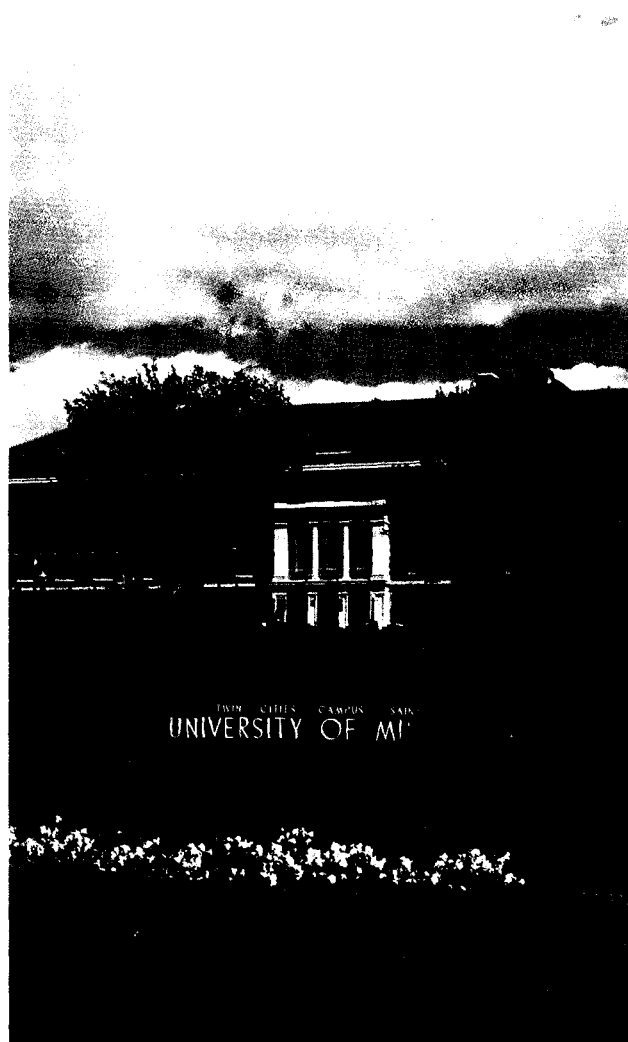


# Agriculture University of Minnesota Bulletin 1989-91



TWIN CITIES CAMPUS S.A.D.  
UNIVERSITY OF MINN.

# Agriculture

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# Introduction

## Resources

This biennial 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 Admissions and Records, 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, religion, color, sex, national origin, handicap, age, 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; and 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; 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, 419 Morrill Hall, University of Minnesota, 100 Church Street S.E., Minneapolis, MN 55455, (612) 624-9547; or to the Director of the Office of Civil Rights, Department of Education, Washington, DC 20202, or to the Director of the Office of Federal Contract Compliance Programs, Department of Labor, Washington, DC 20210.

## Postal Statement

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Cover Photo: Coffey Hall houses the College of Agriculture's administrative offices.

Cover photo by Karl Lorenz. Black and white photos by Nancy Johnson and Tim Rummelhoff.

**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*  
612/624-3045

*Office of Admissions*  
University of Minnesota  
240 Williamson Hall  
231 Pillsbury Drive S.E.  
Minneapolis, MN 55455  
612/624-5555

*Office of Student Financial Aid*  
University of Minnesota  
199 Coffey Hall  
1420 Eckles Avenue  
St. Paul, MN 55108  
612/624-1665

**Major Program Coordinators**

*Agricultural Business Management*  
Rob King, Coordinator  
130f Classroom Office Building  
1994 Buford Avenue  
St. Paul, MN 55108  
612/625-6246

*Agricultural Education*  
Roland Peterson, Coordinator  
320m Vocational-Technical Education  
Building  
1954 Buford Avenue  
St. Paul, MN 55108  
612/624-2221

*Agricultural Industries and Marketing*  
Dale Dahl, Coordinator  
217g Classroom Office Building  
1994 Buford Avenue  
St. Paul, MN 55108  
612/625-7737

*Animal and Plant Systems*  
Don Otterby, Coordinator  
130 Haecker Hall  
1364 Eckles Avenue  
St. Paul, MN 55108  
612/624-0782

*Applied Economics*  
John Waelti, Coordinator  
231 Classroom Office Building  
1994 Buford Avenue  
St. Paul, MN 55108  
612/625-7737

*Food Science*  
Dave Smith, Coordinator  
225 Food Science and Nutrition  
1334 Eckles Avenue  
St. Paul, MN 55108  
612/624-3260

*Natural Resources and Environmental  
Studies*  
Terry Cooper, Coordinator  
436 Borlaug Hall  
1991 Upper Buford Circle  
St. Paul, MN 55108  
612/625-7747

*Nutrition*  
Louise Mullan, Coordinator  
225 Food Science and Nutrition  
1334 Eckles Avenue  
St. Paul, MN 55108  
612/624-3255

*Science in Agriculture*  
Steve Simmons, Coordinator  
204 Borlaug Hall  
1991 Upper Buford Circle  
St. Paul, MN 55108  
612/625-3763

*Scientific and Technical Communication*  
Ann Duin, Coordinator  
202 Haecker Hall  
1364 Eckles Avenue  
St. Paul, MN 55108  
612/624-7260

**Department Offices**

*Agricultural and Applied Economics*  
Michael Boehlje, head  
231 Classroom Office Building  
1994 Buford Avenue  
St. Paul, MN 55108  
612/625-0231

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## Introduction

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### *Agricultural Education*

Edgar A. Persons, head  
320 Vocational-Technical Education  
Building  
1954 Buford Avenue  
St. Paul, MN 55108  
612/624-2221

### *Agricultural Engineering*

George R. Foster, head  
213 Agricultural Engineering  
1390 Eckles Avenue  
St. Paul, MN 55108  
612/625-7733

### *Agronomy and Plant Genetics*

Orvin C. Burnside, head  
411 Borlaug Hall  
1991 Upper Buford Circle  
St. Paul, MN 55108  
612/625-8761

### *Animal Science*

Richard D. Goodrich, head  
122 Peters Hall  
1404 Gortner Avenue  
St. Paul, MN 55108  
612/624-1205

### *Entomology*

Richard L. Jones, head  
219 Hodson Hall  
1980 Folwell Avenue  
St. Paul, MN 55108  
612/624-3278

### *Food Science and Nutrition*

Francis F. Busta, head  
225 Food Science and Nutrition  
1334 Eckles Avenue  
St. Paul, MN 55108  
612/624-3086

### *Horticultural Science*

John V. Carter, acting head  
305 Alderman Hall  
1970 Folwell Avenue  
St. Paul, MN 55108  
612/624-3606

### *Plant Pathology*

Philip O. Larsen, head  
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*

H.H. Cheng, head  
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 the College of Agriculture is to provide students with varied educational experiences and an environment that promotes professional competence; the capacity to attain career success in agriculture, including food or related professions; and a sense of social responsibility.

The major programs offered are interdisciplinary and designed to prepare students graduating from the College of Agriculture 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 currently registered in majors such as agronomy, animal science, horticultural science, and integrated pest management should consider this major.

- **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 will be 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.

## Degrees Offered

**Baccalaureate Degrees**—The major curricula of the College of Agriculture lead to a *bachelor of science* degree.

**Master of Agriculture Degree**—In addition to the above, the College of Agriculture offers the *master of agriculture* degree, a professional, non-research-oriented degree designed for those who seek postbaccalaureate education to further advance their professional competence in agriculture. For more information, see the alphabetical listings in the Programs section. Obtain the brochure *The Master of Agriculture* from the College of Agriculture Office, 277 Coffey Hall, University of Minnesota, 1420 Eckles Avenue, St. Paul, MN 55108 (612/624-3009).

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

## Admission

Requirements for admission to the College of Agriculture for high school graduates and transfer students are explained below. Information for adult special students, international and minority students, and senior citizens is also included. For more information, consult the Office of Admissions, 240 Williamson Hall, 231 Pillsbury Dr. S.E., Minneapolis, MN 55455, (612/625-2008).

You should apply by July 15 for fall quarter admission, November 1 for winter quarter, and February 1 for

spring quarter. Applications received after these dates may be considered but cannot be assured of action in time for enrollment in the quarter you request. A nonrefundable application fee, payable to the University, must accompany your application.

Send requests for information to the College of Agriculture Office, 277 Coffey Hall, University of Minnesota, 1420 Eckles Avenue, St. Paul, MN 55108, or call 612/624-3045.

**Tuition Deposit**—If you are admitted to the College of Agriculture 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. The tuition deposit deadlines are May 1 for fall quarter, November 1 for winter, and February 1 for spring. You must pay the deposit by the deadline or within four weeks after the date on your admission notification letter (whichever is later). 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.

**High School Graduates**—You must submit scores from the Preliminary Scholastic Aptitude Test (PSAT), Scholastic Aptitude Test (SAT), or American College Testing (ACT) program along with your high school rank percentile (HSR). If you are a high school graduate in the upper 60% of your class, you may enter the college if you have completed 12 units (roughly defined as year-long courses) in grades 10 through 12. For those 12 units you should choose from offerings in English, social studies and history, mathematics, the natural sciences, and foreign languages. At least 1 unit must be in natural science or agriculture, and 3 must be in mathematics, including the



## General Information

following: 1 unit in elementary algebra, 1 unit in plane geometry, and 1 unit in higher algebra or its equivalent.

Participation in high school vocational agriculture activities is recognized as excellent preparation for the study of agriculture at the college level. Rural background and experience, however, are not required for admission to the college.

The College of Agriculture uses the following admission criteria:

<i>Formula</i>	<i>Minimum Score</i>
HSR Percentile + PSAT Verbal + PSAT Math	150
HSR Percentile + (SAT Verbal ÷ 10) + (SAT Math ÷ 10)	150
HSR Percentile + (2 x ACT Composite Score)	105

You may seek exception to the above requirements if you can provide information indicating promise of academic success.

**Transfer Students**—You may apply for admission to the College of Agriculture from other colleges or universities. You may be accepted if you meet the entrance requirements of the college and of the major you wish to enter. General requirements for entrance by transfer include a minimum cumulative grade point average of 2.00 (where A=4.00, B=3.00, C=2.00, D=1.00, N or no credit=0.00) and a mathematics background at least equal to that required of high school graduates (see above).

You may seek exception to these requirements if you can provide information indicating promise of academic success.

After you have applied for and been accepted as a transfer student, the Office of Admissions and the College of Agriculture Office (College Office) will evaluate all previous college work according to the standards of the University and the College of Agriculture. You will then be provided with a 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 program to meet as many College of Agriculture requirements as possible. See the requirements for the various curricula in the Programs section and take special note of All-College Requirements near the end of the section.

**Transfer of Credit From Continuing Education and Extension**—If you wish to transfer credits and grades for Continuing Education and Extension (CEE) courses *taken before fall quarter 1989* before you are admitted to the College of Agriculture, then submit a transcript of these courses to the Office of Admissions; if you wish to transfer CEE credits and grades after you have been admitted to the College of Agriculture and have registered for courses, then submit your CEE transcript to the Office of the Registrar (OTR). Both the Admissions Office and OTR will evaluate your CEE transcript and determine which credits and grades will be included on your record in the College of Agriculture.

**Change of College Within the University**—To transfer to the College of Agriculture from another college unit of the University, you must meet the entrance requirements of the College of Agriculture. 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.

**Minority Admission**—The College of Agriculture seeks applications from minority students.

**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.

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*. For enrollment information and deadlines, contact the College of Agriculture Office, 277 Coffey Hall, University of Minnesota, 1420 Eckles Avenue, St. Paul, MN 55108 (612/624-3009).

**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 Admissions and Records, 130 Coffey Hall.

### Financial Aid

Financial aid for students is available in the form of grants, loans, scholarships, and work-study.

To apply for financial aid through the Office of Student Financial Aid (OSFA), students must obtain an application packet and complete the American College Testing Program's Family Financial Statement (FFS) and all other required documents. Although applications are accepted throughout the academic year, priority consideration for the following fall is given to applications that are complete and in OSFA by April.

Exact deadlines are in the application packet.

For an application packet and more information, contact the Office of Student Financial Aid. The St. Paul campus office is in 197 Coffey Hall, 1420 Eckles Avenue, St. Paul, MN 55108. The Minneapolis campus office is in 210 Fraser Hall, 106 Pleasant Street S.E., Minneapolis, MN 55455 (612/624-1665).

**"Bright Future Minnesota," Agricultural Merit Scholars Program**—This program seeks out and nurtures outstanding students interested in pursuing a career in agriculture. Scholarships ranging from \$1,000 to \$3,000 are awarded to students who meet the academic and leadership requirements. Enrichment opportunities such as seminars, workshops, individual research projects, and travel-study experiences are offered.

### Handicapped Students

Wherever possible, special consideration is given to handicapped students to minimize any problems. Through the college 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 Office for Students with Disabilities, 12 Johnston Hall (612/624-4037).

### Orientation-Registration

As a new College of Agriculture 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.

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## General Information

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### 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 College Office for further information and for Request for Special Examination application forms.

A second method of independent study is to take a course without attending classes. Under this method, you pay the usual 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 Admissions and Records, 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 Admissions and Records or the College Office, to change registration. Make all such changes as early as possible in the quarter. Please Note: Cancel/adds are official only if you use the course request forms from Admissions and Records.

**Cancel**—When you cancel a course, you are subject to the following procedures and requirements:

- Cancellations during the first two weeks of a quarter are deleted from your record.
- Cancellations during the third through sixth weeks of a quarter require your instructor's signature on the course request form. A bracketed W is assigned. The withdrawal (W) will not affect your GPA or honor point total.

• Withdrawal from a course after the sixth week of a quarter is strongly discouraged unless there are extenuating circumstances. Cancellations after the sixth week require the signatures of the adviser, instructor, and Scholastic Standing Committee representative on the course request form. (See Scholastic Requirements below for information on the honor point deficiency incurred with cancellation.) *Cancellations during the ninth and tenth week of a quarter are seldom approved by the Scholastic Standing Committee.* If a cancellation is approved, a W is assigned. The withdrawal will count as an F in your honor point total.

**Add**—No signatures are required to add a class during the first week of a quarter. You must have your instructor's signature during the second through sixth weeks of the quarter. After the sixth week of the quarter, adding a course requires the signatures of your instructor and the Scholastic Standing Committee representative. *Approval after the sixth week of the quarter is rarely granted.*

**Grading Change**—A change from one grading system selected for a course to another (e.g., from A-F to S-N or Audit) must be made during the *first two weeks of a quarter*. The choice of grading system *may not be changed after the end of the second week*.

### **Cancellation of Entire**

**Registration**—If you leave the University before the end of a quarter, you must cancel your registration when you stop attending classes. Submit a course request form to the Office of Admissions and Records, 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 Admissions and Records, 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 College Office, 277 Coffey Hall, or at the Admissions and Records Office, 130 Coffey Hall. Consult your adviser about writing the petition and for recommendation for approval. Present your petition to the College 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 Admissions Office, 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 college office for details.

**Course Load**—The typical course load per quarter is 14 to 18 credits. A credit requires an average of three hours of work each week. To carry more than 18 credits, a C average (that is, a cumulative grade point average of not less than 2.00) is required. To carry more than 21 credits, a B average (3.00 GPA) in work of the previous quarter and permission from the Scholastic Standing Committee are required. Undergraduates must carry at least 12 credits each quarter to be considered full-time students.

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## General Information

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**Class Attendance**—Attendance for certain classes in the College of Agriculture is compulsory because of the nature of such classes. If you miss a class for a valid reason, you may request the instructor's assistance in making up the work missed. Instructors are under no obligation to give assistance if the absence is 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 grade point average, but only to satisfy the graduation requirement of a 2.00 grade point average. When a course is withheld from the undergraduate record, it can be reinstated only by an examination for credit or by repeating the course.

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.

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## 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.

**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 College 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 College Office.

### Professional Experience Program

**(PEP)**—Junior and senior students enrolled in curricula offered by the College of Agriculture may participate in the Professional Experience Program (PEP). This program is designed for students who wish to reinforce their academic experience by working in an area related to their course of study. Students work full time for 12 weeks during fall, winter, or spring quarter or during the summer. They earn 4 credits for satisfactory completion of a PEP program and may enroll in two PEP programs for a total of 8 credits. Salaries are paid by the cooperating businesses, industries, producers, and agencies participating in the program. For more information, consult your adviser or the Career Services Office, 272 Coffey Hall (612/624-2710).

**Reserve Officers' Training Corps—**

The ROTC, through its three services—Army, Navy, and Air Force—gives you an opportunity to combine military or naval training with your academic work. You are eligible for ROTC enrollment if you are a U.S. citizen and if you meet certain physical and other qualifications. The general requirements of the programs of the three services and their special characteristics are described in the *Army-Navy-Air Force ROTC Bulletin*. Inquiries may also be made in person or by letter at the following offices in the Armory Building, University of Minnesota, 15 Church Street S.E., Minneapolis, MN 55455: Military Science, room 108; Naval Science, room 203; Aerospace Studies, room 3.

**Minor**

The College of Agriculture offers minor concentrations in two areas. For more information on a specific minor, contact the College Office.

**Agriculture Minor for Non-College of Agriculture Students—**This minor is for non-College of Agriculture students who wish to explore some technical aspects of agriculture so they are better prepared as future leaders. The minor will help prepare them to:

- Understand the interdependence of rural and urban societies.
- Better manage the natural resources used by agriculture for the benefit of humanity.
- Understand the factors regulating supply and demand and the policies which determine the economics of food and fiber production.
- Understand the production practices used by agricultural producers and the environmental and social consequences of these practices.
- Understand the scientific basis of modern agriculture.

**International Agriculture Minor—**

The international agriculture minor is an interdisciplinary program combining

coursework, a seminar, and either a field experience or an in-depth study of the agricultural literature in one area. The minor 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 the College of Agriculture.

**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)

**Grading**

Academic progress in the College of Agriculture 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.

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## General Information

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**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 grade point average is determined by dividing the sum of the grade points earned (A=4.00, B=3.00, C=2.00, D=1.00, F=0.00) by the sum of the credits attempted. A cumulative average of 2.00 (C) is required for graduation. Additional grade point average requirements may be found under the individual curricular listings in 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 College of Agriculture 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 College 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 cancella-

tion during the first six weeks of a quarter. After the second week, the approval of the instructor is required for withdrawal. Withdrawal from a course after the sixth week is strongly discouraged unless extenuating circumstances exist. Withdrawals (Ws) if approved, after the sixth week of the quarter will count as an F in your honor point total.

V—Indicates registration as an auditor or visitor, a noncredit, nongrade registration.

T—Posted on the transcript as a preceding supplement to the original grade to indicate credits transferred from another institution or from one college or campus to another within the University when reevaluation is required.

X—Reported in a two- or three-quarter continuing course in which a grade cannot be determined until the full sequence is completed. The instructor submits a grade for each X when the student has completed the sequence.

**Dean's List**—The Dean's List, published at the end of fall, winter, and spring quarters, is one way that the College of Agriculture recognizes outstanding academic performance by its students. To qualify, you must complete at least 12 day school credits for the quarter with a grade point average of 3.70 or better. It is noted on your transcript when you qualify.

### Scholastic Requirements

College of Agriculture students are expected to maintain an academic standing that will enable them to meet minimum requirements for graduation upon completion of the required number of credits in the major that they have selected. To aid in the early identification of students who are not making satisfactory progress so that appropriate assistance can be provided, the following system has been developed.

**Honor Point System**—An honor point total (HPT) is calculated for each student at the end of each quarter based

on points assigned to the letter grades earned (A=2 honor points per credit, B=1, C or S=0, D=-1, F=-2, N=-2, W [after sixth week of quarter]=-2).

Students whose cumulative honor point total is negative are referred to an adviser, a departmental scholastic committee, or the College Scholastic Standing Committee for action. If a student's honor point deficiency is low enough to remedy within a quarter, the student is placed on the first level of academic probation and the matter is handled by the academic adviser. If the honor point deficiency is too great to remedy within a quarter, the student is placed on a strict academic probation by the College Scholastic Standing Committee as well as referred to the departmental adviser for academic counseling. Students remain on academic probation until any honor point deficiency has been remedied.

Students who have been placed on academic probation will not be permitted to register in the college until they have received permission to do so from the Scholastic Standing Committee. If this approval is granted, specific goals may be established and the student will be expected to meet them. Students who do not meet these goals may be suspended from the college.

Students who entered the College of Agriculture for the first time in or after fall quarter 1977 will not be permitted to graduate with a unit negative honor point total in all coursework taken at the University after admission to the College of Agriculture. Students who entered the college for the first time in or after fall quarter 1981 will not be permitted to graduate with a negative honor point total either overall or in the major.

**Appeal System**—Decisions by the adviser, department scholastic standing committee, and subcommittees of the college Scholastic Standing Committee may be appealed to the college Scholastic Standing Committee, whose decisions



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## General Information

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in turn may be appealed to the dean of the College of Agriculture.

**Repeating Courses**—Students may repeat, for credit, courses in which they have received grades of N or F, and only the first passing grade will be counted toward graduation. (The grades previously earned, however, will remain on the transcript.) Students who want to repeat courses in which they received grades of 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 College of Agriculture faculty member who is the instructor for the course may modify the grade for the exam or piece of work in question or the course grade, or refer the incident to the Scholastic Standing Committee for disposition. In any case, the instructor must report the incident and the action taken by the instructor to the 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 College of Agriculture Office.

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

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

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

**Access to Student Educational Records**—In accordance with the 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. The policy also permits students to review their educational records and to challenge the contents of those records.

Some student information—name, address, telephone number, dates of enrollment and enrollment termination, college and class, major, adviser, and degrees earned—is considered public or directory information. To prevent release of such information outside the University while in attendance at the University, students must notify the records office on their campus.

Students are notified annually of their right to review their educational records. The regents' policy, including a directory of student records, is available for review at the Williamson Hall

Information Center, 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 the College of Agriculture;
3. Earn a minimum grade point average of 2.00 in your major coursework;
4. Meet the honor point total requirements as stated under Scholastic Requirements above.

Graduation application deadlines are set by the College Office and are *two quarters before your expected graduation*. The deadline will be published in the college *Kiosk*, an information sheet that you will receive each quarter with your registration materials. You will be responsible for knowing these deadlines. *Extensions of deadlines are rarely granted*. You may turn in your application and fee to the Office of Admissions and Records, 130 Coffey Hall.

