major). Research supervised by a COA faculty member; recommended course length is one full academic year. Written, bound thesis and oral presentation of research results.

Soil Science (Soil)

1020. THE SOIL RESOURCE. (5 cr, §3125)

Introduction to the 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.

1262. INTRODUCTION TO METEOROLOGY.

(4 cr)

(Same as Geog 1425) Pre-calculus introduction to nature of atmosphere and its behavior. Atmospheric composition, structure, stability, and motion; precipitation processes, air masses, fronts, cyclones and anticyclones; general weather patterns; meteorological instruments and observations; plotting and analysis of maps; forecasting.

3125. BASIC SOIL SCIENCE. (5 cr, §1020; prereq Chem 1001 or Chem 1051)

Basic physical, chemical, and biological properties of soil. Soil genesis, classification, and principles of soil fertility. Lecture, laboratory, 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 laboratory.

3416. SOIL FERTILITY. (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. SOIL FERTILITY LABORATORY. (1 cr; ¶Soil 3416)

Introduction to diagnostic techniques by measuring specific soil fertility parameters. Laboratory and recitation.

3521. COLLEGIATE SOIL JUDGING. (1 cr; prereq 3520)

Methods of collegiate soil judging. Participation on soil judging team during regional or national contests required.

5102. MODELING OF DYNAMIC PROCESSES IN SOIL UNDER NATURAL AND AGRICULTURAL ECOSYSTEMS. (3 cr; prereq access to a personal computer—IBM or compatible—with at least 256K and two disk drives)

Introduction to computer use in the quantitative expression of dynamic processes previously described qualitatively. Lectures and laboratories developed around simple computer models selected to gradually familiarize students with hardware, FORTRAN language, numerical recipes, and modeling techniques.

5114. SPECIAL PROBLEMS IN SOILS. (1-5 cr [may be repeated for max 10 cr]; prereq 3125 or #)

Research, readings, and instruction.

5183. WATER RELATIONS, MINERAL NUTRITION, AND TRANSLOCATION 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. (4 cr; prereq 1020 or equiv or #)

Analyze heat, water, and carbon dioxide exchange between soils, plants, animals, and their environment. Measure relevant environmental processes using field and lab instruments. Predict response of organisms to their physical environment using energy budget analyses. Lectures 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. Introduction to physical laws governing transport of water, chemicals, air, and heat in soils. Lecture, laboratory, problem-solving sessions.

5240. MICROCLIMATE (SOILS). (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. (1 cr; ¶5310)

Lab exercises illustrate principles of soil chemistry discussed in 5310. Laboratory techniques used include pH, atomic adsorption spectrophotometry, ion specific electrodes, colorimetry, redox potential, and titration.

5360. SOIL CLAY MINERALOGY. (3 cr; prereq sr standing 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 laboratory assignments emphasizing techniques of clay mineral identification and analysis. X-ray diffraction, electron optical, thermal, selective dissolution, FTIR spectrosopic, and other methods of analysis.

5416. SOIL FERTILITY. (4 cr, §3416; prereq 3125)

Fundamental concepts in soil fertility evaluation. Emphasis on dynamics of mineral elements in the soil and evaluation and interpretation of plant and soil relationships. Lecture, recitation, clinic.

5417. SOIL FERTILITY LABORATORY. (1 cr; ¶5416)

Introduction to diagnostic techniques by measuring specific soil fertility parameters. Laboratory and recitation.

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.

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.

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 1020 or 3125, PIPa 1001 or #)

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, laboratory, weekly discussion.

5710. FOREST SOILS. (3 cr; prereq 1020 or 3125)

Factors affecting tree growth; estimation, modification, and management effects on site productivity; regeneration.

Course Descriptions

For Graduate Students Only

(For descriptions, see *Graduate School Bulletin*)

8000. SUPERVISED TEACHING EXPERIENCE

8111. COLLOQUIA IN SOIL SCIENCE I

8112. COLLOQUIA IN SOIL SCIENCE II

8124. RESEARCH PROBLEMS IN SOILS

8128. SEMINAR

8250. FLUID FLOW IN SOILS

8330. ADVANCED SOIL CHEMISTRY

**8400. ADVANCED TOPICS IN SOIL FERTILITY/
PLANT NUTRITION**

8630. NITROGEN FIXATION

8632. SOIL MICROBIOLOGY

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.

3011-3012. STATISTICAL ANALYSIS. (4 cr per qtr; prereq college algebra)

3011: Descriptive statistics; elementary probability; estimation; one- and two-sample tests; introduction to regression and ANOVA.

3012: ANOVA; randomized blocks; multiple comparisons; factorial experiments; multiple regression; transformations; 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; prereq §3012, 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 1261)

Univariate and multivariate distributions, law of large numbers, sampling, likelihood methods, estimation and hypothesis testing, regression and analysis of variance and covariance, 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.