**Residency Requirements**—In addition to meeting University residency requirements, baccalaureate degree candidates in the College of Agriculture must earn 30 of their last 45 credits while enrolled in the College of Agriculture.

**Graduation With Distinction and High Distinction**—Graduation “with high distinction” is limited to the top 3% (usually 3.80 GPA or above) of the graduating class; “with distinction” to the next 7% (usually 3.50 GPA or above) of the graduating class.

The calculation of the grade point average to determine the class rank is based on the last 90 credits taken prior to graduation. Only graduating students who have completed at least 90 credits as a student in the College of Agriculture are eligible for honors designations, regardless of the level of their academic performance.

### Career 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 employer representatives. 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. Many workshops on career development are offered by this office.

### Student Organizations

**College of Agriculture Student Board**—The College of Agriculture Student Board promotes student involvement in issues related to the quality and content of education both in and out of the classroom. This purpose is achieved through channels of communication created by the board between the students, faculty, and administration of the College of Agriculture. Through the board, students participate in such matters as consideration of proposed curricula, questions related to instruction, improvement of educational facilities, development of administrative policy, and establishment of the goals of the College of Agriculture. Further information related to the board and its operation may be obtained in 277 Coffey Hall.

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## General Information

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### **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, Home Economics, and Veterinary Medicine. The board brings questions from the student bodies to the administration of the colleges and discusses problems and reaches decisions on matters of general interest. The board cooperates with the Minnesota Student Association and the Assembly Committee on Student Affairs (ACSA).

As a student in the College of Agriculture, you may file for election to this board. Inquire at the Office for Student Affairs, 190 Coffey Hall, for more information.

### **Student Center Board of**

**Governors—**The St. Paul Student Center provides a varied program of social, cultural, and recreational activities and contributes in many ways to the educational objectives of the campus. The St. Paul Student Center Board of Governors, composed of students elected to represent the academic units on the St. Paul campus, formulates policies for operation of the student center and establishes its budget. For information about the St. Paul Student Center, its operation, and opportunities to serve on its various planning and programming committees, inquire at the information desk on the first floor of the student center.

**Freshman Board—**This group, which has an office in 190 Coffey Hall, meets weekly throughout the school year. Sponsored by the St. Paul Board of Colleges, Freshman Board gives you an opportunity to learn about the University—its organization and administration, its governance procedures, and students' role in decision-making. Activities are shared with the Minneapolis Freshman Council on the East Bank campus. All entering students receive

information about Freshman Board during the summer, and the first meeting is traditionally held during the first full week of fall quarter. For further information, inquire at the Office for Student Affairs, 190 Coffey Hall.

**Agricultural Ambassadors—**This group of selected undergraduate students from the College of Agriculture 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 College Office, 277 Coffey Hall.

**Student Representation on College and University Committees—**All College of Agriculture committees and most all-University committees have student representatives. For college committees, selection is made by the College of Agriculture 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 College of Agriculture Student Organizations—**Many of the undergraduate programs sponsor student clubs. Membership and participation in these organizations can add a valuable dimension to your academic program and contribute a great deal to your professional development. Check with your adviser for further information.

# Distribution Requirements



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# Distribution Requirements

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## All-College Requirements

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

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

To help you achieve the goal of a liberal education, the College of Agriculture has set minimum requirements for the four major categories of knowledge listed below. These college distribution requirements meet or exceed the University requirements. They are firmly fixed, and *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 numerous changes that occur in course numbers, titles, and content, a complete list of courses that fulfill each of the four categories below is difficult to maintain. For approval of courses not listed below, consult the College Office, 277 Coffey Hall, (612) 624-3009.

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

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

## Computer Competency

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

## B. Physical and Biological Sciences—14 credits (A-F)

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

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

**(1) Analysis of Human Behavior and Institutions**

Afro 1011, 1025, 1334, 1441, 3013, 3061, 3072, 3091, 3543, 5072  
 AgEc 1101, 1102, 3070, 5720  
 AmIn 1771, 5411, 5422  
 Anth 1102, 3131, 3211, 3212, 3222, 3223, 3241, 3261, 3281, 3293, 3501, 3511, 3512, 3521, 3533, 5112, 5115, 5118, 5121, 5131, 5141, 5151, 5152, 5153, 5154, 5155, 5161, 5162, 5258, 5335, 5411  
 Chic 1105, 1106, 1107, 3115, 3615, 3617  
 Clas 3071, 3072, 3073  
 EAS 1032, 1461, 1462, 1463, 3281, 3315  
 Econ 1101, 1102, 1104, 1105, all courses in Economic Development Systems, Area Studies  
 Fren 3511, 3512, 3513  
 FSoS 1001, 1025, 3015  
 Geog 1301, 3101, 3121, 3131, 3133, 3141, 3161, 3165, 3181, 3211, 3212, 3213, 3215, 3221, 3321, 3331, 3341, 3343, 3344, 3345, 3351, 3371, 3373, 3375, 3378, 3381  
 Ger 3501, 3502, 3511, 3512, 3513  
 Ital 3590

IntR—all courses except 5900, 5910, 5920, 5930  
 Jour 5601, 5721  
 JwSt 1034, 3126, 3142, 3521, 5621  
 Ling 1001, 1005, 3111  
 Pol 1001, 1025, 1026, 1027, 1041, 1054, 1061, 3306, 3307, 3308, 3309, 3321, 3331, 3659, 3661  
 Psy 1001, 1004, 1005, 3101, 3201  
 RelS—all courses except 5890, 5960  
 Scan 1504, 3457, 3501  
 Soc—all courses except methodology and topics courses  
 Span 1501, 1502, 1503, 3501, 3502  
 Spch 5611, 5616, 5617, 5618  
 WoSt 1001, 1002, 1101, 1102, 3102, 3203, 3204, 3300, 3305, 3602

**(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, 3324, 3421, 3864, 3865, 5597  
 AgEc 3040  
 AgEd 1010  
 AmIn 3026, 3030, 3111, 3112, 3121, 3161, 3211  
 AmSt—all courses  
 Anth 3003  
 Chic 3212, 3427, 3428, 3441, 3442  
 Clas 1001, 1002, 1003, 1004, 1005, 1006, 1023, 1024, 1025, 1061, 3071, 3073, 5004  
 ClCv 3940  
 EAS 1063, 1461, 1462, 1463, 3464, 3465, 3467, 3468, 3471, 3472, 3481



## Distribution Requirements

Fren 3599

Hist—all courses listed under the heading "Introductory" in the CLA Bulletin plus 3200, 3434, 3707, 3708, 3821, 3822, 3823, 5171, 5172, 5173, 5281, 5282, 5283

HSci—all courses except 5970, 5990

Hum—all courses except 3755, 3910, 3970, 3980, 5910

JwSt 3521, 3607

Phil 1002, 1003, 1004, 3001, 3002, 3003, 3004, 3005, 3302, 3304

Rhet 1301, 1302, 1303, 1310, 1311, 1376, 3370, 3374, 3375, 3381

Russ 3511, 3512

Scan 3271, 3272, 3273

SOAS 1506, 3411, 3412, 3413, 3501, 3502, 3521

Span 1501, 1502, 1503, 3501, 3502, 3512

Spch 5602, 5607, 5611, 5616, 5617, 5618, 5621, 5622

WoSt 3103, 3307, 3402, 3403, 5101, 5401, 5402

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

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

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

Afro 1301, 3105, 3108, 3301, 3591, 3592, 3601, 5201, 5301, 5551, 5593, 5595, 5597

AmIn 3116, 3221, 3242, 5251

AmSt 1001, 1002, 1003

ArH—all courses except 5895, 5950, 5960, 5970, 5990, 5591

ArtS 1401 only

Chic 3212, 3213, 3507, 3508, 3510, 3511

Clas 1001, 1002, 1003, 1004, 1005, 1006, 1042, 3008, 3072, 3081, 3082, 3083, 3122, 3142, 3145, 3152, 3162, 3181

CLit—all courses

Dsgn 1501, 5505

EAS 3013, 3020, 3201, 3202, 3808, 3941

Engl—all courses except 3851, 3852, 3910, 3920, 3931, 3932, 3940, 3950, 3963, 3970, 3980, 5815, 5821, 5831, 5843, 5851, 5860, 5871, 5910, 5920, 5940, 5950

Foreign languages—all advanced courses that deal directly with literature and that are not listed under category C may be used

Hum—all courses except 39xx, 59xx

JwSt 3315, 3401, 3402, 3403

LA 1022

MidE 3211, 3213, 3601, 3602

Mus 1021, 1602, 1604, 1605, 1606, 1804, 3021, 3027, 3028, 3029, 3708, 3709, 3807, 3808

Rhet—humanities courses: 1301, 1302, 1303, 1310, 1311, 3370, 3375

SOAS 3204, 3456, 5201, 5202, 5203

Th 1101, 1102, 1405, 3171, 3172, 5171, 5172, 5173, 5177, 5178, 5181, 5182, 5186

WoSt 3303, 3304, 3306, 3307, 3308, 5181, 5182

# Programs





# Programs

The requirements for the College of Agriculture 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. Also included below is a description of the graduate-level Master of Agriculture program, which is administered by the College of Agriculture (not the Graduate School).

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

## Agricultural Business Management

*Dr. Robert P. King, Major Coordinator*  
130 Classroom Office Building  
1994 Buford Avenue  
St. Paul, MN 55108  
612/625-1281

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

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

managerial accounting, and transportation analysis.

Students completing this program may also pursue graduate studies in preparation for research, teaching, or continuing education positions in academic institutions, research 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. Completed or have in progress coursework to total 90 credits by the time of admission.
2. Completed the following management "tool" courses on an A-F grading basis by the time you enter the program:
  - Acct 1024, 1025
  - AgEc 1101, 1102 or Econ 1101, 1102
  - IDSc 1010 and OMS 1020
  - Math 1142 or 1211
3. Earned a minimum GPA of 2.80 in all coursework.

College of Agriculture students planning to major in Agricultural Business Management who have not completed the Pre-agricultural Business Management program are assigned a faculty adviser but retain a pre-major status until they are accepted into the program.

Additional information about admission to the program and application materials can be obtained from the major coordinator for the Agricultural Business Management program, 130 Classroom Office Building, or from the College Office, 277 Coffey Hall.

## Major Requirements

Agricultural Business Management students must complete the requirements listed below. Consult with your adviser to determine a suitable sequence for completing the required courses.

Course substitutions in categories A, B, C, and D may be made only with the approval of your adviser and the College Office. Substitutions in categories E and F can be made only with the approval of your adviser and the Agricultural Business Management Major Committee.

### A. Communication, Language, Symbolic Systems—22 credits minimum

Math 1142 Short Calculus (5)  
or Math 1211 Calculus I (5)  
(Students contemplating graduate work are encouraged to take the Math 1211-1221-1231 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 Chemical Principles and Covalent Systems (5)  
One of the following:  
BioC 3001 Elementary Biological Chemistry (4)  
Biol 1103 General Botany (5)  
Biol 1106 General Zoology (5)  
Chem 1002 Chemical Principles and Covalent Systems (5)

### 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 20.  
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 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 20.

### E. Professional Courses in the Major

AGRICULTURAL 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 (5)  
AgEc 3001 Applied Microeconomics: Consumers and Markets (4)  
AgEc 3002 Applied Microeconomics: Managerial Economics (4)  
AgEc 3003 Applied Microeconomics: Markets and Prices (4)  
AgEc 3005 Applied Macroeconomics: Trade, Policy, and Development (4)  
AgEc 3006 Applied Macroeconomics: Government and the Economy (4)  
AgEc 3500 Agricultural Finance (5) or BFin 3000 Finance Fundamentals (4)  
AgEc 3240 Farm and Agribusiness Strategic Management (4)  
AgEc 3260 Agribusiness Operations Management (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 1024 Principles of Financial Accounting I (3)  
Acct 1025 Principles of Financial Accounting II (4)  
Acct 3001 Principles of Managerial 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)  
OM 3000 Operations Management (4)  
Choose additional credits from the following:  
Acct 3255 Managerial Cost Accounting (4)  
AgEc 3450 Farm Input Marketing Economics (4)  
AgEc 3920 Agricultural Law (4)

## Programs

- 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)
- OM 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 (3)
  - AgEc 3430 Dairy Marketing Economics (3)
  - AgEc 3440 Livestock Marketing Economics (3)
  - AgEc 3450 Farm Input Marketing Economics (3)
  - AgEc 5750 Agricultural Trade and Commercial Policies (4)
  - LM 3020 Advanced Logistics Management (4)
  - OM 3000 Introduction to Operations Management (4)

### Finance and Banking—16 credits minimum

- AgEc 5500 Advanced Agricultural Finance (4)
  - BFin 3100 Financial Management (4)
  - BFin 3300 Investment Management and Financial Markets (4)
- Choose additional credits from the following:
- Acct 3160 Financial Statement Analysis (4)
  - Acct 3255 Managerial Cost Accounting (4)
  - AgEc 5480 Futures Markets and Prices (4)
  - BFin 3601 Bank Financial Management (4)
  - Econ 5432 International Finance (4)
  - Ins 3100 Risk Management and Insurance (4)

### Food Marketing—16 credits minimum

- AgEc 5550 Food Marketing Economics (4)
  - Mktg 3010 Buyer Behavior and Market Analysis (4)
  - Mktg 3020 Marketing Operations Management (4)
- Choose additional credits from the following:
- AgEc 5480 Futures Markets and Prices (4)
  - AgEc 5580 Economic Organization of the Household (4)
  - AgEc 5750 Agricultural Trade and Commercial Policies (4)
  - FScN 3272 Introduction to Food Decision Making (2)
  - FScN 3472 Principles of Food Purchasing (4)
  - FScN 5390 Introduction to Food Law (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 3000 or 5000 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 3250, 3606, and 3610 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 the College of Agriculture and the College of Education, is designed 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 agriculture development and in various agriculture-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 farming. The program requires a broad study of agriculture and permits emphasis in animal science, crop science, agricultural economics, agricultural business, horticulture, soils, and agricultural engineering technology. It also, in the Education Specialization, offers the special training in education necessary to qualify for licensure as a teacher of agriculture, horticulture science, agribusiness, and agriscience education.

## Admission Procedures

Students may enter a pre-agricultural education major in the College of Agriculture 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 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 Education Specialization in the College of Education, students must have a minimum overall grade point average of at least 2.50. During the first year in the program, they will be required to complete the Pre-Professional Skills Test (PPST) which is a test of basic reading, writing, and mathematics knowledge.

*The Agricultural Development Specialization.* Students in this option will be eligible for a wide range of positions in agriculture development. 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 grade point average of at least 2.30.

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

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

## Student Teaching

In the Agricultural Education Specialization, students must have an overall grade point average of 2.50 to be eligible for student teaching.

## Graduation Requirements

Students must have an overall grade point average of 2.50 to meet graduation requirements in the Agricultural Education Specialization. They must have an overall grade point average 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

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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 the College of Agriculture. 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

- 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)
- Math 1111 College Algebra (5)
- Agri 1200 Computer Applications in Your Profession (3)

Plus one of the following:

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

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

### B. Biological and Physical Sciences—29 credits minimum

- Chem 1001 Chemical Principles and Covalent Systems (5)
- BioC 3001 Elementary Biological Chemistry (4)
- Biol 1009 General Biology (5)
- One course in physics
- Students must select 10 additional credits of elective courses in biological and physical science or
- Chem 1004 General Principles of Chemistry (5)
- Chem 1005 General Principles of Chemistry (5)
- BioC 3001 Elementary Biological Chemistry (4)
- Biol 1009 General Biology (5)
- Biol 1103 General Botany (5)
- or
- Biol 1106 General Zoology (5)

One course in physics

### 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)
- Hist 1301 American History (4)
- Hist 1302 American History (4)
- Geog 1401 Physical Geography (5)
- Anth 1102 Introduction to Social and Cultural Anthropology (5)
- Any additional course in anthropology
- Pol 1001 American Government & Politics (5)
- Phil 1001 Introduction to Logic (5)
- Phil 1002 Introduction to Philosophy (5)
- Phil 1003 Introduction to Ethics (5)
- Hist 3821 United States in the 20th Century (4)
- Hist 3822 United States in the 20th Century (4)
- Hist 3823 United States in the 20th Century (4)

### D. Literature, Humanities, and Fine Arts—12 credits minimum

Students are encouraged to pursue 12 or more credits in a theme area. However, they may select 12 credits at random from the suggested theme areas. Students may apply up to 5 credits in the performing arts such as music, theatre, and studio arts in category D.

## Agricultural Education Specialization

### Professional Supporting Courses in the Major

#### E. General Education and Related Courses—18 credits minimum\*

- EPsy 3131 Introduction to Human Relations (3)
- VoEd 5800 Working with Special Needs Students (3)
- PubH 3004 Basic Concepts in Personal and Community Health (5)
- SEEd 3155 Psychological Foundations of Secondary Education (5)
- Hlth 1500 American Red Cross Standard First Aid and Personal Safety (2)

\*All courses in category E are subject to change upon completion of program redesign in the College of Education. See your adviser for the latest requirements.

#### F. Agricultural Education—33 credits minimum

- AgEd 1001 Introduction to Agricultural Education (1)
- AgEd 1002 Principles of Career Planning in Agriculture (1)
- AgEd 1003 Personalized Agriculture Career Planning (1)
- AgEd 3029 Directed Experience in Agricultural Education (1)
- AgEd 3031 Student Teaching in 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. Planning and Management (3)
- AgEd 5078 F.F.A. Organization and Management (2)

## Major Courses

### G. Technical Agriculture—64 credits minimum

12 credits from courses in soil science, plant science, or plant protection  
 10 credits in animal science

#### Agricultural Economics/Business—24 credits

- AgEc 1101 Principles of Microeconomics (4)
- AgEc 1102 Principles of Macroeconomics (5)
- AgEc 3810 Principles of Farm Management (4)

At least one of the following:

- BME 5260 Professional Sales Education (3)
- GC 1537 Professional Selling (3)

At least one of the following:

- AgEc 3420 Grain Marketing Economics (3)
- AgEc 3430 Dairy Marketing Economics (3)
- AgEc 3450 Ag Input Marketing (3)
- AgEc 5440 Cooperatives (4)
- AgEc 5480 Futures Marketing (4)

At least one of the following

- AgEc 3005 Applied Macroeconomics: Policy, Trade, and Development (4)
- AgEc 3040 Economic Development of American Agriculture (4)
- AgEc 3070 Agriculture & Economic Growth in Developing Countries (4)
- AgEc 3240 Ag Business Management: Strategic Planning & Control (4)
- AgEc 3260 Ag Business Management: Tactical Planning & Control (4)
- AgEc 3850 Farm Business and Enterprise Analysis (4)
- AgEc 3920 Agricultural Law (4)
- GC 1513 Principles of Small Business Operation (5)
- GC 1540 Accounting Fundamentals (4)

#### Ag Engineering Technology—11 credits minimum

- AgEt 1020 Agricultural Shop Metalwork (4)
- AgEt 5020 Program Planning and Instructional Methods in Agricultural Mechanics (3)

Recommended additional courses:

- AgEd 3041 Ag Education Technology (4)
- AgEt 3606 Farm Building Design, Layout Systems (4)

At least 3 credits in Natural Resources and Environment

Practicum—3 credits

- AgEd 5072 Practicum: Agricultural Business and Industry (3)

### H. General Electives

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

## Agricultural Development Specialization

### Professional Supporting Courses in the Major—42 credits minimum

#### E. General Education—7 credits minimum\*

- Educ 5401 Adult Learning and Development Through the Life Span (3)
- PubH 3003 Fundamentals of Alcohol & Drug Abuse (2)
- Hlth 1500 American Red Cross Standard First Aid and Personal Safety (2)

\*All courses in category E are subject to change upon completion of program redesign in the College of Education. See your adviser for the latest requirements.

#### F. Agricultural Education—35 credits minimum

Professional—15 credits

- AgEd 1001 Introduction Agriculture 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 (3)
- AgEd 5010 Rural Education: Philosophy and Leadership (3)
- AgEd 5021 Education Through Extension Methods (3)

3 additional credits in Agricultural Education

Experiential—20 credits minimum

- \*AgEd 3001 Experiential Learning: Production Agriculture (6-14)
- \*AgEd 3002 Experiential Learning: Agricultural Business (6-14)

\*Combined AgEd 3001 and 3002 credits must not exceed 20. 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 can be used to substitute for some or all of the experiential learning credits.

#### G. Technical Agriculture—64 credits minimum

12 credits in Soil, Plant Science, and/or Plant Protection

8 credits in Animal Science

Agricultural Economics—19 credits

- AgEc 1101 Principles of Microeconomics (4)
- AgEc 1102 Principles of Macroeconomics (5)
- AgEc 1250 Principles of Accounting (or equivalent) (5)

- AgEc 3500 Farm and Agribusiness Finance (or equivalent) (5)

Agricultural Business—18 credits

At least one course from:

- BME 5260 Professional Sales Education (3)
- GC 1537 Professional Selling (3)

## Programs

At least *one* course from:

- BME 5253 Supervisory Training (3)
- GC 3560 Personnel Administration (3)
- GC 3602 Applied Supervision (3)

At least *two* courses from:

- AgEc 3420 Grain Marketing (3)
- AgEc 3430 Dairy Marketing (3)
- AgEc 3440 Livestock and Meat Marketing (3)
- AgEc 3850 Farm Business and Enterprise Analysis (4)
- AgEc 5440 Cooperatives (4)
- AgEc 5480 Futures Marketing (4)
- GC 1551 Marketing: Introduction (4-5)
- GC 1513 Principles of Small Business Operation (5)
- AgEd 3810 Principles of Farm Management (4)

At least *one* course from:

- AgEc 3005 Applied Macroeconomics: Policy Trade Development (4)
- AgEc 3040 Economic Development of American Agriculture (4)
- AgEc 3070 Agriculture & Economic Growth in Developing Countries (4)

7 credits in Agricultural Engineering

### H. General Electives

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

### *Post Baccalaureate: Agricultural Education Teaching Specialization*

### General Features

This program provides an alternative teacher education experience. The program is designed for students with baccalaureate degrees in agriculture or forestry 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 at the secondary and adult levels. 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.

## Agricultural Engineering

(Institute of Technology)

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

A four-year professional curriculum leading to the degree of bachelor of agricultural engineering, B.Ag.E., is offered by the department of Agricultural Engineering through the Institute of Technology. Students register in the Institute of Technology. Emphasis in the curriculum is on the physical sciences and engineering design, but economics, agricultural science, and other subjects are included.

Each student, with the assistance of an adviser, plans a curriculum tailored to his or her individual interests. The principal fields of specialization within agricultural engineering are design of agricultural power and machinery, soil management and water control, building design and environmental control, and food and process engineering. Students select special courses from a number of subject areas to give them a broad background in topics related to their specialization.

### Lower Division (98 credits)

- Comp 1011 Writing Practice I (5)
- Math 1211-1221-1231 Calculus I-II-III (15)
- Math 3211-3221 Multivariable Calculus, Introduction to Linear Algebra and Linear Differential Equations (10)
- Phys 1271-1281-1291 General Physics (12)
- Phys 1275-1285-1295 General Physics Laboratory (3)
- Chem 1004-1005 General Principles (10)
- AgEn 1060 Agricultural Engineering Orientation (1)
- AgEn 1031 Computations in Agricultural Engineering (2)
- ME 1025 Engineering Graphics (4)
- AEM 1015 Statics (4)
- AEM 3016, 3036 Deformable Body Mechanics, Dynamics (8)
- CE 3400 Fluid Mechanics (4)
- CSci 3101, CSci 3102 or AgET 3030 Computer Programming (4)
- Liberal Education Electives (16)

### Upper Division (92 credits)

- Comp 3031 Technical Writing for Engineers (4)
- EE 3003-3004 Circuits and Electronics (5)
- ME 3301-5342 Thermodynamics, Heat Transfer (8)
- AgEn 3052 Physio-Engineering in Agriculture (4)

- AgEn 3060 Analysis in Agricultural Engineering (4)  
AgEn 5081, 5082, 5083 or 5084 Design (4)  
Agricultural Engineering Electives (five courses from at least three of groups a-e) (20)
- (a) AgEn 5060 Processing  
AgEn 5130 Food Engineering  
AgEn 5140 Thermal Processes for Food
  - (b) AgEn 5330 Agricultural Machinery  
AgEn 5340 Agricultural Tractors
  - (c) AgEn 5540 Erosion Control, Watershed Engineering  
AgEn 5550 Drainage and Irrigation Engineering
  - (d) AgEn 5730 Agricultural Structures Design  
AgEn 5740 Environmental Control for Agricultural Production  
AgEn 5910 Agricultural Waste Management
  - (e) AgEn 5070 Automatic Control and Instrumentation  
AgEn 5072 Finite Element Methods: Fundamentals and Applications  
AgEn 5074 Microcomputer Interfacing
- Engineering Electives (4)  
Agricultural and Biological Science Electives (8)  
Liberal Education Electives (11)  
Electives as needed to meet graduation requirements of 190 credits (20)

Electives are usually chosen to develop professional competence in a given area of specialization, but they can be used for broad professional preparation. Sample programs and lists of suggested electives are available at the department office or from individual advisers.

## Agricultural Industries and Marketing

Dr. Dale C. Dahl, Coordinator  
217g Classroom Office Building  
1994 Buford Avenue  
St. Paul, MN 55108  
612/625-5778

Industries related to modern agriculture include the manufacturers and distributors of farm production inputs (such as equipment, structures, animal feed, health products, seeds, 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, turf). These industries employed about 18 million workers in 1988 and created nearly 16% of the U.S. Gross National Product that year. These "agribusinesses" regularly search for employees who have specialized, yet broad training—individuals knowledgeable

about the scientific aspects of agriculture, able to work and communicate with others effectively, and competent to use quantitative methods to solve current business problems.

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

- (1) to provide a broad-based educational program reflecting the academic strengths of the College of Agriculture and the University at large, and
- (2) to prepare students for a challenging career in the 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. Certified advisers assist students with selecting courses in the area of emphasis, identifying appropriate internships or practicum experiences, and choosing electives to build breadth and depth into their undergraduate programs.

In addition, this major emphasizes development of communication skills, using oral and written form, in various interactive settings. Courses in business methods and economic analysis assist students in recognizing and solving 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



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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—47 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)
  - Rhet 3562 Writing in Your Profession (4)
  - Spch 3411 Small Group Communication Processes (4)
  - Rhet 5258 Interviewing: Dynamics of Face-to-Face Communication (4)
  - GC 1537 Professional Selling (4)  
or BME 5260 Professional Sales Education (3)
- One additional communications elective from the following courses:
- Jour 3201 Principles of Advertising (4)
  - Rhet 3254 Advanced Public Speaking (4)
  - Spch 3431 The Role of Persuasion in the Modern World (4)
  - Spch 3441 Communication in Organizations (4)

#### 2. Quantitative Methods

- AgEc 1250 Principles of Accounting (5)  
or Acct 1024 Principles of Financial Accounting I (3)  
and 1025 Principles of Financial Accounting II (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—19 credits minimum

- Biol 1009 General Biology (5)
- Chem 1001 Chemical Principles and Covalent Systems (5)
- Chem 1002 Chemical Principles and Covalent Systems (5)  
or BioC 3001 Elementary Biological Chemistry (4)

#### One of the following:

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

### C. The Individual and Society—16 credits minimum

See All-College Requirements on page 20.

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

#### One of the following:

- AgEc 3040 Economic Development of American Agriculture (4)
- Rhet 3375 Humanities: Agricultural Heritage (4)
- Rhet 1310 Humanities: The Land in American Experience (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 on page 20.

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 Project—4 credits minimum  
PEP 5000 Professional Experience Program (internship) (4)  
or AIM 5001 Marketing Practicum (4)
- 2. Economics/Business—27 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 of the following:

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

#### One of the following:

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

### F. Agricultural Sciences—33 credits minimum

- One course in Agricultural Engineering  
or FScN 1102 Technology of Food Processing (4)
- Agro 1010 Principles of Agronomy (4-5)  
or Hort 1100 Biology of Horticultural Production (4)
- AnSc 1100 Introduction to Animal Science (5)
- Soil 3125 Basic Soil Science (4)  
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*—16 credits minimum
- AnSc 3220 Animal Breeding (5)
- AnSc 3301 Systemic Physiology (6)

AnSc 3401 Principles of Animal Nutrition (3)

One of the following:

- AnSc 3402 Feeding Farm Animals (2)
- 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 1510 Consumer Meat Science (2)
- AnSc 3113 Animal Welfare (4)
- AnSc 3305 Reproductive Physiology, Artificial Insemination, and Lactation (5)
- AnSc 5231 Dairy Cattle Breeding (4)
- AnSc 5240 Animal Cytogenetics (4)
- AnSc 5280 Livestock Entomology (3)
- AnSc 5601 Swine Production (4)
- AnSc 5602 Sheep Production (4)
- AnSc 5603 Beef Cattle Production (4)
- AnSc 5604 Dairy Farm Management (4)
- AnSc 5605 Poultry Production (4)
- AnSc 5609 Principles of Farm Animal Environment (3)
- GCB 3022 Genetics (4)
- LACS 3502 Animal Health and Disease (5)

*Crops/Soils Industries*—16 credits minimum

Agro 3020 Crop Growth Culture and Management (5)

Soil 3416 Soil Fertility (4)

Plus at least 7 credits from the following:

- AgET 3250 Farm Machinery Management (4)
- Agro 3010 Adaptation, Distribution, and Ecology of Field Crops (4)
- Agro 3030 Maturation, Harvest, and Storage of Field Crops (1)
- Agro 3060 Field Plot Design in Agronomy (4)
- Agro 3100 Morphology and Identification of Crops and Weeds (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)
- Agro 5060 Small Grains, Sunflower and Sugarbeet Management (3)
- Soil 3104 Computer Applications in Soil Science (2)
- Soil 3118 Seminar: Soil and Water Pollution and Public Policy (1)
- Soil 3225 Physical Soil Management and Conservation (4)
- Soil 3417 Soil Fertility Laboratory (1)
- Soil 3520 Soil Morphology, Classification, and Genesis (4)
- Soil 5104 Agricultural Systems Analysis, Modeling (4)
- Soil 5230 Soil-Plant-Water Relations (3)
- Soil 5240 Microclimatology (3-4)
- Soil 5560 Soil Survey Interpretation (4)
- Soil 5610 Soil Biology (4)

*Horticultural Industries*—22 credits minimum

Hort 1016 Greenhouse Management (2)

Hort 1036 Plant Propagation (4)

Plus at least 16 credits from the following:

- 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 5041 Environmental Physiology of Horticultural Plants (3)
- Hort 5042 Turf Grass Science (5)
- Hort 5046 Nursery Management I (4)
- Hort 5048 Nursery Management II (4)
- Hort 5052 Commercial Floriculture, Fall Crops (4)
- Hort 5053 Commercial Floriculture, Winter Crops (4)
- Hort 5054 Commercial Floriculture, Spring Crops (4)

*Food Industries*—16 credits minimum

AgEc 5550 Food Marketing Economics (4) (if not used under category E)

BioC 3031 Survey of Biochemistry (4)  
or FScN 1212 Scientific Principles of Food Preparation (4)

Plus at least 8 credits from the following:

- FScN 3110 Food Chemistry (4)
- FScN 3112 Food Chemistry Laboratory (2)
- FScN 3403 Experimental Foods (4)
- FScN 3272 Introduction to Food Decision-Making (2)
- FScN 3400 Food Communication Techniques (3)
- FScN 3472 Principles of Food Purchasing (4)
- FScN 3730 Quantity Food Production Management (5)
- FScN 5360 Sensory Evaluation of Food Quality (4)
- FScN 5390 Introduction to Food Law (4)

*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. Donald Otterby, Major Coordinator*  
130 Haecker Hall  
1364 Eckles Avenue  
St. Paul, MN 55108  
612/624-0782

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

## Programs

emphasis. Students majoring in Animal and Plant Systems may be prepared 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, government, 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 emphasize

ing 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 College 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—25 credits minimum

- Math 1111 College Algebra and Analytical Geometry (5)  
or Math 1201 Pre-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)  
or Agro 3060 Field Plot Design in Agronomy (3)  
or OMS1020 Data Analysis and Statistical Inference for Managers (4)
- Recommended courses:
- Math 1142 Short Calculus
  - or Math 1211 Calculus I (5)

#### Computer Competency

Computer skills are necessary for today's student. As a student in the College of Agriculture, you will use computer applications in your coursework no matter which major you choose. You will be expected to have basic computer competency in word processing, spreadsheets, database management, and telecommunications. Your level of computer competency will

be assessed in the advising process. If you lack 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**—5 credits minimum

Biol 1009 General Biology (5)

At least one of the following:

Biol 1103 General Botany (5)

Biol 3012 Plant Biology (5)

Biol 1106 General Zoology (5)

Biol 3011 Animal Biology (5)

Chemistry—Select one of the following sequences:

Chem 1001 Chemical Principles and Covalent Systems (5)

Bioc 3001 Elementary Biological Chemistry (4)

Bioc 3031 Survey of Biochemistry (4)

or

Chem 1001 Chemical Principles and Covalent Systems (5)

Chem 1002 Chemical Principles and Covalent Systems (5)

Bioc 3031 Survey of Biochemistry (4)

or

Chem 1004 General Principles of Chemistry (5)

Chem 1005 General Principles of Chemistry (5)

Bioc 3001 Elementary Biological Chemistry (4)

Bioc 3031 Survey of Biochemistry (4)

or

Suggested for students planning on graduate study:

Chem 1004 General Principles of Chemistry (5)

Chem 1005 General Principles of Chemistry (5)

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, 1045 Introductory Physics & Laboratory (4,1)

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

\*GCB 3022 Genetics (4)

or Biol 5003 Genetics (4)

\*Please note: Required of all students except those in Environmental Horticulture.

Remainder of credits from the following:

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

Geo 1002 Historical Geology (4)

Geo 1005 Geologic Perspectives on Energy (4)

EBB 3001 Introduction to Ecology (4)

EBB 3111 Vertebrate Behavior (4)

or AnSc 3111 Introduction to Animal Behavior (4)

Ent 5320 Ecology of Agriculture

Bot 3109 Plant Anatomy (5)

Soil 5240 Microclimatology Soils (3 or 4)

Phys 1042, 1046 Introductory & Laboratory Physics (4,1)

Phys 1071, 1075 Introductory Meteorology & Laboratory (4,1)

or Soil 1262 Introduction to Meteorology (4)

Math 1142 Short Calculus (5)

MicB 3103 General Microbiology (5)  
or VPB 3103 General Microbiology

**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 20.

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

See All-College Requirements, page 20.

**E. General Requirements in the Major**—6 credits

Ent 1005 Economic Entomology (4)

or Ent 5280 Livestock Entomology (3)

Soil 1020 Soil Resource (4)

or Soil 3125 Basic Soil Science (4)

One course in Agricultural Engineering

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)

LACS 3502 Animal Health and Disease (5)

One of the following:

AnSc 5401 Swine Nutrition and Feeding (4)

AnSc 5403 Ruminant Nutrition (4)

AnSc 5405 Poultry Nutrition (4)

At least two of the following:

AgEc 3001 Applied Microeconomics: Consumers and Markets (4)

AgEc 3002 Applied Microeconomics: Managerial Economics (4)

AgEc 3003 Applied Microeconomics: Markets & Prices (4)

AgEc 3810 Principles of Farm Management (4)

AgEc 3430 Dairy Marketing Economics (3)

AgEc 3440 Livestock and Meat Marketing Economics (3)

GC 1513 Principles of Small Business Operations (5)

GC 1537 Professional Selling (3)

One of the following:

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)

Technical course 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 Farm and Agribusiness finance (5)

AgEc 3810 Principles of Farm Management (4)

AgEc 3930 Agricultural Law (4)

AgEc 5020 Applied Linear Programming (4)

AgEc 5440 Cooperatives and Agribusiness Organization (4)

AgEc 5840 Management of the Farm Business (4)

AgET 3030 Introduction to Problem Solving with Computers (4)

AgET 3250 Farm Machinery Management (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 3100 Morphology and Identification of Crops and Weeds (4)

Agro 3020 Crop Growth and Culture (5)

or Hort 1100 Biology of Horticultural Production (4)

Agro 5030 Weed Control (5)

AnPl 5060 Integrated Management of Cropping Systems (4)

Hort 1036 Plant Propagation (4)

or Agro 3130 Seed Technology (2)

PIPa 3001 Plant Pathology (5)

PIPh 3131 Survey of Plant Physiology (4)

Soil 3416, 3417 Soil Fertility and Lab (4,1)

One course in Animal Science (3-5)

One of the following:

Agro 5020 Introduction to Plant Breeding (4)

Agro 3030 Maturation, Harvest, and Storage of Field Crops (4)

Hort 3033 Postharvest Handling and Physiology of Horticultural Crops (3)

One of the following:

AgEc 3810 Principles of Farm Management (4)

AgEc 3420 Grain Marketing Economics (3)

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 3225 Physical Soil Management and Conservation (4)

or Soil 3520 Soil Morphology, Classification, and Genesis (4)

Additional electives to be selected from:

AgEt 3250 Farm Machinery Management (4)

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 5060 Small Grains, Sunflower, and Sugar Beet Management (3)

Agro 5070 Ecology of Field Crops (3)

Soil 3225 Physical Soil Management and Conservation (4)

or Soil 3520 Soil Morphology, Classification, and Genesis (4)

Soil 5230 Soil-Plant-Water Relations (4)

Soil 5240 Microclimatology Soils (3 or 4)

Soil 5610 Soil Biology (4)

Horticultural Food Production Technical courses—16 credits

Required Courses:

Hort 1016 Greenhouse Management (2)

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 1100 Biology of Horticultural Production (4)

GC 1513 Principles of Small Business Operations (5)

Hort 1016 Greenhouse Management (2)

Hort 1021 Woody Plant Materials (5)

Hort 1022 Herbaceous Plant Materials (5)

Hort 1036 Plant Propagation (5)

PIPa 3001 Introductory Plant Pathology (5)

PIPh 3131 Survey of Plant Physiology (4)

Soil 3416, 3417 Soil Fertility and Laboratory (4,1)  
 Additional 12 credits from the following:

- Acct 1024, 1025 Principles of Financial Accounting I & II (3,3)
  - or AgEc 1250 Principles Accounting (5)
- Acct 3001 Managerial 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: Governments and the Economy (4)
- AgEc 3290 Agribusiness Management (4)
- AgEc 3500 Farm and Agribusiness Finance (4-5)
- AgEc 3920 Agricultural Law (4)
- 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 & Information Management (4)
- Jour 3201 Principles of Advertising (4)
- Mktg 3000 Principles of Marketing (4)
- Mktg 3010 Buyer Behavior & 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  
 Required courses:

- Hort 3030 Landscape Design of Residential and Small Commercial Sites (4)
- Hort 3072 Turf Management (4)
- Hort 5026 Landscape Management (5)
- Hort 5042 Turf Grass Science (5)
- Hort 5046 Nursery Management I (4)
- Hort 5048 Nursery Management II (4)
- LA 1025 Basic Visualization I (4)

Floriculture Sequence

Required courses:

- Hort 3053 Ornamentals for Interior Design (4)
- Hort 3081 Floral Design and Floriculture Business (4)
- Hort 5040 Plant Growth Regulation (4)
- Hort 5052 Commercial Floriculture, Fall Crops (4)
- Hort 5053 Commercial Floriculture, Winter Crops (4)
- Hort 5054 Commercial Floriculture, Spring Crops (4)

**Integrated Pest Management**—53 credits minimum

Required courses:

- Agro 3100 Morphology and Identification of Crops and Weeds (4)
- Agro 3020 Growth, Development, and Culture of Field Crops (5)
  - or Hort 1100 Biology of Horticultural Production
- Agro 5030 Weed Control (5)
- AnPl 5060 Integrated Management of Cropping Systems (4)
- PIPa 3001 Plant Pathology (5)
- PIPa 5000 Professional Experience Program in Integrated Pest Management (4)
- PIPa 5700 Plant Disease Control (4)
- PIPh 3131 Survey of Plant Physiology (4)
- One Course in Animal Science

One of the following:

- AgEc 3002 Applied Economics: Managerial Economics (4)
- AgEc 3450 Agricultural Input Marketing Economics (3)
- AgEc 3810 Principles of Farm Management (4)

Technical courses:

At least three courses 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)
- Agro 5060 Small Grains, Sunflower, and Sugar Beet Management (3)
- Ent 5020 Insect Taxonomy (5)
- Ent 5040 Insect Ecology (3)
- Ent 5220 Stored Product Pest Management (4)
- Ent 5250 Forest Entomology (4)
- Ent 5280 Livestock Entomology (3)
- Hort 1016 Greenhouse Management (4)
- Hort 1036 Plant Propagation (4)
- Hort 1100 Biology of Horticultural Production (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 5105 Introduction to the Study of Fungi (4)
- PIPa 5005 Viruses and Bacteria in Plant Disease (4)
- PIPa 5006 Fungi, Algae, and Parasitic Seed Plants in Plant Disease (4)
- PIPa 5007 Air Pollution and Other Abiotic Causes of Plant Disease (3)
- PIPa 5008 Introduction to Plant Nematology (2)
- 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.

## Programs

### Biological Sciences

Freshman and sophomore students interested in earning a degree in the biological sciences may complete their prerequisite work in the College of Agriculture, since the College of Biological Sciences (CBS) accepts junior and senior students only. They will be assisted in program planning by an adviser in CBS and can transfer to CBS when they have met the requirements for entry. Pre-CBS students may apply directly to the College of Agriculture for admission.

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

### Applied Economics

*Dr. John Waelti, Major Coordinator*  
231 Classroom Office Building  
1994 Buford Avenue  
St. Paul, MN 55108  
612/625-7737

The Applied Economics major prepares students for careers in private and public agencies, agribusinesses, or for graduate work. Areas of emphasis include: Management and Finance; Marketing; Trade, Policy, and Development; Resource and Environmental Economics; as well as a student-designed individualized area of emphasis. This curriculum places a heavy emphasis on fundamental written and oral communication skills as well as development of a strong foundation in economic principles and their applications.

The intent of this curriculum is to offer flexibility to students while providing a strong fundamental core of knowledge. The core group of professional courses includes economic principles, basic micro/macro theory, and statistics. Students may select the remainder of their courses depending on their interests.

Note: A total of 65 credits in the entire program must be 3000 level or above.

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

##### *Quantitative Methods*

Math 1142 Short Calculus (5)  
or Math 1211 Calculus I (5)

Note: Students contemplating graduate work are encouraged to take the Math 1211-21-31 Sequence (5,5,5)

##### *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 Chemical Principles & Covalent Systems (5)

Plus one additional course from the following:

BioC 3001 Elementary Biological Chemistry (4)  
Biol 1103 General Botany (5)  
Biol 1106 General Zoology (5)  
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 on page 20.

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

See All-College Requirements on page 20.

#### E. Professional Courses—59 credits minimum

AgEc 1000 Orientation to Agricultural & Applied Economics (1)  
AgEc 1101 Principles of Microeconomics (4)  
AgEc 1102 Principles of Macroeconomics (5)  
AgEc 3001 Applied Microeconomics: Consumers & Markets (4)  
AgEc 3002 Applied Microeconomics: Managerial Economics (4)  
AgEc 3003 Applied Microeconomics: Markets and Prices (4)  
AgEc 3005 Applied Macroeconomics: Trade, Policy and Development (4)  
AgEc 3006 Applied Macroeconomics: Government and the Economy (4)  
AgEc 1250 Principles of Accounting (5)  
or Acct 1024,1025 Principles of Financial Accounting I & II (3,3)  
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. Student may apply these 16 credits towards an area of emphasis. Major advisers will provide recommended course listings.

**F. Science and Technology Emphasis**—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 3000 or 5000 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. Students must have their course selections approved by their adviser and the Applied Economics major committee.

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

## Food Science

*Dr. David Smith, Coordinator*  
225 Food Science and Nutrition  
1334 Eckles Avenue  
St. Paul, MN 55108  
612/624-1290

*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 develop proficiency in a related discipline through one of the areas of specialization offered: consumer emphasis, process/technology, chemistry, or microbiology. Graduates of the program work in a variety of technical, marketing and promotional positions in the consumer food industry.

The program is open to students registered in either the College of Agriculture or the College of Home Economics. 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.