5161f-5162w-5163s. APPLIED STATISTICAL METHODS. (4 cr per qtr, §5201, §5301, §5302, §5421; prereq §5131, admission to grad study in stat or #)

5161: Sampling methodology. Estimation from sample surveys. Simple and multiple regression. Use of statistical packages. 5162: Advanced topics in linear regression. Nonlinear models. Generalized linear models. Categorical data analysis. Logistic regression. 5163: Variance reduction designs for experiments. Factorial, fractional, and confounded designs. Optimal designs. Analysis of covariance. Unbalanced data analysis.

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)

Mathematical treatment of survey sampling, including stratified and multistage sampling; models for nonsampling errors.

5271. BAYESIAN DECISION MAKING. (4 cr, §Econ 5271-5272; prereq §5132)

Axioms for personal probability and utility. Elements of statistical decision theory. Bayesian analysis of linear models.

5301f,w,s. DESIGNING EXPERIMENTS. (5 cr, §5163; prereq 3012 or 5021 or 5133 or #)

Control of variation, construction, and analysis of complete and incomplete block, split plot, factorial, and groups of similar experiments. Confounding, crossover, and optimum-seeking designs.

5302f,w,s. 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 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 5133 or 5301 or 5302 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.

5601w. NONPARAMETRIC METHODS. (4 cr; prereq 5021 or 5122 or 5132 or #)
Necessary discrete and continuous probability distributions. Goodness of fit, sign tests, order statistics, rank tests for location and for scale, two-sample and k-sample comparisons, association. Methods and applications.

5890. SENIOR PAPER. (2 cr; prereq sr stat major)
Satisfies senior project requirement for majors. Directed study. Paper on specialized area, consulting project, or original computer program.

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 varies by topic, #)
Topics vary.

Veterinary Biology (VB)

Offered by the College of Veterinary Medicine

5140. 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. AVIAN PHYSIOLOGY. (5 cr; prereq AnSc 3301 or 6 cr systemic phys or equiv. #; offered even yrs)
Physiology of wild and domestic birds.

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.

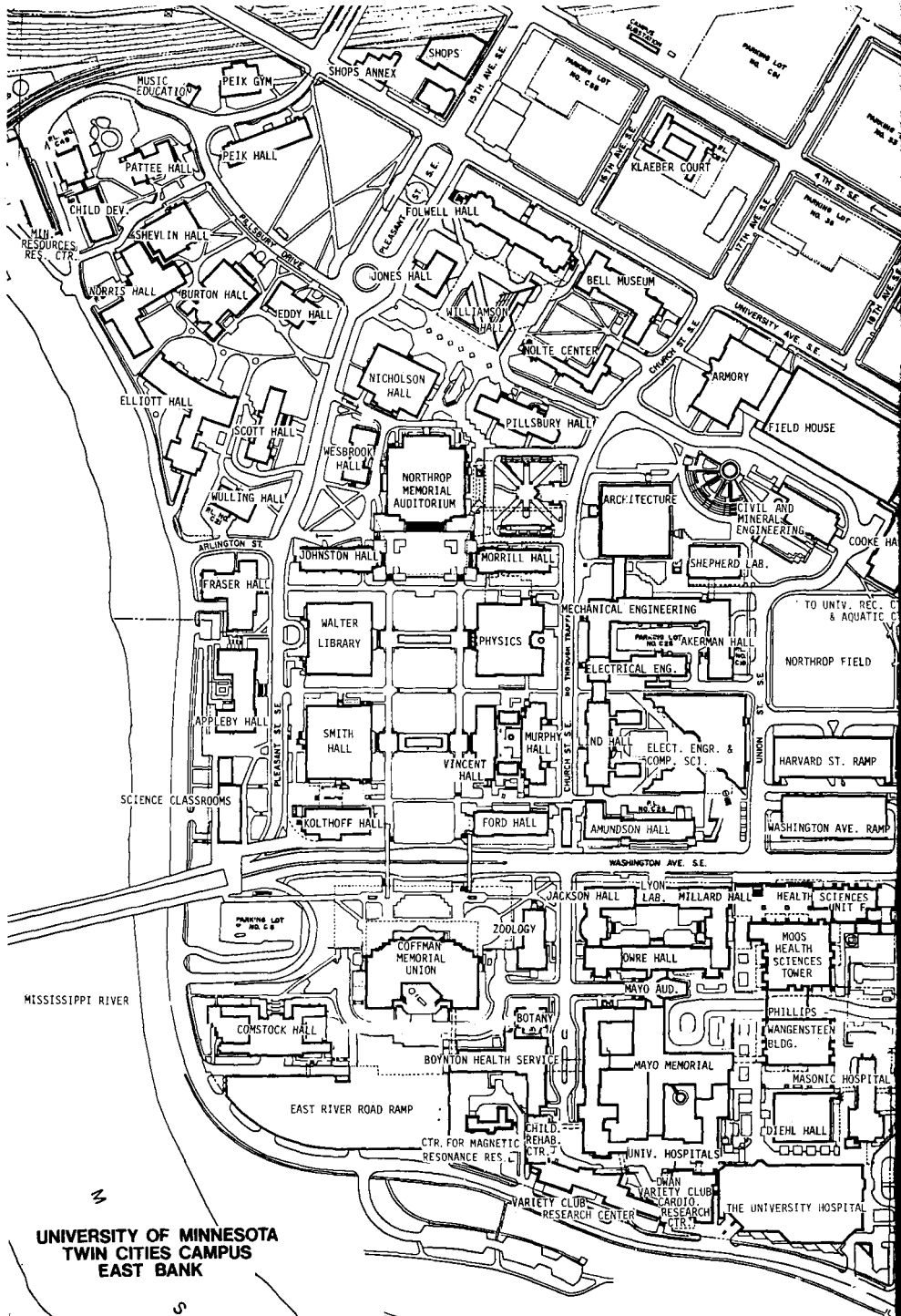
Veterinary Pathobiology (VPB)