## Undergraduate Food Science Curriculum

### A. Communication, Language, Symbolic Systems

Math 1211, 1221 Calculus I and II (5,5)  
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)  
Stat 3011, 3012 Statistical Analysis (4,4)  
or Stat 5021 Statistical Analysis (5)

### B. Physical and Biological Sciences

Biol 1009 General Biology (5)  
Biol 5001 Biochemistry (4)  
or BioC 3031 Survey of Biochemistry (4)  
Chem 1004 General Principles of Chemistry (5)  
Chem 1005 General Principles of Chemistry (5)  
Chem 3301, 3305 Elementary Organic Chemistry I and Laboratory I (4,2)  
Chem 3302, 3306 Elementary Organic Chemistry II and Laboratory II (4,2)  
MicB 5105 Biology of Microorganisms (5)  
or VPB 3103 General Microbiology (5)  
Phys 1041, 1045 Introductory Physics and Lab (4,1)  
Phys 1042, 1046 Introductory Physics and Lab (4,1)

### C. The Individual and Society

—14 credits minimum

See All-College Requirements on page 20. One course required in the area of Development of Civilization.  
AgEc 1101 Principles of Microeconomics (4)  
or Econ 1101 Principles of Microeconomics (4)  
AgEc 1102 Principles of Macroeconomics (5)  
or Econ 1102 Principles of Macroeconomics (5)

### D. Literature, Humanities, and Fine Arts

—9 credits minimum

See All-College Requirements on page 20.



# Programs

## E. Professional Courses in the Major

- FScN 1102 Technology of Food Processing (4)
- FScN 1612 Principles of Nutrition (4)
- FScN 3110 Food Chemistry (4)
- FScN 3112 Food Chemistry Laboratory (2)
- FScN 3403 Experimental Foods (4)
- FScN 5100 General Seminar (1)
- FScN 5120 Food Microbiology (5)
- FScN 5122 Control of Microorganisms in Food Processing (2)
- FScN 5123 Microbiology of Food Fermentations (2)
- FScN 5135 Food Engineering Unit Operations (5)
- FScN 5136 Unit Operations Laboratory (2)
- FScN 5312 Chemical and Instrumental Analysis of Foods (5)

One course from the following:

- FScN 5512 Meat Technology (4)
- FScN 5522 Technology of Fluid and Concentrated Milk Products (4)
- FScN 5523 Technology of Fermented Dairy 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)

**F. Areas of Specialization: Students are required to complete at least 20 credits of coursework in one of the following areas of specialization.**

### *Consumer Emphasis—20 credits minimum*

Required courses:

- FScN 5360 Sensory Evaluation of Food Quality (4)
- FScN 5403 Experimental Study of Foods (5)
- FScN 5474 Food Marketing Economics (4)

Additional credits from the following:

- FScN 3272 Introduction to Food Decision-Making (2)
- FScN 3400 Food Communication Techniques (3)
- FScN 3472 Principles of Food Purchasing (4)
- FScN 3612 Biological Aspects of Nutrition (4)
- FScN 3730 Quantity Food Production Management (5)
- FScN 5000 Professional Experience Program (4)
- FScN 5412 Physicochemistry of Foods (3)
- FScN 5413 Structural-Functional Relations in Food Systems (3)
- FScN 5350 Application of Experimental Design in the Food Industry (4)
- FScN 5462 Advanced Topics in Sensory Evaluation of Food (2-4)
- Jour 5251 Psychology of Advertising (4)
- Mgmt 3001 Fundamentals of Management (4)
- Mktg 3000 Principles of Marketing (4)

### *Food Technology/Processing—20 credits minimum*

Required courses:

- Mgmt 3001 Fundamentals of Management (4)
- One of the following: (**Please note: May not be used in Area E.**)

- FScN 5512 Meat Technology (4)
- FScN 5522 Technology of Fluid and Concentrated Milk Products (4)
- FScN 5523 Technology of Fermented Dairy 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)

Additional credits from the following:

- Agro 3030 Maturation, Harvest, and Storage of Field Crops (4)
- AnSc 1120 Livestock and Meat Evaluation (4)
- FScN 5000 Professional Experience Program (4)
- FScN 5412 Physicochemistry of Foods (3)
- FScN 5413 Structural-Functional Relations in Food Systems (3)
- FScN 5310 Advanced Food Chemistry (3)
- FScN 5524 Sensory Evaluation of Dairy Products (1)
- FScN 5360 Sensory Evaluation of Food Quality (4)
- FScN 5380 Food Packaging (3)
- FScN 5390 Introduction to Food Law (4)
- FScN 5512 Meat Technology (4)
- FScN 5522 Technology of Fluid and Concentrated Milk Products (4)
- FScN 5523 Technology of Fermented Dairy Products (4)
- FScN 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)
- Mktg 3000 Principles of Marketing (4)

### *Food Chemistry—20 credits minimum*

**Please note:** Students must take Biol 5001 in Physical and Biological Sciences (Category B).

Required courses:

- BioC 5025 Laboratory in Biochemistry (2)
- FScN 5310 Advanced Food Chemistry (3)
- FScN 5412 Physicochemistry of Foods (3)
- FScN 5413 Structural-Functional Relations in Food Systems (3)

Additional credits from the following: (20 credits)

- Chem 3100 Quantitative Analysis Lecture (3)
- Chem 3101 Quantitative Analysis Laboratory (2)
- Chem 3303 Elementary Organic Chemistry III (4)
- Chem 3304 Elementary Bioorganic Chemistry (4)
- Other courses in Chem or BioC at 5000 level

### *Food Microbiology—20 credits minimum*

**Please note:** Students must take MicB 5105 in Physical and Biological Sciences (Category B).

**Required courses:**

- BioC 5025 Laboratory in Biochemistry (2)
- Biol 5003 Genetics (4)
- MicB 5321 Physiology of Bacteria (3)

**Additional credits from the following:**

*Highly Recommended*

- FScN 5320 Food Biotechnology (3)
- FScN 5111 Independent Study in Food Science and Nutrition (1-5)
- MicB 5216/5218 Immunology (4,3)
- MicB 5232 Medical Microbiology (3)
- MicB 5352 Applied Microbiology (4)
- Additional Suggestions*
- BioC 5002 Biochemistry Topics (3)
- Biol 5125 Recombinant DNA Laboratory (4)
- MicB 5234 Medical Microbiology Laboratory (2)
- MicB 5424 Biology of Viruses (4)
- MicB 5811 Field Studies in Microbial Ecology (5)
- PIPa 5105 Introduction to Study of Fungi (4)
- PIPa 5106 Mycology: Ascomycetes-Fungi Imperfecti (4)
- PuBH 5171 Environmental Microbiology (4)

**Individualized Area of Specialization**

If the above areas do not meet students' educational and career goals an area of specialization may be designed by students in consultation with their adviser. The specialization that is developed must be submitted to the undergraduate studies committee for approval. *Approval of this committee must be obtained before beginning any courses in the area of specialization.*

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

## Landscape Architecture

*Department of Landscape Architecture  
205 North Hall  
2005 Buford Avenue  
St. Paul, MN 55108  
612/625-8285*

Freshman and sophomore students interested in earning a degree in Landscape Architecture may complete their prerequisite work in the College of Agriculture. Students can transfer to the newly formed 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.

Effective July 1, 1989, the School of Architecture and Landscape Architecture was granted independent collegiate

status. A separate bulletin for this new college will be issued in the near future.

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.

### Bachelor of Landscape Architecture (BLA) Program

This five-year program emphasizes the design process and an understanding of the various facets of nature, culture, and human behavior that affect the design, planning, and management of land. It is designed to provide the basic professional training for the practice of landscape architecture. It leads to the professional Bachelor of Landscape

## Programs

Architecture degree. The BLA degree program is accredited by the Landscape Architectural Accreditation Board, an affiliate of the American Society of Landscape Architects.

A total of 230 credits are required for graduation, 130 of them in 3000- and 5000-level courses. This more advanced work includes sequences in design, landscape technology, communications, and history and theory. Completion of the advanced work requires a minimum of three years. All required core courses with an LA prefix plus Hort 1021 and 1022 must be completed with a minimum grade of C.

It is recommended that students complete a minimum of 800 hours of work experience outside of classwork. At least 400 of these hours should be spent in landscape construction or in a landscape nursery and 400 hours in the office of a professional landscape architect.

### **Bachelor of Landscape Architecture (BLA/MLA) Combined Degree Program**

This alternative program is available for students with baccalaureate degrees who wish to pursue both professional and scholarly studies in landscape architecture. The program is jointly offered by the College of Architecture and Landscape Architecture and the Graduate School. It is designed to provide the basic professional training for the practice of landscape architecture and an opportunity for research in a specialized area of the field.

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

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

This non-professional program is designed to allow students to explore a broad range of environmental courses as well as complete two years of professional courses in landscape architecture.

Upon completion of the B.E.D. degree requirements, students may continue on for the professional B.L.A. degree, enter a professional master's degree program, 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 192 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 landscape architecture program are detailed below. For information about the Bachelor of Environmental Design Program, see the *Bulletin of the College of Architecture and Landscape Architecture* or the *Institute of Technology Bulletin*.

### **Admission Procedures**

To enter the Bachelor of Landscape Architecture degree program, students must submit an application by April 1 of the year they wish to begin. 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 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 75 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 Landscape Architecture degree program application form available from the Department of Landscape Architecture, 205 North Hall, University of Minnesota, 2005 North Buford Avenue, St. Paul, MN 55108.

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 grade point average of 2.50 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 ½ x 11-inch booklet. A portfolio larger than 24 x 36 inches will not be accepted. Material not enclosed in a carrying case is also unacceptable. Slides must be in an 8 ½ 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 grade point average; (2) the student's maturity and experience; (3) the student's letter of intent; (4) the estimated design potential of the student; and (5) the availability of staff and space.

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

### Major Requirements

Students must complete a minimum of 75 out of 100 credits of the pre-landscape architecture requirements in categories A through E before applying for admission to the Landscape Architecture Program.

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

Rhet 1101 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 1111 College Algebra and Analytical Geometry (5)

One of the following:

College-Level Math (1008 or higher)

College-Level Statistics

College-Level Computer Programming

Phil 1001 Introduction to Logic (5)

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

AgEc 3300 Agricultural Management Systems (4)

IDSc 3131 Database Management Systems (4)

#### B. Physical and Biological Sciences—18 credits minimum

These credits are to be selected from courses in such areas as botany, biology, chemistry, geology, natural sciences, and physics. Student are encouraged to enroll in Biol 1009 General Biology, Biol 1103 General Botany, Geol 1001 The Dynamic Earth—An

## Programs

Introduction to Geology or Geog 1401 Physical Geography, and EBB 3001 Introduction to Ecology.

See your adviser if you have questions about selecting coursework.

### **C. The Individual and Society**—16 credits minimum

See All-College Requirements on page 20. One course required in the area of Development of Civilization.

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

See All-College Requirements on page 20.

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

LA 1022 History of Landscape Architecture (4)

Soil 1020 The Soil Resource (4)

12 credits in Studio Arts

One course from:

LA 1021 History of Architecture (4)

LA 1023 History of Cities (4)

Arch 5056 Modern Architecture (4)

Arch 5061 Contemporary Architecture (4)

Two courses from:

LA 1001 Design Your Environment (2)

LA 1024 Landscape Theory (4)

LA 1031 Introduction to Landscape Architecture (4)

LA 3001 Environmental Design: Theory and Process (4)

LA 3002 Environmental Design: People and Environment (4)

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

Hort 1021 Woody Plant Materials (5)

Hort 1022 Herbaceous Plant Materials (5)

LA 1025 Basic Visualization I (4)

LA 1026 Basic Visualization II (4)

LA 3065 Landscape Construction: Landforms Systems (4)

LA 3067 Landscape Construction: Structural Systems and Materials (4)

LA 3069 Landscape Construction: Mechanical Systems (4)

LA 3081 Basic Design (6)

LA 3082 Basic Design (6)

LA 3083 Basic Design (6)

LA 3091 Intermediate Design (6)

LA 3092 Intermediate Design (6)

LA 3101 Communicating Landscape Quality (4)

LA 5063 Landscape Construction: Spatial Performance (4)

LA 5103 Urban Landscape Design (6)

LA 5105 Recreational Planning and Design (6)

LA 5107 Regional Landscape Design (6)

LA 5110 Advanced Landscape Planning and Design (6)

LA 5117 Planting Design: Aesthetic and Functional Criteria (4)

LA 5119 Planting Design: Ecological Principles/Land Use Concepts (4)

LA 5224 Contemporary Issues in Landscape Architecture (4)

LA 5226 Professional Practice (4)

LA 5265 History of Landscape Architecture: Individual Influences (4)

LA 5562 Introduction to Geographic Information Systems (4)

**G. Electives** supporting the professional degree to complete the 230 credits required for graduation with the bachelor of landscape architecture degree.

## Master of Agriculture

*College of Agriculture*

*277 Coffey Hall*

*612/624-3009*

The master of agriculture (M.Ag.) is an advanced professional degree, administered by the College of Agriculture, emphasizing competence in the application of knowledge and management of science and technology or technical communications. This application and management thrust contrasts with the research orientation of the master of science degree, administered by the Graduate School. The master of agriculture instructional program is at the graduate level but is not part of the Graduate School. Advanced professional competence in principles and applications of scientific technology and management are developed through an individual program of study in a field or combination of fields in agricultural and related sciences. The professional M.Ag. degree is usually considered terminal; students planning eventual Ph.D. study should pursue master of science (M.S.) training.

**Degree Requirements**—Majors are offered in most departments in the College of Agriculture. Consult the College Office (277 Coffey Hall) or the brochure "The Master of Agriculture" for current offerings.

As part of the 45-credit minimum requirement, at least 18 credits (A/F) in the major and 9 credits (A/F) in a related field are required. All courses must be taken at the graduate level. The related field must consist of credits earned in a single discipline or in closely allied disciplines outside the major. Students

must also complete a communications skills course, an "integrating paper," and a final oral exam that includes a seminar presentation.

Up to 18 quarter transfer credits of B or better taken before admission may be used in partial fulfillment of the program requirement. Transferred courses must be at the graduate level and must have been completed within three years of admission.

For an application and more information, contact the College of Agriculture, 277 Coffey Hall, 1420 Eckles Avenue, St. Paul, MN 55108 (612/624-3009).

## Natural Resources and Environmental Studies

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

*College of Agriculture*  
Terence H. Cooper, Major Coordinator  
439 Borglaug Hall  
1991 Upper Buford Circle  
St. Paul, MN 55108  
612/625-7747

*College of Natural Resources*  
John Bell, Major Coordinator  
Assistant Dean, College of Natural Resources  
135 Natural Resources Administration  
2003 Upper Buford Circle  
St. Paul, MN 55108  
612/624-6768

Participating Departments: College of Agriculture—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 natural resource 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

- 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)
- Stat 3011 Statistical Analysis (4)

# Programs

## Computer Competency

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

## B. Physical and Biological Sciences—24 credits minimum

- Biol 1009 General Biology (5)
- Biol 1103 Botany (5)
  - or Biol 1106 Zoology (5)
- Chem 1001, 1002 Chemical Principles and Covalent Systems (5,5)
  - or Chem 1003 Physical World Chemistry (5)
  - or Chem 1004, 1005 General Principles of Chemistry (5,5)
- Phys 1001, 1005 The Physical World (4,1)
  - or Phys 1041, 1045 Introductory Physics and Laboratory (4,1)
- 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 (5)
- 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:

- FR 1201 Conservation of Natural Resources (3)
- 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:

- FR 1201 Conservation of Natural Resources (3)
- NRES 1001 Orientation to Natural Resources and Environmental Studies (1)
- NRES 1010 Issues in the Environment (3)
  - or FR 3250 Role of Renewable Natural Resources in Development Countries (2)

- 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 3099 Problem-Solving in Natural Resources I (1)
- NRES 3100 Problem-Solving in Natural Resources II (3)

## Physical and Biological Fields

- AgEt 5410 Hydrology and Water Quality (5)
  - or FR 5114 Forest Hydrology (3)
- FR 3104 Forest Ecology (3)
- or EBB 3001 Introduction to Ecology (4)
- Soil 1020 The Soil Resource (4)
  - or Soil 3125 Basic Soil Science (4)
- 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)
- FR 5212 Natural Resource Inventory (3)
- FR 5240 Natural Resource Policy and Administration (3)

## Resource Management Fields

- Agro 3010 Adaptation, Distribution, and Ecology of Field Crops (4)
  - or Soil 3225 Physical Soil Management and Conservation (4)
  - or AgEc 3040 Economic Development of American Agriculture (4)
- FR 5100 Silviculture (3)
  - or FR 5241 Natural Resource Management: Political and Administration (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.

# Natural Resources and Environmental Studies

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.

Strongly recommended:

AgEc 5650 Economics of Natural Resources (4)  
PA 5721 Environmental Process (3)  
or Pol 5523 The Politics of the Regulatory Process (4)

Recommended courses:

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 3225 Physical Soil Management & Conservation (4)

*Resources and Environmental Protection*—Focus on understanding major environmental protection issues and the approaches available for their resolution. Topical concerns include solid waste management, sanitary waste disposal, air and water pollution, and protection of plant and animal resources.

Recommended courses:

Anth 5117 Anthropology of Resource Management (4)  
CE 5510 Solid & Hazardous Waste Management (4)  
CE 5515 Water & Wastewater Microbiology (4)  
Econ 5611 Resource and Environmental Economics (4)  
FR 5153 Advanced Forest Hydrology (4)  
FR 5458 Water Quality Management (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)  
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 3225 Physical Soil Management & Conservation (4)

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

Recommended courses:

FR 3300 Elements of Surveying (2)  
FR 5130 Geographic Inform 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 Recreation Design (4)

FR 5241 Natural Resource Mangement: 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 3520 Soil Morphology (4)

Soil 3225 Physical Soil Management & Conservation (4)

*Soil Resources*—Focus on the management, interpretation and inventory of soil resources. Emphasis on preventing soil erosion and reductions in land degradation and to reduce the adverse impacts of erosion on water and air quality.

Strongly recommended:

Soil 3416, 3417 Soil Fertility and Lab (4,1)

Soil 3520 Soil Morphology (4)

Soil 3225 Physical Soil Management and Conservation (4)

Soil 5710 Advanced Forest Soils (3)

Recommended:

EBB 5613 Assessing the Ecological Effects of Pollution (4)

Geo 5611 Groundwater Geology (4)

Soil 5340 Organic and Pesticidal Residues (5)

Soil 5550 Peatlands (3)

Soil 5610 Soil Biology (4)

*Water Resources (Hydrology & 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 1211 and 1221 in place of Math 1142 in Category A)

Strongly recommended:

CE 3400 Fluid Mechanics (4)

CE 5401 Water Resources Engineering (4)

FR 5458 Water Quality Management (4)

Soil 5240 Microclimatology (4)

Recommended courses:

AgEt 5540 Erosion Control, Watershed Engineering (4)

AgEt 5550 Drainage and Irrigation Engineering (4)

CE 5405 Hydrology and Hydrologic Design (4)

FR 5153 Advanced Forest Hydrology (4)

CE 5505 Water Quality Engineering (4)

Geo 5108 Advanced Environmental Geology (4)

Geo 5601 Limnology (4)

Geo 5611 Groundwater Geology (4)

Soil 3225 Physical Soil Management & Conservation (4)

Soil 3520 Soil Morphology (4)

Soil 5232 Soil Physics (5)

Soil 5424 Applied Climatology (3)

Soil 5550 Peatlands (3)

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



# Programs

## Nutrition

Louise Mullan, Major Coordinator  
225 Food Science and Nutrition  
1334 Eckles Avenue  
St. Paul, MN 55108  
612/624-3255

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 and Dietetics* 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 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. Participation in the experience component requires that a student maintain a minimum cumulative grade point average of 2.80. Many dietetic internships and graduate programs require a 3.00 or higher cumulative grade point average for admission. 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 grade point average of 3.00 or higher.

### A. Communication, Language, Symbolic Systems—22 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 1111 College Algebra and Analytical Geometry (5)

### Computer Competency

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

### B. Physical and Biological Sciences

- Biol 1009 General Biology (5)
- Biol 5001 Biochemistry (4)
- BioC 5025 Laboratory in Biochemistry (2)
- CBN 3001 Elementary Anatomy (4 or 5)
- Chem 1004,1005 General Principles of Chemistry (5,5)
- Chem 3301,3305 Elementary Organic Chemistry I and Lab (4,2)
- Chem 3302,3306 Elementary Organic Chemistry II and Lab (4,2)
- VPB 3103 General Microbiology (5)  
or MicB 5105 Biology of Microorganisms (5)
- Phsl 3051 Human Physiology (5)  
or Phsl 1002 Human Physiology: Introductory Survey for Allied Health Sciences (4)

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

See All-College Requirements on page 20. One course required in the area of Development of Civilization.

- AgEc 1101 Principles of Microeconomics (4)  
or Econ 1101 Principles of Microeconomics (4)
- AgEc 1102 Principles of Macroeconomics (5)  
or Econ 1102 Principles of Macroeconomics (5)
- Psy 1001 Introduction to Psychology (5)
- Soc 1001 Introduction to Sociology (4)

### D. Literature, Humanities, and Fine Arts—9 credits minimum

See All-College Requirements on page 20 for suggested courses.

### E. Professional Courses in the Major

- FScN 1612 Principles of Nutrition (4)
- FScN 3110 Food Chemistry (4)
- FScN 3112 Food Chemistry Laboratory (2)
- FScN 3272 Introduction to Food Decision Making (2)
- FScN 3403 Experimental Foods (4)
- FScN 3472 Principles of Food Purchasing (4)
- FScN 3610 Community Nutrition (2)

- FScN 3612 Biological Aspects of Nutrition (4)  
 FScN 3730 Quantity Food Production Management (5)  
 FScN 5100 General Seminar (1)  
 FScN 5622 Macro-Nutrient Metabolism (5)  
 FScN 5623 Vitamin and Mineral Biochemistry (4)  
 FScN 5665 Applied Clinical Nutrition I (3)  
 FScN 5666 Applied Clinical Nutrition II (3)  
 FScN 5667 Applied Clinical Nutrition III (2)  
 FScN 5750 Principles of Food Service Management (4)  
 LaMP 5177 Pathology for Allied Health Students: General and System Pathology (4)  
 Mgmt 3001 Fundamentals of Management (4)  
 At least 4 additional credits in sociology or anthropology.  
 Psychology of Learning (one of 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)  
 Statistics/Computers (one of the following):  
 EPsy 5260 Introductory Statistical Methods (4)  
 PubH 5404 Introduction to Biostatistics and Statistical Decision (4)  
 Soc 3801 Sociological Methods I: Descriptive Statistics (5)  
 Stat 1001 Introduction to Ideas of Statistics (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.

### Nutrition Science

If you want a nutrition science emphasis or are considering graduate study, you may, with the approval of your adviser, substitute up to 28 credits from the courses listed below for an equivalent number of credits from the major requirements. Courses cannot be substituted for FScN 5622 or 5623. This option is intended primarily to prepare students for graduate study and does not meet the American Dietetic Association requirements for internship.

- BioC 5744 Analytical Biochemistry (4)  
 BioC 5751 General Biochemistry (4)  
 BioC 5752 General Biochemistry (4)  
 Chem 1006 Principles of Solution Chemistry (4)  
 Chem 3100 Quantitative Analysis Lecture (3)  
 Chem 3303 Elementary Organic Chemistry III (4)

- Chem 5520 Elementary Physical Chemistry (3)  
 Chem 5521 Elementary Physical Chemistry (3)  
 Math 1142 Short Calculus (5)  
 or Math 1201 Pre-Calculus (5)  
 Math 1211 Calculus I (5)  
 Math 1221 Calculus II (5)  
 10-15 credits of college-level physics

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

## Science in Agriculture

*Dr. Steve Simmons, Major Coordinator*  
 204 Borlaug Hall  
 1991 Upper Buford Circle  
 St. Paul, MN 55108  
 612/625-3763

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

The Science in Agriculture major is an interdisciplinary program of seven departments in the College of Agriculture. 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.

## Programs

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 1211, 1221 Calculus I and II (5,5)
- One additional communications course (4-5)

#### Computer Competency

Computer skills are necessary for today's student. As a student in the College of Agriculture, you will use computer applications in your coursework no matter which major you choose. You will be expected to have basic computer competency in word processing, spreadsheets, database management, and telecommunications. Your level of computer competency will be assessed in the advising process. If you lack 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—63 credits minimum

Required courses:

- BioC 3031 Survey of Biochemistry (4)  
or Biol 5001 Biochemistry (4)
- Biol 1009 General Biology (5)
- One of the following courses:
  - 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)
- Chem 1004, 1005 General Principles of Chemistry (5,5)  
or Chem 1031, 1032 Chemistry Principles I and II (5,5)
- 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)
- Phys 1041, 1045 and 1042, 1046 Introductory Physics and Laboratory (4,1) (4,1)  
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.

- Biol 1103 Botany (5)
- Biol 1106 Zoology (5)
- Biol 3011 Animal Biology (5)
- Biol 3012 Plant Biology (5)
- Chem 1133 Elementary Quantitative Analysis (5)
- Chem 5520 Elementary Physical Chemistry (3)
- EBB 3001 Introduction to Ecology (4)
- FScN 1102 Technology of Food Processing (4)
- Math 3066 Elementary Differential Equations (4)
- PBio 3109 Plant Anatomy (5)
- PBio 3201 Introductory Plant Taxonomy (4)

PIPh 3131, 5132 Survey of Plant Physiology and Laboratory (4,2)  
 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*

One course required in the area of Development of Civilization. See All-College Requirements on page 20.

*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**

- AgEd 1002 Principles of Career Planning in Agriculture (1)
- ScAg 5009 Undergraduate Research Thesis (9)
- Stat 5021 Statistical Analysis (5)  
 or Stat 3011, 3012 Statistical Analysis I and II (4,4)

**Area of emphasis requirements**

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 Animal Breeding (5)
- AnSc 3301 Systemic Physiology (6)
- AnSc 3401 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 (1)
  - 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 Crop Growth and Culture (5)  
 or Hort 1100 Biology of Horticultural Production (4)
- Geol 1601 Oceanography (4)
- Geog 3421 Climatology (4)
- Soil 3125 Basic Soil Science (4)
- Soil 5240 Microclimatology (4)
- 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 3110 Food Chemistry (4)
- FScN 5120 Food Microbiology (5)
- A minimum of 18 additional credits selected from:
  - FScN 3403 Experimental Foods (4)
  - FScN 5122 Control of Microorganisms in Food Processing (2)
  - FScN 5123 Microbiology of Food Fermentations (2)
  - FScN 5135 Food Engineering (5)
  - FScN 5310 Advanced Food Chemistry (3)
  - FScN 5312 Chemical and Instrumental Analysis of Foods (5)
  - FScN 5360 Sensory Evaluation of Foods (4)
  - FScN 5412 Physicochemistry of Foods (3)
  - FScN 5413 Structural-Functional Relations in Food Systems (3)
  - FScN 5522 Technology of Fluid and Concentrated Milk (4)
  - FScN 5530 Industrial Processing of Fruits and Vegetables (4)
  - FScN 5540 Fats and Oils Chemistry and Technology (4)
  - FScN 5512 Meat Technology (4)
  - FScN 5562 Flavor Technology (4)
  - FScN 5555 Freezing and Dehydration of Foods (5)

*Nutrition—31 credits minimum*

- FScN 1612 Principles of Nutrition (4)
- FScN 3612 Biological Aspects of Nutrition (4)
- FScN 5622 Macro-Nutrient Metabolism (5)
- FScN 5623 Vitamin and Mineral Biochemistry (4)
- BioC 5025 Biochemistry Laboratory (2)
- A minimum of 12 additional credits selected from:
  - FScN 3110 Food Chemistry (4)  
 and FSeN 3112 Food Chemistry Laboratory (2)
  - FScN 5612 Experimental Nutrition (4)
  - FScN 5643 World Food Supply Problems (3)
  - AnSc 3401 Animal Nutrition (4)
  - 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 Crop Growth and Culture (5)  
 or Hort 1100 Biology of Horticultural Production (4)
  - Agro 5030 Weed Control (5)

## Programs

- Ent 1005 Economic Entomology (4)  
or Ent 3005 Introductory Entomology (4)  
PlPa 3001 Intro Plant Pathology (5)  
Soil 3125 Basic Soil Science (4)

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

### *Agronomy:*

Required courses:

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

One of the following:

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

### *Entomology:*

Required courses:

- Ent 5020 Insect Taxonomy (5)  
Ent 5030 Insect Physiology (3)

One of the following:

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

### *Horticultural Science:*

Required courses:

- Hort 1016 Greenhouse Management (4)  
Hort 1036 Plant Propagation (4)

One of the following:

- Hort 3072 Turf Management (4)  
Hort 5021 Ornamental Plant Materials (5)  
Hort 5032 Tree Fruit Production (4)  
Hort 5033 Small Fruit Production (3)  
Hort 5034 Commercial Vegetable Production (3)  
Hort 5035 Commercial Vegetable Production (3)  
Hort 5040 Plant Growth Regulation (4)  
Hort 5041 Environmental Physiology of Horticultural Plants (3)  
Hort 5046 Nursery Management I (4)  
Hort 5048 Nursery Management II (4)  
Hort 5052 Commercial Floriculture (4)  
Hort 5053 Commercial Floriculture (4)  
Hort 5054 Commercial Floriculture (4)

### *Plant Pathology:*

Required courses:

- PlPa 5500 Disease Epidemiology and Management (4)  
PlPa 5700 Plant Disease Control (4)

One of the following:

- PlPa 5005 Viruses and Bacteria in Plant Disease (4)  
PlPa 5006 Fungi, Algae, and Parasitic Seed Plants in Plant Disease (4)  
PlPa 5007 Air Pollution and Abiotic Causes of Plant Disease (3)  
PlPa 5008 Introduction to Plant Nematology (3)

- PlPa 5105 Introduction to the Study of Fungi (4)  
PlPa 5650 Clinical Plant Pathology (2-6)

### *Soil Science—31 credits minimum*

- Agro 3020 Crop Growth and Culture (5)  
or Hort 1100 Biology of Horticultural Production (4)  
Soil 3125 Basic Soil Science (4)  
Soil 3225 Physical Soil Management and Conservation (4)  
Soil 3416 Soil Fertility (4)  
Soil 3417 Soil Fertility Laboratory (1)  
Soil 3520 Soil Morphology, Classification, and Genesis (4)  
Soil 5240 Microclimatology (4)  
Remaining credits selected from:  
Soil 5104 Agricultural Systems Analysis and Modeling (4)  
Soil 5230 Soil-Plant-Water Relations (3)  
Soil 5232 Soil Physics (5)  
Soil 5310 Soil Chemistry (4)  
Soil 5515 Soil Development, Classification, and Geography (4)  
Soil 5560 Soil Survey Interpretations (4)  
Soil 5610 Soil Biology (4)  
Soil 5710 Advanced Forest Soils (3-4)

Students desiring 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.

## Scientific and Technical Communication

*Dr. Ann Hill Duin, Major Coordinator*  
202 Haecker Hall  
1364 Eckles Avenue  
St. Paul, MN 55108  
612/624-3445

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

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

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

For suggested course lists, contact the Department of Rhetoric or consult the All-College Requirements on page 20.

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

- application form—available in 202 Haecker Hall
- pre-major checklist—available in 202 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.

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

Students will retain pre-major status until they are formally accepted into the major program. For more information, contact the STC Program major coordinator, 202 Haecker Hall, 624-3445.

## Major Requirements

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

### A. Communication, Language, Symbolic Systems—29 credits minimum

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

- Rhet 1101 Writing to Inform and Persuade (4)
- Rhet 1104 Library Research Methods (1)
- Rhet 1151 Writing in Your Major (4)

## Programs

- 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. To provide a basic background, students are required to take the following two courses:

- Agri 1200 Computers in Your Profession (3)  
Math 1111 College Algebra and Analytical Geometry (5)  
And one of the following:  
AgET 3030 Introduction to Problem-Solving with Computers (4)  
CSci 3101 A FORTRAN Introduction to Computer Programming (4)  
CSci 3102 Introduction to Pascal Programming (4)  
CSci 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 3001 Elementary Biological Chemistry (4)  
BioC 3031 Survey of 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 Chemical Principles and Covalent Systems (5)  
or Chem 1004 General Principles of Chemistry (5)  
Chem 1002 Chemical Principles and Covalent Systems (5)  
or Chem 1005 General Principles of Chemistry (5)  
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, 1045 Introductory Physics and Lab (4, 1)  
Phys 1042, 1046 Introductory Physics and Lab (4, 1)

### 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. 20-22 of the *College of Agriculture 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. 20-22 of the *College of Agriculture 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

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

##### Required:

- EngW 5401 Introduction to Professional Editing (4)  
Rhet 3565 Writing for Publication (4)  
Rhet 3572 Grammatical Editing for Technical Writers (2) (must be taken prior to EngW 5401)  
Rhet 5581 Document Design (4)  
And two of the following:  
Rhet 5572 Procedures and Policies Manual (2)  
Rhet 5573 Grant Proposal (3)  
Rhet 5574 Electronic Publishing (2)  
Rhet 5575 Newsletter (3)

##### Recommended:

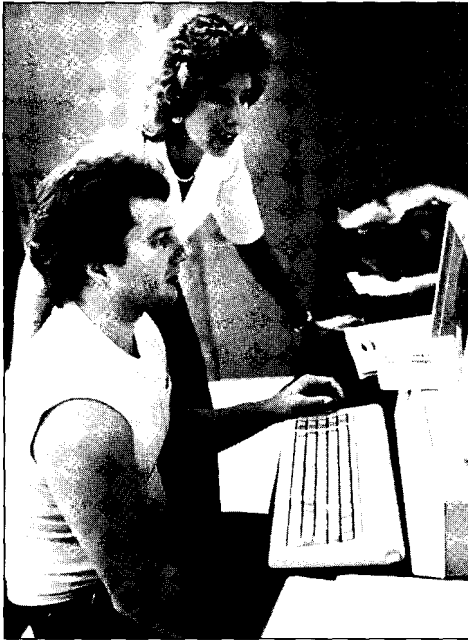
- Comp 3014 Writing for Quantitative Social Sciences (4)  
Comp 3015 Writing about Science (4)  
Comp 3027 Advanced Expository Writing (4)  
Comp 3050 Topics in Advanced Composition (4)

#### 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)

*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—5 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:*

Ind 1600 Drafting (3)  
Jour 1002 Visual Communication (2)

*Recommended:*

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)

### 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 (two of the following):*

Rhet 3xxx Organizational Behavior (4)—contact 202 Haecker Hall for more information  
Rhet 5170 Managerial Communications (4)  
Rhet 5600 Transfer of Technology (4)

*Recommended:*

Rhet 5165 Studies in Organizational Communication, Conflict, and Change (4)  
Rhet 5400 Dissemination and Utilization of Information (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 Rhetorical Theory (4)

*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 College Reading (4)  
Rhet 5500 Research in Communication Strategies (4)  
Rhet 5531 Technical Writing Course Development (2)  
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.



# Programs

## 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)

## SCIENCE AND TECHNOLOGY—20 credits minimum

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

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

## 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 (4-6)

You must complete at least one internship experience. The internship cannot be completed until you are officially enrolled in the major. For the primary internship experience, you will:

- complete a contract detailing the duration, hours, and duties of the internship
- meet with your adviser a minimum of three times during the duration of the internship
- submit a final internship report

You can find internship opportunities by reading notices posted on department bulletin boards, talking with your adviser and other instructors, and through personal research.

**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 the College of Agriculture. They must meet the requirements for admission to the College of Agriculture and must be accepted into the major of their choice. Pre-veterinary medicine students are 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 mini-bulletin, or the Office of Academic Affairs and Research, College of Veterinary Medicine, 460 Veterinary Teaching Hospitals, University of Minnesota, 1365 Gortner Avenue, St. Paul, MN 55108 (612/624-4747).

# 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.

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)

**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.

**1200. COMPUTER APPLICATIONS IN YOUR PROFESSION.** (3 cr; prereq ag major)

Introduction to the microcomputer applications of word processing, database management, spreadsheets, and telecommunications. Using these techniques on projects and problem-solving exercises related to the student's professional interests.

**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 of their experiences in international agriculture.

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

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

**5100. INTRODUCTION TO FARMING SYSTEMS RESEARCH AND EXTENSION.** (3 cr)

Introduction to Farming Systems Research and Extension, an interdisciplinary and holistic approach to understanding limited resource family farms and integrating family farm research and extension.

**5101. FIELDWORK IN FARMING SYSTEMS RESEARCH AND EXTENSION.** (3 cr; prereq 5100)

Advanced theory of and practice in Farming Systems Research and Extension with opportunities for student fieldwork.

## 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 or AgEc 1030)

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.** (5 cr, §Econ 1102 or AgEc 1020)

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.** (5 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; Agri 3000; S-N grading, free elective for AgEc undergrads)

Oral presentation and discussion of students' research papers, literature review of selected topics, discussions with students and staff on their experiences in international agriculture.

**3001. APPLIED MICROECONOMICS: CONSUMERS AND MARKETS.** (4 cr; prereq 1001 or Econ 1101, Math 1142 or 1211, Stat 1101 or MSci 1010, 1020, §3101 or Econ 3101)

The portion of microeconomic theory that relates to the consumer, the household, and demand for both public and private goods. Integration of empirical applications with theory, including the estimation of demand functions from actual data.

**3002. APPLIED MICROECONOMICS: MANAGERIAL ECONOMICS.** (4 cr; prereq 3001, Acct 1024 or AgEc 1250 or #)

Microeconomic theory that relates to the firm and its application to managerial problems. Integration of empirical applications 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.

**3005. 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.

**3006. APPLIED MACROECONOMICS: GOVERNMENT AND THE ECONOMY.** (4 cr; prereq 1101, 1102 or Econ 1101, 1102, §3102 or Econ 3102)

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.

**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; the 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; the contribution of economics to analyzing these problems; the use of economics in agricultural development policy and planning.

**3240. FARM AND AGRIBUSINESS STRATEGIC MANAGEMENT.** (4 cr; prereq 3002, 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. *This course will be taught starting in 1990-91.*

**3260. AGRIBUSINESS OPERATIONS**

**MANAGEMENT.** (4 cr; prereq 3002, 3003, 3500 or #)

Annual planning, implementation, and control in agribusiness firms; design of information systems to support management operations; forecasting; risk management. *This course will be taught starting in 1990-91.*

**3290. AGRIBUSINESS MANAGEMENT.** (4 cr; prereq 3002 and Mgmt 3001 for agricultural business majors, 3101 or # for others)

Application of economic, other social science, and technical concepts to the decision-making process of firms supplying inputs to agriculture and/or processing and distributing agricultural products. *This course will be replaced by 3240 in 1990-91.*

**3300. AGRICULTURAL MANAGEMENT INFORMATION SYSTEMS.** (4 cr, §MIS 3300; prereq 1030)

Introduction to information systems technology, conceptual foundations of MIS, and MIS design implementation and management for farm and non-farm firms in agriculture. *This course will be replaced by 3240 in 1990-91.*

**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.** (3 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.

## Course Descriptions

### **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.** (3 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; the farm labor input; farm labor usage and markets; farm-generated inputs and alternative enterprise combinations. Purchased farm inputs: farm machinery and buildings, animal production input markets, crop production input markets.

### **3500. FARM AND AGRIBUSINESS FINANCE.** (5 cr; prereq 1250 or Acct 1024, 1025, and 3002 or #)

Analysis of financing and investment policies for farm and agribusiness firms with reference to effects on liquidity, solvency, and profitability. Introduction to financial intermediaries in agriculture.

### **3610. RESOURCE DEVELOPMENT AND ENVIRONMENTAL ECONOMICS.** (3 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, \$3820; prereq AgEc 1101 or Econ 1101; not open to majors in AgEc dept)

Introduction to the use of farm accounts in planning; application of economic principles and budgeting procedures to the development of enterprise budgets and whole farm plans; development of projected cash flows; and evaluation of investment alternatives.

### **3820. FARM MANAGEMENT ECONOMICS.** (4 cr; prereq 1250, 3101)

Introduction to the use of farm accounts in planning; application of economic principles and budgeting procedures to the development of enterprise budgets and whole farm plans; development of projected cash flows; and evaluation of investment alternatives. *This course will be replaced by 3240 in 1990-91.*

### **3850. FARM BUSINESS AND ENTERPRISE ANALYSIS.** (4 cr; prereq 3810 or 3820)

Principles of selecting, organizing, maintaining, and using a farm accounting system. Financial statements and farm financial management. Tax preparation and planning; analysis and forward planning of crop and livestock enterprises and the overall farm business. *This course will be replaced by 3860 in 1990-91.*

### **3860. FARM OPERATIONS MANAGEMENT.** (4 cr; prereq 3002, 3003, 3500 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. *This course will be taught starting in 1990-91.*

### **3900. SPECIAL TOPICS IN THE ECONOMICS OF PUBLIC SERVICES.** (3 cr; prereq AgEc 1102 or Econ 1102 or #)

Upper division seminar on public service issues; discussion of principles of analysis followed by case studies on topics of current interest such as economics of income maintenance, education, transportation, health services, housing, municipal services.

### **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 from quarter to quarter 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 for undergrad, 3 cr for grad; prereq 1101 or Econ 1101, Math 1111 or 1131)

Application of linear programming to farm and agribusiness firms. Emphasizes economic concepts using minimal mathematics. Develops skills in computer use for decision-making. Profit maximization, cost minimization, and transportation analysis.

**5104. AGRICULTURAL SYSTEMS ANALYSIS AND MODELING.** (4 cr, \$PIPa 5104, AnSc 5104, Soil 5104; prereq Math 1142 or #)

Introduction to bioeconomic modeling as preparation for interdisciplinary agricultural systems analysis. Basic concepts; deterministic and stochastic models; delays, feedback, and clockwork; data acquisition; model verification and validation; role of models for agroecosystem management. This course is offered in alternate years.

**5400. INTERMEDIATE MARKET AND PRICE ANALYSIS.** (4 cr for undergrad, 3 cr for grad; prereq 3101 or 3001-2, 3 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 for undergrad, 3 cr for grad; prereq 1101, 1102 or Econ 1101, 1102)

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 for undergrad, 3 cr for grad; prereq 1101, 1102 or Econ 1101, 1102)

Economics of cash and futures trading on organized markets; futures trading theory; hedging and speculation.

**5500. ADVANCED AGRICULTURAL FINANCE.** (4 cr for undergrad, 3 cr for grad; prereq 3500)

Analysis of financial institutions and financial markets. Managerial policy issues confronting managers of financial intermediaries with reference to those operating in an agricultural setting. Current problem confronting financial intermediaries.

**5550. FOOD MARKETING ECONOMICS.** (4 cr for undergrad, 3 cr for grad, \$FScN 5474; prereq 3101 or 3001 or Econ 3101 or #)

Analytical and empirical treatment of consumer food behavior. Data and methods used to study economic and nutritional aspects of food consumption. Students pursue individual projects.

**5580. ECONOMIC ORGANIZATION OF THE HOUSEHOLD.** (4 cr for undergrad, 3 cr for grad; prereq 3001 or Econ 3101 or #)

Economic concepts applied to the analysis of household production, market and nonmarket work, family formation and size, and household consumption activity.

**5600. LAND ECONOMICS.** (4 cr for undergrad, 3 cr for grad; prereq 3101, 3102 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.** (4 cr for undergrad, 3 cr for grad; 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.** (4 cr for undergrad, 3 cr for grad; 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 for undergrad, 3 cr for grad; 3001 or 3002 or 3101 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 for undergrad, 3 cr for grad; prereq 3001, 3002 or 3101 or Econ 3101 or Econ 5151 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.** (4 cr for undergrad, 3 cr for grad; prereq 3001, 3002, 3003 or 3101 or Econ 3101 or #)

Introduction to the issues of finance and supply and demand for public services; pricing, producing, and financing public goods; bureaucratic decision-making; implementation of policies.

**5710. U.S. AGRICULTURAL POLICY.** (4 cr for undergrad, 3 cr for grad; prereq 3001, 3002, 3003, 3005, 3006 or #)

U.S. agricultural policy in an open world economy. The role of private markets and government; historical evolution of U.S. agricultural policy; key issues in agricultural program design; functioning of markets for grain, land, other inputs, and food products; the role of public interest groups and the future of American agricultural policy.