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 laboratory 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.

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.



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**Recipient of the Horace T. Morse-Minnesota Alumni Association Award for Outstanding Contributions to Undergraduate Education.*

†General Mills Land-Grant Chair in Cereal Chemistry and Technology

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‡Recipient of the Distinguished Teaching Award.

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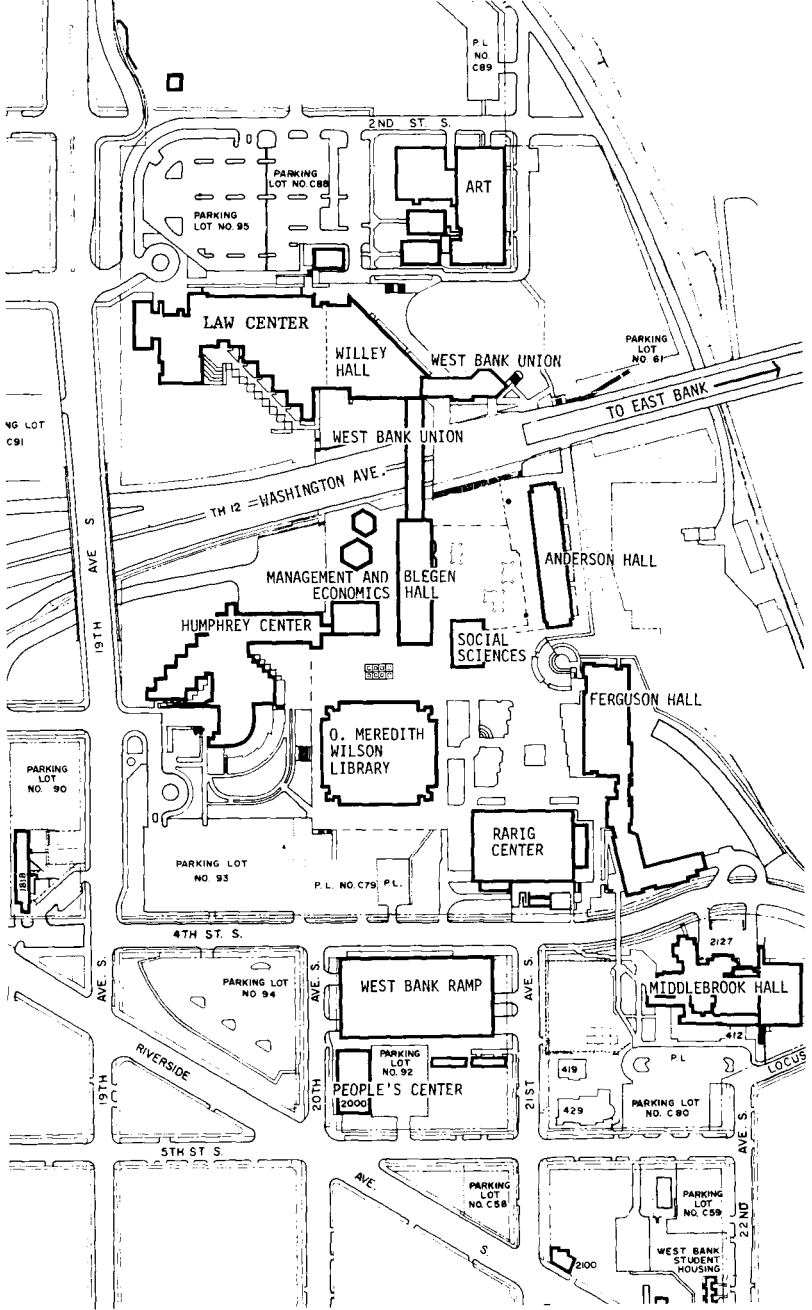
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