**5720. ECONOMICS OF WORLD AGRICULTURE.** (4 cr for undergrad, 3 cr for grad; prereq 3001, 3002, 3003 or 3101, 3102 or 3005, 3006 or Econ 3101, 3102 or #)

Distribution, quality, and use of agricultural resources; agricultural organization and structure; location of agricultural activity; national and international agricultural policies.

## Course Descriptions

**5730. EUROPEAN AGRICULTURE AND EUROPEAN FOOD AND AGRICULTURAL POLICIES.** (4 cr for undergrad, 3 cr for grad; prereq 3001, 3002, 3003 or 3101 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 for undergrad, 3 cr for grad; prereq 3001, 3002, 3003 or 3101 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.** (4 cr for undergrad, 3 cr for grad; prereq 3003, 3005 or 3101, 3102 or Econ 3101, 3102) Patterns of trade in agricultural products; trade policies and practices of export and import nations; commodity agreements; agricultural trade policies of common market areas; negotiations and potential trade developments.

**5790. WORLD FOOD SUPPLY PROBLEMS.** (3 cr, \$Agro 5200, \$Soc 5675, \$LACS 5280, \$FScN 5643; prereq ag, pre-vet med, home econ, or soc sci majors, or #, or agricultural economics grads with #) A multidisciplinary approach to the social, economic, and technical problems of feeding the world's growing population. Principles sought from the social, economic, plant, and animal sciences for their application to food problems.

**5840. MANAGEMENT OF THE FARM BUSINESS.** (4 cr for undergrad, 3 cr for grad; prereq 3820; 3830, 3850 recommended) Decision-making procedures under conditions of uncertainty; development of an information system to monitor and control the ongoing operation; control of crop and livestock enterprises; labor management; cash flow management. *This course will be replaced by 3860 in 1990-91.*

**5860f. ECONOMICS OF AGRICULTURAL PRODUCTION.** (4 cr for undergrad, 3 cr for grad; primarily for grads; prereq 21 cr in economics or agricultural economics) Production economics applied to agriculture; profitable combination of production factors; comparative advantage and location 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*)

**8200. ADVANCED TOPICS IN AGRICULTURE AND APPLIED ECONOMICS**

**8205. RESEARCH METHODOLOGY IN AGRICULTURAL ECONOMICS**

**8210. APPLIED ECONOMETRICS**

**8220. APPLIED MATHEMATICAL PROGRAMMING**

**8231. AGRICULTURAL PRICES**

**8245. AGRICULTURAL MARKETING ECONOMICS**

**8264. RESOURCE ECONOMICS**

**8266. APPLIED REGIONAL ECONOMICS**

**8270. APPLIED WELFARE ECONOMICS AND PUBLIC POLICY**

**8278. AGRICULTURAL AND ECONOMIC DEVELOPMENT**

**8287. PRODUCTION FUNCTIONS: THEORY AND ESTIMATIONS**

**8288. DYNAMIC PRODUCTION ECONOMICS**

**8345. SEMINAR: AGRICULTURAL MARKETING**

**8360. SEMINAR: LAND ECONOMICS AND TENURE**

**8364. SEMINAR: RESOURCE ECONOMICS AND POLICY**

**8366. SEMINAR: APPLIED REGIONAL ECONOMICS**

**8370. AGRICULTURAL 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**

## 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 AgEd 1002)

Developing personal career plans is the course's central focus. 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. It is 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. It is 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.

**3031. STUDENT TEACHING IN AGRICULTURE.** (10 cr; prereq jr, 5028, SeEd 3155, #)

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

**3041. PRACTICUM: AGRICULTURAL EDUCATION TECHNOLOGY.** (1-3 cr [may be repeated for max 5 cr])

Individualized study packages of 1 credit each of technology in agriculture, horticulture, off-farm agriculture, agricultural mechanics, adult and beginning farmer programs, youth organizations, program evaluation, and visual aids.

**5000. PROFESSIONAL EXPERIENCE PROGRAM.** (4 cr; prereq #; not for grad cr; 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; S-N optional)

Observation of and participation in activities of Extension Service staff at the county and state level; familiarization with staffing, program planning and development, and educational and administrative functions.

**5028. TEACHING METHODS IN AGRICULTURAL EDUCATION.** (5 cr; prereq SeEd 3155 or ¶SeEd 3155)

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.



## Course Descriptions

### **5032. HIGH SCHOOL CURRICULUM IN AGRICULTURE.** (3 cr; prereq 10 cr education)

Philosophy, organization, and administration of instruction in agriculture departments in secondary schools.

### **5034. PROCEDURES IN TEACHING AGRICULTURE.** (3 cr)

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. Designed to facilitate participant's instructional planning, resource development, and instruction. Topic to be identified with each offering.

### **5043. FARM MANAGEMENT.** (1-3 cr [max 12 cr])

Application of agricultural economics theory, principles, techniques, and materials. Designed to facilitate participant's instructional planning, resource development, and instruction. Topic to be identified with each offering.

### **5049. AGRICULTURAL EDUCATION FOR ADULTS.** (3 cr; prereq 6 cr in ag and applied econ, AgEd 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 utilization of curriculum materials based on farm business record data.

### **5055. METHODS IN FARMING SYSTEMS RESEARCH AND EXTENSION.** (3 cr, §HEED 5055, Agro 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 AgEd 5055 or HEEd 5055)

Seminar and fieldwork projects; sondeos and on-farm trials conducted.

### **5061. PROGRAM PLANNING AND EVALUATION.** (3 cr; prereq sr)

Development of program of agricultural education in community school, integration with total school program, administrative relationships, techniques and use of program evaluation in planning.

### **5071. SUPERVISED OCCUPATIONAL EXPERIENCES IN AGRICULTURE.** (3 cr)

Organization and administration of an occupational experience program in agriculture for high schools and area schools.

### **5072. PRACTICUM: AGRICULTURAL BUSINESS AND INDUSTRY.** (1-3 cr per qtr [max 9 cr]; prereq 5071 or #)

Observation, study, and experience in agricultural business and industry; application to educational problems in agriculture.

### **5078. FFA ORGANIZATION AND MANAGEMENT.** (2 cr)

Development of FFA (vocational agribusiness education student organization) knowledge, organization, and integration of activities into the curriculum, and management of chapter operations.

### **5080. ORGANIZATION AND MANAGEMENT.** (3 cr; prereq #)

Administrative structure and function of subcollegiate programs.

### **5081. CURRENT ISSUES FOR THE BEGINNING AGRICULTURE TEACHER.** (1-3 cr [max 3 cr]; prereq #)

Teaching methods, organizing learning resource materials, managing classroom and 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 exp as an agriculture teacher in AgEd 5081, #; continuous regis required in 3 consecutive qtrs; S-N only)

A 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 education)

Preparation of a paper dealing with studies in agricultural education applied to professional responsibilities.

**5128. METHODS OF TEACHING.** (3 cr; prereq non-agricultural education major and/or #)

Methods of teaching agriculture or related subjects; 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 education major and/or #)

Methods and procedures in planning a curriculum to teach within a specific subject matter area; curriculum construction in the subject matter field for use in native country setting.

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

Various approaches to effective 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 HEd 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)*

**1020. AGRICULTURAL SHOP—METALWORK.** (4 cr; prereq Chem 1004 or #; 2 lect and 6 lab hrs per wk)

Arc and oxyacetylene welding, soldering, use and conditioning of metalworking tools, and identification and characteristics of metals used in farm machinery.

**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.

## Course Descriptions

### **1215. FIELD MACHINERY PRACTICAL.** (2 cr; 4 lect hrs per wk)

Field machinery principles from the standpoint of machinery used; how it works; principles of operation; overall functions of tilling, seeding, applying chemicals and harvesting; methods of performance evaluation; adjustments that affect performance; and selection for profitable production.

### **3030. INTRODUCTION TO PROBLEM SOLVING WITH COMPUTERS.** (4 cr; prereq Math 1111 or equiv; 3 lect hrs, 1 rec hr per week)

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.

### **3250. FARM MACHINERY MANAGEMENT.** (4 cr; prereq 1215 or experience in field machinery operation; 3 lect and 3 lab hrs per wk)

Mechanical principles of tractors and field machinery. Measuring and predicting the output of a tractor. Implement size and power requirements as related to soil type. Basic management principles applied to determine the size of machinery required for an enterprise.

### **3606. FARM BUILDING DESIGN, LAYOUT, SYSTEMS.** (4 cr; prereq Math 1111, Phys 1001 or 1041; 2 lect and 4 lab hrs per wk)

Farmstead layout, land measurements, and surveying. Design and usage of concrete, wood, and metal in agricultural buildings with applications and fabrication of building components. Environmental considerations, including animal heat loss, insulation, ventilation, solar energy, sensing devices, and controllers. Waste management.

### **3610. ELECTRICITY AND ELECTRONICS IN AGRICULTURE.** (4 cr; prereq Math 1111, Phys 1041; 3 lect and 2 lab hrs per wk)

Basic theory and practical application of electricity in agriculture. Electric motors, heating, lighting, and controls. Selection and maintenance of electrical equipment. Electronic devices and computer control.

### **5020. PROGRAM PLANNING AND INSTRUCTIONAL METHODS IN AGRICULTURAL MECHANICS.** (3 cr; prereq 10 cr agricultural engineering technology, AgEd 3031 or ¶AgEd 3031)

Planning and designing high school vocational agriculture facilities, organizing equipment, tools, supplies, and storage required by the instructional program. Administering the agricultural mechanics program. Developing teaching techniques and program planning as related to student-supervised study programs in agricultural mechanics.

### **5027. APPROPRIATE TECHNOLOGY FOR INTERNATIONAL DEVELOPMENT.** (4 cr; prereq Math 1111, Chem 1001 or 1004, Phys 1041; 3 lect and 3 lab hrs per wk)

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 laboratory.

### **5030, 5031, 5032, 5033, 5034, 5035. PROBLEMS AND FIELD STUDIES IN ADVANCED AGRICULTURE.** (1-3 cr; prereq 5020 or #)

Principles and practices pertaining to implementation of instructional programs in agricultural mechanics. Selection, application, operation, service, and maintenance of equipment used in agricultural mechanics for the specific instructional program.

#### **5030. Agricultural Tractor and Engine Power**

#### **5031. Agricultural Machinery and Mechanization**

#### **5032. Electrical Power and Processing**

#### **5033. Farm Buildings and Environment Control**

#### **5034. Natural Resources Development and Management**

#### **5035. Metal Fabrication Materials and Techniques**

### **5040. ADVANCED METHODS FOR TEACHING AGRICULTURAL MECHANICS.** (3 cr; prereq #; 2 lect and 3 lab hrs per wk; off campus fall and spring)

Trends and role of agricultural mechanics in the mechanization of agriculture. Organization of instructional areas, selection of tools, supplies, reference materials, and facilities. Preparation of instructional materials and methods of effective teaching. Development of teaching demonstrations and procedures.

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

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

### **5099. RCD INTERDISCIPLINARY SEMINAR I.** (4 cr, 5099-5100, §RCD 5099, §AgEc 5099, §LA 5099, §Soil 5099; prereq resource and community development sr or #)

Selected speakers, readings, and discussion topics dealing with resource and community development analysis and implications for resource allocation. Students participate as a team, combining disciplinary skills to analyze complex resource problems.

### **5100. RCD INTERDISCIPLINARY SEMINAR II.** (4 cr, 5099-5100; §RCD 5100, §AgEc 5100, §LA 5100, §Soil 5100; prereq 5099 or #)

(Continuation of 5099) Papers, presentations, and critiques on selected complex resource problems in Seminar I.

**5400. DRAINAGE AND IRRIGATION.** (4 cr, prereq Soil 3210; 3 lect and 2 lab hrs per wk)  
Soil moisture excesses and deficiencies. Theory and design of tile drainage, surface drainage, and sprinkler irrigation systems. Development of irrigation water supplies. Selection of pumps and power units for drainage and irrigation. Economic feasibility. Legal problems and procedures.

**5410. HYDROLOGY AND WATER QUALITY.** (5 cr; prereq Math 1111, Phys 1041, Chem 1004, 1005, 3 lect, 3 lab, and 1 rec hrs per wk)  
The 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 to those who have completed the prerequisite courses.

**1031. COMPUTATIONS IN AGRICULTURAL ENGINEERING.** (2 cr; prereq IT lower division, CSci 3101 or equiv, Math 1231; 1 lect and 2 rec hrs per wk)  
Introduction to problems in agricultural engineering. Elementary numerical and computational techniques. Applications involving FORTRAN programming.

**1060. AGRICULTURAL ENGINEERING ORIENTATION.** (1 cr; S-N only; 2 hrs per wk)  
Introduction to agricultural engineering practice through lectures, readings, demonstrations, and classroom discussions. Identification of professional opportunities and responsibilities.

**3052. PHYSIO-ENGINEERING IN AGRICULTURE.** (4 cr; prereq IT student, AEM 3016 or ¶AEM 3016; 3 lect and 3 lab hrs per wk)  
Mechanical and hydraulic properties of porous media, moisture relations; strength parameters for structural and mechanical design. Soil-machine action involved in tillage and traction. Energy and water balance in the soil-plant system. Plant structure and growth. Engineering and management requirements.

**3060. ANALYSIS IN AGRICULTURAL ENGINEERING.** (4 cr; prereq IT student, CSci 3101 or equiv, Math 3211; 4 lect hrs per wk)  
Introduction to probability. Normal and other frequency distributions. Elementary statistics with applications to problems in agricultural engineering. Engineering economics and benefit cost analysis.

**3970. DIRECTED STUDIES IN AGRICULTURAL ENGINEERING.** (Cr ar; prereq #)  
Independent study of topic(s) involving physical principles as applied to agricultural production and land resources.

**5050. INTERN REPORTS.** (2 cr per qtr; prereq IT student)  
Required of students in the engineering intern program during the employment periods.

**5060. PROCESSING.** (4 cr; prereq IT upper division or grad IT major, 3052, ME 5342; 3 lect and 3 lab hrs per wk)  
Size reduction, cleaning, and conveying of agricultural products. Properties of air, water vapors, and biological materials. Engineering principles of moisture and heat transfer applied to drying of grain crops. Theory and application of refrigerated and controlled atmosphere storage.

**5070. AUTOMATIC CONTROL AND INSTRUMENTATION.** (4 cr; prereq IT upper division, Forest Products major or grad, 3060, CE 3400 or equiv; 3 lect and 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.

**5072. FINITE ELEMENT METHOD: FUNDAMENTALS AND APPLICATIONS.** (4 cr; prereq IT upper division 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 fundamental engineering areas. Applications in heat transfer, fluid mechanics, solid mechanics, radial and axisymmetric field problems, and time-dependent field problems.

**5074. MICROCOMPUTER INTERFACING.** (4 cr; prereq IT upper division or grad IT major, AgET 3030 or CSci 3101 or CSci 3102; 2 lect and 4 lab hrs per wk)  
Introduction to digital components, integrated circuits and microcomputers. Interfacing of microcomputers for data acquisition and control.

**5081, 5082, 5083, 5084. DESIGN.** (4 cr per qtr; prereq IT upper division, completion of appropriate AgEn sr level courses, or #; 1 lect and 6 lab hrs per wk)  
An engineering design project in the student's interest area(s), integrating previous work and covering the whole range of the design process from conceptualization through preparation of the project report. 5081: Power and machinery. 5082: Soil and water. 5083: Structures and environment. 5084: Food engineering.

**5130. FOOD ENGINEERING.** (4 cr; prereq IT upper division or grad IT major, thermodynamics, 3060 or #; 4 lect hrs per wk)  
Fundamental requirements for handling food products. Separation processes in the food industry. Storage of foods. Optimization techniques, experimental design, project management methods, and engineering economics for the food industry.

## Course Descriptions

**5140. THERMAL PROCESSES FOR FOOD.** (4 cr; prereq IT upper division or grad IT major, heat transfer, 5060 or #; 3 lect and 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.

**5191-5192. 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.

**5330. AGRICULTURAL MACHINERY.** (4 cr; prereq IT upper division or grad IT major, knowledge of agricultural mechanisms as assessed by instructor; 3 lect and 3 lab hrs per wk) Operation and performance characteristics of agricultural machines. Forces operating on selected machine components. Control systems, design for operator convenience and safety. Machinery selection and management. Design of machine elements and assemblies. Motion analysis.

**5340. AGRICULTURAL TRACTORS.** (4 cr; prereq IT upper division or grad IT major, ME 3301; 3 lect and 3 lab hrs per wk) Engineering principles governing performance of tractor and implement systems. Transmission design, hydraulic control systems, terramechanics, ergonomics, thermodynamics of diesel engines.

**5540. EROSION CONTROL, WATERSHED ENGINEERING.** (4 cr; prereq IT upper division or grad IT major, 3052 or CE 3300, CE 5401 or #; 3 lect and 3 lab hrs per wk) Measurement and mechanics of watershed runoff and soil erosion. Estimating peak runoff, soil losses, and sediment yields. Environmental effects. Principles of small watershed planning for flood control, water storage, and sediment control. Hydraulic design of graded and storage type terraces, grass waterways, diversions, and erosion control structures.

**5550. DRAINAGE AND IRRIGATION ENGINEERING.** (4 cr; prereq IT upper division or grad IT major, 3052 or CE 3300, CE 5401 or #; 3 lect and 3 lab hrs per wk) Flow of water through agricultural soils. Irrigation and drainage requirements, salinity control, evapotranspiration, water supply development and control. Conveyance of drainage and irrigation waters. Considerations for design, layout, and construction of irrigation and drainage systems. Institutional, environmental, and economic aspects of soil moisture control.

**5730. AGRICULTURAL STRUCTURES DESIGN.** (4 cr; prereq IT upper division or grad IT major, 3052, AEM 3016; 3 lect and 3 lab hrs per wk) Buildings and materials used in agricultural production. Static, live, snow, and wind loads. Codes and standards. Costs. Concrete formulation, quality, testing, footings, columns, beams, slabs. Wood terminology and characteristics, plywood, fasteners, protection. Systems, planning, and interaction of buildings with agriculture production.

**5740. ENVIRONMENTAL CONTROL FOR AGRICULTURAL PRODUCTION.** (4 cr; prereq IT upper division or grad IT major, ME 5603; 3 lect and 3 lab hrs per wk)

Ventilation, insulation, and condensation control in enclosed plant and animal production structures. Biological constraints upon the system. Temperature, humidity, light, and contaminants, e.g., dust, noxious gases, and pathogens. Simulation of weather phenomena for prediction of environmental conditions.

**5910. AGRICULTURAL WASTE MANAGEMENT ENGINEERING I.** (4 cr; prereq IT upper division or grad IT major, 3052, Chem 1005; 3 lect and 3 lab hrs per wk) Sources and characteristics of agricultural wastes, including animal manures, crop residues, sediments, processing wastes, and domestic wastes. Effects on the environment. Sanitary collection, storage, treatment, and disposal. Use of liquid and solid wastes. Nonurban water supply and quality.

### For Graduate Students Only

(For descriptions, see *Graduate School Bulletin*)

#### 8100. SEMINAR

**8190, 8191, 8192. ADVANCED PROBLEMS AND RESEARCH**

**8500. HYDROLOGIC MODELING—SMALL WATERSHEDS**

**8700. MOISTURE AND HEAT TRANSFER**

### Agricultural Industries and Marketing (AIM)

**5001f. MARKETING PRACTICUM.** (4 cr) Multidisciplinary lecture/seminar involving development and presentation of a marketing plan for an agricultural input or product. Includes market definition and feasibility analysis, promotion and advertising presentation, and critique of plan alternatives.

### Agronomy and Plant Genetics (Agro)

**1001. SEMINAR: ORIENTATION TO AGRONOMY.** (1 cr; S-N only)

Introduction to agronomy—its programs and objectives in teaching, research, and extension through informal seminars with staff and students. Visits to research and teaching facilities to acquaint students with personnel and facilities of the department.

## **1010. PRINCIPLES OF AGRONOMY.** (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 laboratory.

## **1020. SPECIAL PROBLEMS.** (1-3 cr; prereq 5 cr agronomy, #)

In-depth research or studies in agronomy. Intended for students who wish to pursue aspects of agronomy in greater depth than that offered in formal courses or who wish to investigate areas not presently offered in courses. Tutorial instruction under staff guidance.

## **3000. SEMINAR IN INTERNATIONAL AGRICULTURE.** (1 cr)

Oral presentation and discussion of students' research papers, literature review of selected topics, discussion with students and staff about their experiences in international agriculture.

## **3010. ADAPTATION, DISTRIBUTION, AND ECOLOGY OF FIELD CROPS.** (4 cr; prereq Biol 1009)

Principles of crop adaptation, distribution, and ecology in a context of current and projected world crop needs. Emphasis on the importance of adaptation to crop distribution and production and on the relationships of crops to the environmental factors of light, moisture, and temperature. Crop production practices as a means of managing environmental factors. Lecture and discussion.

## **3020. GROWTH, DEVELOPMENT, AND CULTURE OF FIELD CROPS.** (5 cr; prereq Biol 1009, Chem 1005 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 laboratory.

## **3030. MATURATION, HARVEST, AND STORAGE OF FIELD CROPS.** (4 cr; prereq Biol 1009, Chem 1005 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 laboratory.

## **3060. FIELD PLOT DESIGN IN AGRONOMY.** (3 cr; prereq jr)

Principles of field plot technique and design as applied to field demonstrations and experiments involving one or two variables. Experiment interpretation procedures including analysis of data, tests of significance, and treatment comparisons. Computers are used for some data processing and statistical procedures.

## **3100. 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 laboratory.

## **3120. GRAIN GRADING AND UTILIZATION.** (2 cr)

Practice and principles of grain grading, factors influencing U.S. grain grades and their importance in affecting market value and subsequent utilization. Concurrent registration with AgEc 3420 Grain Marketing Economics recommended. Lecture and laboratory.

## **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 3100 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.

## **3200. SEMINAR.** (1 cr; prereq jr or sr, #)

Investigation through literature review and group discussion of selected topics in agronomy. Major emphasis on recent advances in agronomy.

## **5000. PROFESSIONAL EXPERIENCE PROGRAM.** (4 cr; prereq #; not for grad cr; S-N only; 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 agronomy, #)

In-depth research or studies in agronomy. Intended for advanced students who wish to pursue aspects of agronomy in greater depth than that offered in formal courses or who wish to investigate areas not presently offered in courses. Independent study and research under staff guidance.

## **5010. FORAGE PRODUCTION AND UTILIZATION.** (4 cr; prereq 1010 or #)

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

## **5020. INTRODUCTION TO PLANT BREEDING.** (4 cr; prereq GCB 3022 or equiv)

Application of genetic principles to improvement of crop plants. Includes self-pollinated, cross-pollinated, and asexually propagated crops.

## Course Descriptions

**5030. WEED CONTROL.** (5 cr; prereq 1010 or #; Agro 3020 and/or PIPh 3131 recommended)  
Survey of the magnitude of the weed problem. Regulatory aspects of weed control and herbicide usage. Principles and methods of weed control. Lecture and discussion.

**5040. 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.

**5055. METHODS IN FARMING SYSTEMS RESEARCH AND EXTENSION.** (3 cr; §AgEd 5055, HeEd 5055)  
Introduction to theory and practice of interdisciplinary and holistic approaches to complex farm, rural family, and community problems. Techniques in problem identification and development of desirable and feasible alternatives appropriate for domestic and international situations.

**5060. SMALL GRAINS, SUNFLOWER, AND SUGAR BEET MANAGEMENT.** (3 cr; prereq 3010, 3020, 3030, 5030, Soil 1122 or #)  
Discussion and case study of agronomic principles for production of wheat, oats, barley, sunflowers, and sugar beets, including crop and variety selection and rotation, tillage and seedbed preparation, planting, cultural practices, pest control, harvest, and use.

**5070. ECOLOGY OF FIELD CROPS.** (3 cr; prereq Agro 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 diversification, crop diversity, canopy architecture, and whole-system productivity. Lecture and discussion.

**5110. ADAPTATION, DISTRIBUTION, AND ECOLOGY OF FIELD CROPS.** (3 cr, §3010; prereq Biol 1009)  
Principles of crop adaptation, distribution, and ecology in a context of current and projected world crop needs. Emphasis on the importance of adaptation to crop distribution and production and on the relationships of crops to the environmental factors of light, moisture, and temperature. Crop production practices as a means of managing environmental factors. Lecture and discussion.

**5120. GROWTH, DEVELOPMENT, AND CULTURE OF FIELD CROPS.** (5 cr, §3020; prereq Biol 1009, Chem 1005 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 1005 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, and discussion.

**5200. WORLD FOOD SUPPLY PROBLEMS.** (4 cr, §AgEc 5790, §FScN 5643, §Soc 5675, §LACS 5280; prereq sr or grad with #)  
A multidisciplinary approach to the social, economic, and technical problems of feeding the world's growing population. Principles sought from the social and economic sciences and plant, animal, and food sciences for their application to world food problems.

**5310. ORIENTATION TO FIELD CROP BREEDING.** (1 cr; prereq Agro 5020 or #)  
Field study of plant breeding programs and techniques.

### For Graduate Students Only

(For descriptions, see *Graduate School Bulletin*)

**8000. SUPERVISED TEACHING EXPERIENCE IN AGRONOMY**

**8010. RESEARCH IN AGRONOMY**

**8020. SEMINAR: AGRONOMY**

**8030. MODE OF ACTION OF HERBICIDES**

**8050. PHYSIOLOGY OF FIELD CROPS**

**8080. CURRENT TOPICS IN AGRONOMY**

**8100. PASTURE AND FORAGE RESEARCH TECHNIQUES**

**8200. PRINCIPLES OF PLANT BREEDING I**

**8210. PRINCIPLES OF PLANT BREEDING II**

**8220. APPLICATION OF QUANTITATIVE GENETICS TO PLANT BREEDING**

**8230. CYTOGENETICS**

**8240. PLANT GENETICS IN RELATION TO PLANT IMPROVEMENT**

**8270. SEMINAR: PLANT BREEDING**

**8280. CURRENT TOPICS IN PLANT BREEDING**

**8320. ORIENTATION TO AGRONOMY AND SOILS FIELD RESEARCH TECHNIQUES**

**8330.\* RESEARCH IN PLANT GENETICS**

## Animal and Plant Systems (AnPI)

### 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; S-N only, #)

Practical experience in management skills and routines in the care of swine.

### 1302. MANAGEMENT TECHNIQUE: SHEEP. (1 cr; S-N only, #)

Practical experience in management skills and routines in the care of sheep.

### 1303. MANAGEMENT TECHNIQUE: BEEF. (1 cr; S-N only, #)

Practical experience in management skills and routines in the care and production of beef cattle.

### 1304. MANAGEMENT TECHNIQUE: DAIRY. (1 cr; 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; 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.

**1600. HORSE PRODUCTION.** (4 cr, \$5501)  
Breeds, selection, diseases, feeding, reproduction, management, and color inheritance of light horses. Demonstrations of equitation, tack, and farriery.

### 1601. HORSE EQUITATION AND MANAGEMENT. (1 cr)

Equitation, dressage, tack, grooming, and schooling in Western and English styles of riding. Management, nutrition, and record keeping concerning riding horses.

### 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 laboratory. Recommended for students planning vocations in meat animal production, extension, vocational agriculture, and agribusiness.

### 3141. ADVANCED DAIRY JUDGING. (1 cr; prereq 1110)

Evaluation and selection of dairy cattle. Visits to local dairy herds. Training in presentation of oral and written reasons. Students selected from this course participate in intercollegiate judging contests.



## Course Descriptions

**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 for 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 3001)

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

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

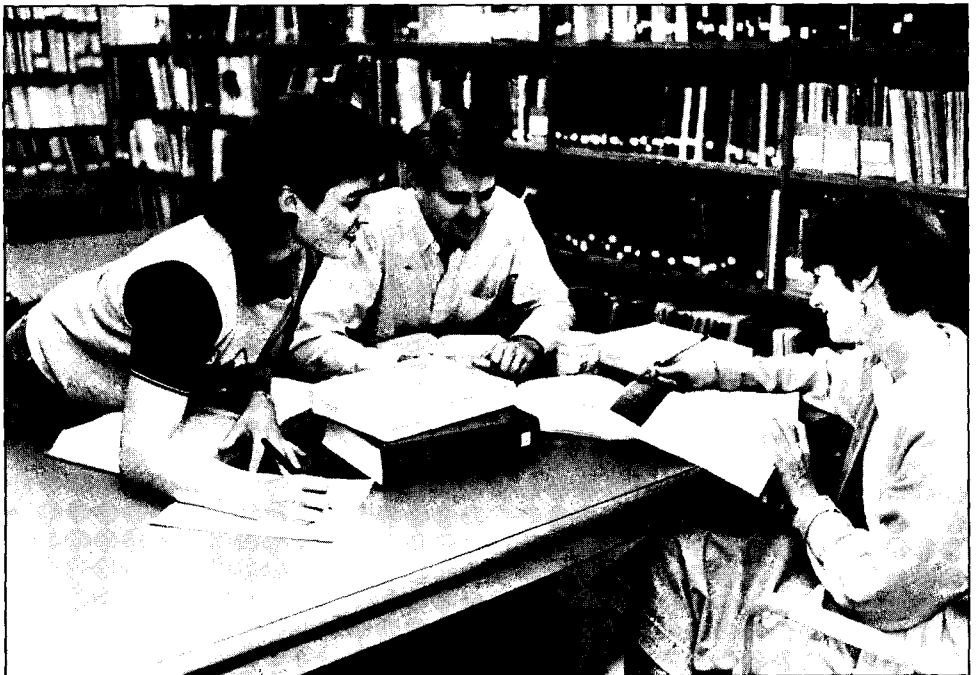
Functions of the reproductive organs, fertilization, the estrous cycle and its endocrine control, reproductive efficiency, and problems and principles of artificial insemination. Anatomy, physiology, and biochemistry of the mammary gland. Mammary growth, initiation and maintenance of lactation, milk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

**3401. PRINCIPLES OF ANIMAL NUTRITION.** (3 cr, §1401; prereq Chem 1002 or BioC 3301 or Chem 3301)

Classification and function of nutrients; use of nutrients for body maintenance, growth, egg production, gestation, and lactation; comparative study of the digestive systems of farm animal species.

**3402. FEEDING FARM ANIMALS.** (2 cr, §1401; prereq 3401)

Feeding and methods in ration formulation, with barn visits for swine, beef, dairy, sheep, horses, layers, broilers, and turkeys. Focus on modern concepts and computer feed formulation.



**3510. GROWTH AND DEVELOPMENT OF**

**ANIMAL TISSUES.** (3 cr; prereq 3301, BioC 3031, 3301 or Biol 5001; 1120 recommended)  
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.

**3730H. HONORS SEMINAR IN ANIMAL SCIENCE.** (1 cr; prereq jr or sr, #)

Faculty and graduate students discuss their research in terms of content, importance, and impact on animal agriculture.

**3770H. HONORS SENIOR RESEARCH THESIS IN ANIMAL SCIENCE.** (2 cr; prereq sr, #)

Participation in extension programs or in designing and conducting an experiment in area of student's interest. Will work closely with a faculty advisor; culminate with a thesis and seminar presentation.

**5000. PROFESSIONAL EXPERIENCE PROGRAM.** (4 cr; prereq #; S-N only; free elective for animal science 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.

**5104. AGRICULTURAL SYSTEMS ANALYSIS AND MODELING.** (4 cr, \$PIPa 5104, \$AgEc 5104, \$Soil 5104; prereq Math 1142 or #)

Introduction to bioeconomic modeling as preparation for interdisciplinary agricultural systems analysis. Basic concepts; deterministic and stochastic models; delays, feedback, and clockwork; data acquisition; model verification and validation; role of models in agroecosystem management.

**5231. DAIRY CATTLE BREEDING.** (4 cr; prereq 3220 or #)

Application of quantitative genetic principles to the breeding of dairy cattle. Primary emphasis on evaluation of males, females, and systems of breeding. Rates of genetic improvement with and without artificial insemination.

**5240. ANIMAL CYTOGENETICS.** (4 cr; prereq GCB 3022 or #)

Application of cytogenetics to problems in animal biology. Emphasis on relationship of cytogenetic principles and practices to other fields such as animal breeding, pathology, cellular biology, and systematics.

**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, Biol 5001 or BioC 5001)

Current developments in endocrinology including introductory and review material, methodology, applicability of results to basic and applied research, and impact on existing endocrine principles.

**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 utilization 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 LACS 5165)

Application of 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.

**5407. LABORATORY ANALYSIS OF FEEDSTUFFS.** (2 cr; prereq sr or #)

The chemistry and theory of feedstuff analyses and interpretation of results. AOAC methods used. Students analyze samples of feedstuffs for dry matter, protein, ether extract, ash, crude fiber, neutral detergent fiber, acid detergent fiber, and lignin. Practical application of feed analyses emphasized.

**5601. SWINE PRODUCTION.** (4 cr; prereq 3401; 3220 recommended)

Application of principles of animal breeding, nutrition, physiology, and economics. Swine production systems including swine feeding, breeding programs, selection of breeding animals, management of all classes of swine, housing, diseases, parasites.

## Course Descriptions

### **5602. SHEEP PRODUCTION.** (4 cr; prereq 3401; 3220, 5403 recommended)

Status and characteristics of the sheep industry; application of principles of animal breeding, nutrition, physiology, and economics to management of sheep breeding flocks. Ration formulation, management, and marketing of feedlot lambs.

### **5603. BEEF CATTLE PRODUCTION.** (4 cr; prereq 3401; 3220, 5403 recommended)

Status and characteristics of the beef cattle industry; application of principles of animal breeding, nutrition, physiology, and economics to management of beef cattle breeding herds. Ration formulation, management, and marketing of feedlot cattle.

### **5604. DAIRY FARM MANAGEMENT.** (4 cr; prereq 1520, 5403 or #; 3220 recommended)

Application of principles of animal breeding, nutrition, physiology, and economics to planning and management of the dairy farm; genetic influences, housing requirements, health programs for large herds, feed budgets, and record analysis emphasized.

### **5605. POULTRY PRODUCTION.** (4 cr; 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.

### **5703. LITERATURE AND SEMINAR.** (2 or 3 cr [3rd cr for 2nd seminar report]; prereq jr)

Introduction to library resources concerned with animal science. Techniques of searching, abstracting, and constructing reviews for written and oral reports from library materials. Evaluation of seminar reports.

### **5710. SPECIAL PROBLEMS.** (Cr ar; prereq #)

Research in an area of animal science under supervision of a staff member. Written report on the research required.

### **5715. TUTORIAL.** (Cr ar; prereq #)

Informally structured course to encourage study in depth of a specific discipline in animal science. Pertinent readings, centered 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**

### **8230. LINEAR MODEL METHODS**

### **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**

## **Entomology (Ent)**

### **1001s. INSECTS AND SOCIETY.** (3 cr; prereq Biol 1009 or equiv or #)

Nontechnical discussion of the impact of insects on human society. Involvement of insects in human disease; impact of insects on food production; biological, chemical, and genetic control of pest species; influence of insects on human history, literature, and art; and insect behavior and natural history. Lectures, demonstrations, and field trips.

### **1005s. 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 entomology 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 studies of external and internal anatomy and histology of insects; phylogeny and function.

**5020f. INSECT TAXONOMY.** (5 cr; prereq 3005 or equiv)  
Identification of adults and immatures of taxa within insect orders.

**5030w.\* INSECT PHYSIOLOGY.** (3 cr; prereq #; BioC 5001 and 5002 or MdBc 5100 recommended)  
Essential processes of insects. Includes nerve and muscle mechanisms, energy metabolism, respiration, nutrition and digestion, excretion, regulation and interactions of processes, sensory mechanisms, and behavior. Reproductive behavior, embryology, and postembryonic development of insects.

**5040w.\* 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 entomology or biology)  
Characteristics and social behavior of honey bees; colony development and management; diseases and their control; hive products; pollination. Lectures and laboratory demonstrations.

**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.** (4 cr; prereq 5 cr entomology and 5 cr plant pathology or equiv or #)  
(Same as PIPa 5215) Insect transmission and dissemination of plant pathogens; development of plant-insect relationships and habits of principal insect vectors.

**5220s. STORED PRODUCT PEST MANAGEMENT.** (4 cr; prereq 1005 or 3005 or #; offered 1989 and alt yrs)  
Principles of management to protect stored food and fiber; pest identification, damage assessment, and prevention and control procedures based on interrelationships within storage ecosystems.

**5250s.\* FOREST ENTOMOLOGY.** (4 cr; prereq any two courses among the forestry, zoological, botanical, biological, and/or agricultural sciences)  
Lectures and laboratory concerning ecology and population management of forest insects, with heavy emphasis on tree factors and biological control.

**5275s. MEDICAL ENTOMOLOGY.** (4 cr; prereq 3005 or #)  
Principal arthropods noxious to human beings and animals. Emphasis on those that serve as vectors of pathogenic organisms of human beings and animals.

**5280w. LIVESTOCK ENTOMOLOGY.** (3 cr)  
Biology and management of arthropods that affect livestock production systems.

**5300f. CHEMICALS AND INSECT BEHAVIOR.** (2 cr; prereq 3005 or EBB 5112 and 12 cr organic chemistry; offered 1989 and alt yrs)  
Survey of the nature and behavioral role of chemicals affecting insect behavior, with emphasis on mating and host location. Research techniques also discussed.

**5310. SAMPLING BIOLOGICAL POPULATIONS.** (4 cr; prereq Stat 5021 or equiv)  
Design of sampling plans for study of field and laboratory populations of living organisms.

**5320f. ECOLOGY OF AGRICULTURE.** (4 cr, one 3000+ level course in Agron or Hort or An Sci, one 3000+ level course in Ent or Plant Path or Soils 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, introductory entomology and course in ecology)  
Principles of biological control: history, ecological basis, classical biological control, augmentation, analysis of selected projects.

## Course Descriptions

**5350f. INSECT PATHOLOGY.** (3 cr; prereq 5030; offered 1989 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 1990 and alt yrs)  
Identification and natural history of aquatic insects. Field trips to be arranged.

**5370s. PRINCIPLES OF SYSTEMATICS.** (3 cr; prereq 3005 or equiv, 5020; offered 1989 and alt yrs)  
Procedures of systematic entomology, systematic literature, zoological nomenclature, use and construction of keys, and presentation of results of systematic research.

**5380w. LEPIDOPTEROLOGY.** (2 or 3 cr with term paper; prereq course in entomology or #; one course each in ecology and genetics recommended; offered 1990 and alt yrs)  
Overview of Lepidoptera, with emphasis on processes and phenomena such as polymorphism, mimicry, and individual quality that are well demonstrated by this insect order.

**5600. FIELD ENTOMOLOGY AT ITASCA.** (5 cr; prereq introductory biology; offered SSI at Itasca)  
Insect fauna in various natural habitats of the park and surrounding areas. Includes field trips and collection and identification of insects, as well as studies of general morphology, life histories, and habitats of local species.

**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 #)  
Undergraduate students may develop a short-term research project during one or both summer terms.

**5650. HOUSE AND GARDEN INSECTS.** (3 cr; 3 lect and 6 lab hrs per wk)  
Identification and life history of commonly encountered Minnesota insects. Lectures by selected faculty and short field trips.

**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, laboratory, or library studies in various aspects of entomology.

**5920f,w,s. SPECIAL LECTURES IN ENTOMOLOGY.** (Cr ar; offered when feasible)  
Lectures and/or laboratories in special fields of entomological research given by a visiting scholar or regular staff member.

## For Graduate Students Only

(For descriptions, see *Graduate School Bulletin*)

**8040s. ADVANCED INSECT GENETICS**

**8050s. TOXICOLOGY**

**8200w. COLLOQUIUM IN APICULTURE**

**8230w. COLLOQUIUM IN INSECT PHYSIOLOGY**

**8240w. COLLOQUIUM IN INSECT ECOLOGY**

**8300f,w,s. GRADUATE SEMINAR**

**8500.\* RESEARCH IN ENTOMOLOGY**

## Food Science and Nutrition (FScN)

**1010. MAN'S FOOD.** (4 cr, §1012)  
Human nutritional needs; food composition, world food supply, consumption patterns, acceptance, quality programs and regulations, food preservation, commercial processes, packaging, marketing, and national and international food programs.

**1012. NUTRITION: CONCEPTS AND ISSUES.** (3 cr, §1010)  
Fundamental concepts of nutrition, including human nutritional requirements, function of nutrients in body, and nature of nutrient deficiencies. Selection of foods for balanced diet. Dietary survey. Vegetarianism, weight loss, fad diets. Relationship of nutrition to physical activity, obesity, cancer, heart disease, food processing, world food problems.

**1020. INTRODUCTORY MICROBIOLOGY.** (4 cr; especially for students in home economics; prereq third-qr fr or #)  
Fundamental principles of microbiology. Characteristics of bacteria, yeasts, molds, and other microorganisms, their importance in preparation and preservation of foods, relation to health and well-being of the individual and the family.

**1030. UNDERSTANDING CHEESE.** (2 cr; intended for nonmajors)  
Conversion of milk into cheese; cheese curing; optimum characteristics of many varieties of natural cheeses; fondue, process, and club cheeses; nutritional value and care of cheese in the home.

**1102. TECHNOLOGY OF FOOD PROCESSING.** (4 cr; prereq high school chemistry and biology)  
Introduction to the technology of processing foods with special reference to the prevention of biological, microbiological, physical, and chemical deterioration. Changes in food composition, microbiological safety, food laws and regulations, technologies of the major food processes such as canning, freezing, and drying.

## **1212. SCIENTIFIC PRINCIPLES OF FOOD**

**PREPARATION.** (5 cr; prereq Chem 1002 or 1005)  
Introduction to composition and chemical and physical properties of foods; interaction and reaction of foods in preparation procedures; evaluation of food products prepared in the laboratory using quality standards.

## **1215. HOME PRESERVATION OF FOODS.** (2 cr; intended for nonmajors)

Description and demonstration of safe methods of home food preservation. Students prepare various products in the laboratory. Methods covered include canning, freezing, fermenting, and drying.

## **1612. PRINCIPLES OF NUTRITION.** (4 cr; prereq HS Chem and Biol)

Human nutritional requirements, function of nutrients, nature of deficiencies. Vegetarianism, weight loss, fad diets, activity, obesity, cancer, heart disease, food processing, safety, world food problems.

## **3110. FOOD CHEMISTRY.** (4 cr; prereq BioC 1302 or Biol 5001)

Structures, properties, reactions, and functions of basic chemical components of foods. Chemical properties of food systems, influence of processing, storage, and preparation.

## **3112. FOOD CHEMISTRY LABORATORY.** (2 cr; prereq 3110 or ¶3110)

Laboratory experiments to investigate chemical properties and reactions of selected food systems and food components.

## **3272. INTRODUCTION TO FOOD DECISION MAKING.** (2 cr; prereq 1612)

Factors considered in planning nutritionally adequate and aesthetically pleasing menus for various eating patterns and cost levels. Use of computer to calculate menu nutrient content and to plan menus.

## **3400. FOOD COMMUNICATION TECHNIQUES.** (3 cr; prereq 1212 or 3403)

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.

## **3403. EXPERIMENTAL FOODS.** (4 cr; prereq 3110)

Principles and modern concepts of food systems and preparation; laboratory projects to illustrate effects of different procedures and ingredients.

## **3472. PRINCIPLES OF FOOD PURCHASING.**

(4 cr; prereq 5 cr in food science and nutrition)  
Principles of purchasing the basic groups of foods. Relative cost of key nutrients from different foods within a food group. Food prices and indices of change. Laws and regulations pertinent to the labeling of food. Food standards and grades. Relation of these factors to the purchasing of food.

## **3602. NUTRITION IN PROFESSIONAL HEALTH CARE.**

(4 cr, \$3600; prereq chemistry, human physiology, pharmacology, pathophysiology, regis in a professional health discipline)  
General principles of nutrition in professional health care. Nutrition as factor in attaining and maintaining health. Role of health practitioner in nutrition education.

## **3610. COMMUNITY NUTRITION.** (2 cr; prereq 1612 or equiv, 5 cr Anth or Psy 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)  
Influence of biological changes through the life cycle on nutrient requirements; needs as affected by exercise, digestion, absorption, energy and other nutrient balances, protein energy malnutrition, infection.

## **3662. INTRODUCTION TO THE CLINICAL PRACTICE OF DIETETICS.** (2 cr; prereq 12 cr in food science and nutrition, regis in coordinated program in dietetics)

Introduction to the practice of dietetics in hospitals, outpatient clinics, public service agencies, and food services.

## **3703. FIELD EXPERIENCE IN FOODSERVICE MANAGEMENT.** (3-18 cr; prereq regis in coordinated program in dietetics or #)

Supervised foodservice production and management experience in a community or health care facility.

## **3730. QUANTITY FOOD PRODUCTION MANAGEMENT.** (5 cr; prereq 1212 or 3403, 3472)

Participation in management procedures used in selection, storage, preparation, pricing, and service of food in quantity. A quantity foodservice used as laboratory.

## **3732. LECTURE IN QUANTITY FOOD PRODUCTION MANAGEMENT.** (2 cr; prereq 3403, 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 science and nutrition, #; not for grad cr; A-F grading only; Extension regis only)

Up to 12 weeks of planned experience in a selected position in the food industry; evaluative reports and consultations with faculty advisers and employers.

## **5100. GENERAL SEMINAR.** (1 cr; prereq sr or #)

Literature review and presentation of papers in selected areas of food science and nutrition.

## **5111. INDEPENDENT STUDY IN FOOD SCIENCE AND NUTRITION.** (1-5 cr [may be repeated for cr]; prereq Δ)

Individual laboratory or library research in some area related to food science or nutrition.

## Course Descriptions

### **5120. FOOD MICROBIOLOGY.** (5 cr; prereq MicB 5105 or VPB 3103)

Relationship of environment to growth, and survival of microorganisms in foods; characteristics of microorganisms in foods; recognition and control of food-borne pathogens.

### **5122. CONTROL OF MICROORGANISMS IN FOOD PROCESSING.** (2 cr; prereq 5120 or #; ¶5123 advised, especially for food science majors)

Factors that influence control and destruction of microorganisms; chemical, physical, and microbiological principles in cleaning and sanitizing food processing equipment; inactivation of microorganisms and thermal process evaluation; microbiological preservation methods; development of sanitation programs; microbiological criteria; hazard analysis and critical control point concept.

### **5123. MICROBIOLOGY OF FOOD FERMENTATIONS.** (2 cr; prereq 5120 or #; ¶5122 advised, especially for food science majors)

Characteristics of bacteria, yeasts, and molds involved in dairy and food fermentations; properties of lactic bacteriophages, methods of control in dairy fermentations; composition and factors that influence activity of dairy and food starter cultures; microbiology of natural and controlled fermentations; use of microorganisms in production of single-cell protein and products consumed in food, and in waste use.

### **5135. FOOD ENGINEERING UNIT OPERATIONS.** (5 cr; prereq 1102 or ¶1102, Math 1142, Phys 1041-1046)

Principles and food system applications of following unit operations: fluid flow, heat transfer, drying, evaporation, contact equilibrium (distillation, extraction, crystallization, membrane processes), and mechanical separation (filtration, centrifugation, sedimentation, sieving).

### **5136. UNIT OPERATIONS LABORATORY.** (2 cr; prereq 5135)

Applications of food engineering unit operations; experiments involving fluid flow, heat and mass transfer.

### **5310. ADVANCED FOOD CHEMISTRY.** (3 cr; prereq 3110)

Changes in chemical structure and functional properties of foods as modified by processing. Additional topics in areas of flavor, color, safety, nutritive value, sweeteners, and irradiation of food.

### **5312. CHEMICAL AND INSTRUMENTAL ANALYSIS OF FOODS.** (5 cr; prereq 3112, BioC 5025 or #)

Application of quantitative physical, chemical, and instrumental methods of analysis to examination of food products; evaluation of methods and interpretation of results.

### **5320. FOOD BIOTECHNOLOGY.** (3 cr; prereq 5123, Biol 5001)

Impact of biotechnology in agriculture, nutrition, and food processing. Discussion of recombinant DNA and related technologies, bioprocess engineering, and fermentation technology.

### **5350. APPLICATION OF EXPERIMENTAL DESIGN IN THE FOOD INDUSTRY.** (4 cr; prereq course in statistics)

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

### **5360. SENSORY EVALUATION OF FOOD QUALITY.** (4 cr; prereq 3110 and Stat 3081 or 5021 or equiv)

Fundamentals of sensory perception. Test designs and methods used in studying the sensory quality of foods.

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

Lecture and demonstration of principles of packaging as they apply to foods and the food industry.

### **5390. INTRODUCTION TO FOOD LAW.** (4 cr; prereq 1102 or #)

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

### **5402. MODERN FOOD PREPARATION PRINCIPLES AND PRACTICES.** (2-4 cr; prereq organic chemistry and 15 cr food science and nutrition)

Experimental bases of principles underlying present-day food preparation practices; development of experiences illustrative of such principles in high school teaching, dietetics, and foods in business.

### **5403. EXPERIMENTAL STUDY OF FOODS.** (5 cr; prereq 3112, 3403, 5360)

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

### **5404. CURRENT ISSUES IN FOOD AND NUTRITION.** (2-4 cr; prereq 15 cr food science and nutrition or #)

Evaluation of popular and scientific literature dealing with nutrition, food additives, food safety, food fads, health foods, environmental contamination, the consumer movement, naturally occurring food toxicants, processed foods, synthetic foods, and organically grown foods.

### **5406. CURRENT LITERATURE IN FOODS.** (2-4 cr [may be repeated for max 6 cr]; prereq 5413, Δ)

Assigned readings, reports, and discussions of topics in the experimental study of foods.

**5412. PHYSICO-CHEMISTRY OF FOODS.** (3 cr; prereq 3110)

Characterization of crystalline systems, gels, emulsions, foams, and rheological systems; functionality of food macromolecules in these systems.

**5413. STRUCTURAL-FUNCTIONAL RELATIONS IN FOOD SYSTEMS.** (3 cr; prereq 3110)

Food as a complex biochemical system. Functionality of various biological entities and chemical constituents of food systems.

**5462. ADVANCED TOPICS IN SENSORY EVALUATION OF FOOD.** (2-4 cr; prereq 5360)

Review of current literature pertinent to specific topics under active investigation.

**5472. FOOD PURCHASING.** (4 cr; prereq principles of economics and 15 cr food science and nutrition)

Cost-quality relationships of diverse food products as affected by technological changes. Composition and nutritive value of processed and formulated food products. Functional role of food additives. Recent legislation pertinent to labeling and grading of food products.

**5473. ADVANCES IN THE MANAGEMENT AND PREPARATION OF FOOD.** (2-4 cr; prereq 3403, 3472 or equiv)

Recent developments in food materials and methods of preparation; their implications in the management of time, money, and energy expenditures.

**5474. FOOD MARKETING ECONOMICS.** (4 cr, §AgEc 5550; prereq AgEc 3101 or #)

Economics of U.S. food marketing. 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 3110)

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 3110, 5120, 5135 or #)

Application of scientific principles to problems involved in processing fluid and dehydrated milk systems and their control. Demonstration of basic processing operations including heating, cooling, homogenization, evaporation, drying, crystallization, and freezing.

**5523. TECHNOLOGY OF FERMENTED DAIRY PRODUCTS.** (4 cr; prereq 3112, 5123)

Integration of chemical, microbiological, and physical principles involved in the manufacture and storage of cheeses and fermented milks.

**5524. SENSORY EVALUATION OF DAIRY PRODUCTS.** (1 cr; prereq 3110 or #)

Laboratory and commercial procedures for evaluating sensory properties and market quality of dairy products. Causes and identification of common defects in flavor, physical properties, and appearance.

**5530. INDUSTRIAL PROCESSING OF FRUITS AND VEGETABLES.** (4 cr; prereq 3110, 5120, 5135 or #; 3 lect and 3 lab hrs per wk)

Relationship of chemical, physical, and microbiological principles to commercial processing of fruits and vegetables from procurement of raw products through preparation, preservation, packaging, storage, transportation, and merchandising. Emphasis on preservation methods involving heat sterilization, freezing, dehydration, and fermentation.

**5540. FATS AND OILS CHEMISTRY AND TECHNOLOGY.** (4 cr; prereq 3112 or #)

Nature of fats and oils; their structure, composition, and chemical and physical properties; raw materials for fat and oil products; extraction, refining, hydrogenization, and other industrial manipulations; handling, storage, and analysis and grading of raw materials and finished products.

**5555. FREEZING AND DEHYDRATION OF FOODS.** (5 cr; prereq 3110, 5120, 5135 or #)

Principles involved in the processing, handling, and storage of frozen, dry, and intermediate moisture foods, with emphasis on physicochemical properties of water in foods.

**5562. FLAVOR TECHNOLOGY.** (4 cr; prereq 1102, 3110 or #)

Flavor and off-flavor development in foods. Industrial production of food flavorings, 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.)

**5612. EXPERIMENTAL NUTRITION.** (4 cr; prereq 5622 or ¶5622, BioC 5025 or #)

Principles and methods of diet formulation, dietary manipulation, energy and nitrogen balance, and body composition analyses in experimental animal models. Use and evaluation of methods and interpretation of results.

**5622. MACRO NUTRIENT METABOLISM.** (5 cr; prereq 3612, Biol 5001, Phsl 3051)

Physiological function and metabolic fate of carbohydrates, lipids and proteins, and their involvement in fulfilling energy needs for maintenance, growth, and work.

**5623. VITAMIN AND MINERAL BIOCHEMISTRY.** (4 cr; prereq 3612, Biol 5001, Phsl 3051)

Nutritional/biochemical and physiological function of essential vitamins and minerals in humans and experimental animal models.



## Course Descriptions

### **5624. A METABOLIC APPROACH TO CLINICAL NUTRITION.** (4 cr; prereq 5622, 5623)

Focus on individual human in clinical setting; the interaction of calorie deprivation, metabolic demands of illness, and nutritional implications of medical treatment.

### **5642. FIELD EXPERIENCE IN COMMUNITY NUTRITION.** (3-18 cr; prereq at least one course in human nutrition, #)

Application of nutrition information to problems of health and welfare, involving assigned readings, discussions, and experience in a community agency.

### **5643. SEMINAR: WORLD FOOD SUPPLY PROBLEMS.** (3 cr, \$AgEc 5790, \$Agro 5200, \$Soc 5675, \$LACS 5280; prereq sr or grad)

A multidisciplinary approach to social, economic, and technical problems of feeding the world's growing population.

### **5662. CLINICAL NUTRITION.** (3 cr; prereq 5622, Biol 3021 or #)

Application of principles of normal nutrition to clinical problems, with description of altered nutrient requirements under conditions of human disease. Nutritional therapy for common clinical conditions and effects of treatment on nutritional status of patient.

### **5664. FIELD EXPERIENCE IN CLINICAL NUTRITION.** (3-18 cr; prereq course in human nutrition, #)

Application of nutrition information to problems of health and disease, involving assigned readings, discussions, and experience in a clinical facility.

### **5665. APPLIED CLINICAL NUTRITION I.** (3 cr; prereq Biol 5001, Phsl 3051 or 1002, LaMP 5177 or #)

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 therapy for diseases of the cardiovascular and respiratory systems and common disorders of the endocrine system, notably diabetes mellitus; nutrition intervention in obesity.

### **5667. APPLIED CLINICAL NUTRITION III.** (2 cr; prereq 5665, 5666 or demonstrated equiv)

Pathology, treatment, and nutrition therapy for diseases of the urinary tract, inborn errors of metabolism, and allergies. Nutritional considerations in eating and central nervous system disorders, and osteoporosis.

### **5668. ADVANCED CLINICAL NUTRITION.** (2 cr; prereq 5662 or #)

An integrated approach to prevention and treatment of illness focusing on the role of nutrition in total medical care.

### **5693. SELECTED ASPECTS OF NUTRITION.** (2-4 cr [may be repeated for max 12 cr]; prereq sr, 1212, 3612 or #)

In-depth investigation of a single, preselected aspect of nutrition in any one offering. Teaching procedure and approach determined by nature of topic and student needs. Specific topic announced in advance of course offering.

### **5694. METABOLIC BASIS FOR THERAPEUTIC NUTRITION.** (4 cr; prereq 5664 or #)

Physiological and biochemical bases for dietary treatment and exploration of dietary principles related to adequate nutrition. Case study presentations and clinical experience included.

### **5702. SELECTED ASPECTS OF FOODSERVICE MANAGEMENT IN HEALTH CARE FACILITIES.** (3 cr; prereq 3 cr elementary statistics, 6 cr economics, #)

Management techniques applied to foodservices for health care facilities. Methods of analyses and control.

### **5705. FIELD EXPERIENCE IN FOODSERVICE MANAGEMENT.** (3-18 cr; prereq regis in coordinated program in dietetics or #)

Application of principles of foodservice management to problems in community, commercial, or health care facility.

### **5732. PRINCIPLES OF FOODSERVICE ORGANIZATION AND MANAGEMENT.** (4 cr; prereq sr, 3732, Mgmt 3001, regis in coordinated program in dietetics)

Management of foodservice personnel, financial control, regulations, related administrative problems.

### **5750. PRINCIPLES OF FOODSERVICE MANAGEMENT.** (4 cr; prereq 3730 or 3732, Mgmt 3001)

Application of management principles in a foodservice. Business procedures, personnel management, financial management, cost control, and related administrative problems. Field trips may be required.

### **5755. CURRENT TOPICS IN FOODSERVICE MANAGEMENT.** (4 cr [may be repeated for max 8 cr]; prereq #)

In-depth examination of timely issues. Content varies from quarter to quarter.

## **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**

**8627. HUMAN NUTRITION AND AGING**

**8777. THESIS CREDITS: MASTERS**

**8888. THESIS CREDITS: DOCTORAL**

**Nutr 8745. SEMINAR**

**Nutr 8777. THESIS CREDITS: MASTERS**

**Nutr 8888. THESIS CREDITS: DOCTORAL**

**Nutr 8990. GRADUATE RESEARCH**

**Horticultural Science (Hort)**

**1010. HOME HORTICULTURE.** (4 cr; no cr for horticulture majors or minors)

For non-horticulture majors. Applied knowledge of propagation and culture of fruits, vegetables, lawns, flowers, and house plants. Identification and use of trees and shrubs in the home landscape. Lectures and laboratory.

**1016. GREENHOUSE MANAGEMENT.** (2 cr; prereq 1100)

Fundamentals of greenhouse construction and management; through discussion of cultural and physiological principles.

**1021. WOODY PLANT MATERIALS.** (5 cr)

Taxonomy, ecology, and landscape uses of trees, shrubs, and evergreens. Lectures, laboratories, and field trips.

**1022. HERBACEOUS PLANT MATERIALS.** (5 cr)

Taxonomy, ecology, and landscape uses of perennial and annual flowers, tender and hardy bulbs, ground covers, wild flowers. Lectures, laboratory, and garden experience.

**1036. PLANT PROPAGATION.** (4 cr)

Principles and techniques of propagating plants by seeds, cuttings, grafts, buds, layers, and division. Lectures on principles; laboratories on practice of various propagating techniques; and field trips.

**1099. ORIENTATION TO HORTICULTURE.**

(1 cr; S-N only)

A survey of the field of horticulture including discussion of job potentials for horticulture majors.

**1100. BIOLOGY OF HORTICULTURAL PRODUCTION.** (4 cr; prereq Biol 1103)

Discussion of factors influencing the successful production of horticultural crops. For horticulture majors and other students planning to take advanced horticulture courses. Lectures, experiments, and discussion.

**3030. LANDSCAPE DESIGN OF RESIDENTIAL AND SMALL COMMERCIAL SITES.** (4 cr; prereq 1021, LA 1025 or Ind 1600)

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

**3033. POSTHARVEST HANDLING AND PHYSIOLOGY OF HORTICULTURAL CROPS.**

(3 cr; prereq 1100)

Fundamental principles in postharvest handling of horticultural crops; precooling, transporting, and storing. Postharvest changes, senescence, respiration, ripening and ethylene physiology. Government laws and regulations. Lectures, discussion, laboratory, field trips.

**3053. ORNAMENTALS FOR INTERIOR DESIGN.** (4 cr; prereq 1036 or #)

Identification, use, and culture primarily of foliage plants used in interior decoration. Lectures, reference reading, and field trips.

**3072. TURF MANAGEMENT.** (4 cr; prereq Soil 1122, either Hort 1100 or Agro 3020)

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

**3081. FLORAL DESIGN AND FLORICULTURE BUSINESS.** (4 cr; prereq GC 1513)

Principles of design from construction of simplistic line designs to complex commercial retail arrangements. History and theory of floral design, use of foliage, accessories, and color. Organization of floral industry, past and future trends, postharvest physiology, marketing, merchandizing, cost accounting, and seasonality of business.

**3097. HORTICULTURE PRACTICUM.** (2-4 cr; prereq upper division horticulture major, Δ)

Approved field, laboratory, or greenhouse experiences in application of horticultural information and practices.

## Course Descriptions

**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.

**5021. ORNAMENTAL PLANT MATERIALS.** (5 cr, §1021, §1022; offered by special arrangement) Identification and use of wide range of ornamental plant materials including trees, shrubs, annuals, perennials, and plants for interior design. Application of information and personal observations to individual student's area of study.

**5026. LANDSCAPE MANAGEMENT.** (5 cr) Application of basic biological principles to establishment and maintenance of horticultural plantings including commercial, private utility, recreational, highway, and park lands. Techniques and equipment for landscape plantings; adoptive management models for business and institutional organization.

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

Principles of tree fruit production. Three 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. Lectures, laboratory, field trips.

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

Principles of small fruit production. Major small fruit crops of the U.S. Site selection, cultural and management practices, systematics, physiological and environmental control of plant development, pest control. Lectures, laboratory, field trips.

**5034. COMMERCIAL VEGETABLE AGRICULTURE.** (5 cr; prereq 1100 or Agro 1010, Soil 1122; PIPh 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. Lectures, laboratories, and field trips.

**5038. RESEARCH METHODS IN PLANT PROPAGATION.** (3 cr; prereq 1036 or #; offered winter of odd yrs)

Basic concepts, theory, and techniques involved in propagating plants studied through literature search and discussion. Students design and conduct experiments with plants or propagation techniques of special interest.

**5040. PLANT GROWTH REGULATION.** (4 cr; prereq 15 cr plant sciences incl 3 cr plant physiology) 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 use of these principles to solve horticultural problems.

**5041. ENVIRONMENTAL PHYSIOLOGY OF HORTICULTURAL PLANTS.** (3 cr; prereq 15 cr plant sciences, PIPh 3131; offered fall of even yrs) Lectures and assigned readings on the relation of water, temperature, and light to the growth and development of horticultural plants.

**5042. TURF GRASS SCIENCE.** (5 cr; prereq 3072, PIPa 1001, PIPh 3131)

For advanced students in turf with career objectives in professional turf management. All phases of the turf industry considered, with emphasis on the ecology, physiology, and theory of turf population dynamics and on specialized management situations such as golf course, commercial sod production, and fine turf athletic situations.

**5046. NURSERY MANAGEMENT I.** (4 cr, 5046, 5048†; prereq 1021, 1036, 1100)

Introduction, history, organization, and scope of the nursery industry. General nursery business administration, production schedules and cultural management for seed beds and field grown stock. *Field trips are required.*

**5048. NURSERY MANAGEMENT II.** (4 cr, 5046, 5048†; prereq 5046)

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 will include field trips and greenhouse and field training in nursery operations. *Field trips are required.*

**5052. COMMERCIAL FLORICULTURE, FALL CROPS.** (4 cr; prereq 1016)

Physiological and cultural aspects of optimized production of principal florist crops of economic importance. Chrysanthemums, cut flowers, and potted plants especially adapted to Christmas sales. Lectures, reference reading, and field trips to greenhouses, wholesalers, and retail flower stores.

**5053. COMMERCIAL FLORICULTURE, WINTER CROPS.** (4 cr; prereq PIPh 3131 or #)

Physiological and cultural aspects of bulbous plants (tulips, narcissi, bulbous irises, hyacinths, crocuses, and lilies) and year-round production of azaleas. Emphasis on latest research in growth, developmental, and flowering physiology of these commercially important floricultural crops. Lectures, reference reading, laboratory experience, and field trips.

**5054. COMMERCIAL FLORICULTURE, SPRING CROPS.** (4 cr; prereq 1016)

Physiological and cultural aspects of optimized production of principal florist crops of economic importance. Roses, snapdragons, gloxinias, geraniums, bedding plants, and other spring crops. Lectures, reference reading, and field trips to greenhouses, wholesalers, garden centers, and retail stores.

**5091. DIRECTED STUDIES.** (2-6 cr; prereq 8 cr upper division horticulture course, Δ)

Opportunities for in-depth exploration of concepts, technology, materials, or programs in specific area to expand professional competency and self-confidence. Planning, organizing, implementing, and evaluating knowledge obtained from formal education and experience.

**For Graduate Students Only**

(For descriptions, see *Graduate School Bulletin*)

**Agro 8270.\* SEMINAR: PLANT BREEDING**

**GCB 8900. SEMINAR: GENETICS**

**Hort 8022. BREEDING ASEXUALLY PROPAGATED CROPS**

**Hort 8023. EVOLUTION OF CROP PLANTS**



**Hort 8041. DISCUSSIONS IN ADMINISTRATIVE ORGANIZATION**

**Hort 8042. HORTICULTURAL SEMINAR**

**Hort 8045.\* PLANT HARDINESS**

**Hort 8051x.\* ADVANCED PROBLEMS IN HORTICULTURAL CROP BREEDING**

**Hort 8052x.\* ADVANCED PROBLEMS IN PHYSIOLOGY OF HORTICULTURAL CROPS**

**Hort 8060. DISCUSSIONS IN POTATO RESEARCH**

**Hort 8061.\* DISCUSSIONS IN INCOMPATIBILITY**

**Hort 8062.\* DISCUSSIONS IN PLANT HARDINESS**

**Hort 8063.\* DISCUSSIONS IN HORTICULTURAL PLANT BREEDING**

**Hort 8064.\* DISCUSSIONS IN FLORICULTURAL SCIENCE**

**Hort 8065.\* DISCUSSIONS IN POSTHARVEST PHYSIOLOGY**

**Hort 8066. DISCUSSIONS IN HORTICULTURAL RESEARCH**

**Landscape Architecture (LA)**

Effective July 1, 1989, the School of Architecture and Landscape Architecture was granted independent collegiate status. A separate bulletin for this new college will be issued in the near future.

**1001. THE DESIGN OF ENVIRONMENTS.** (2 cr)

A survey of the role of landscape architecture in design and planning the environment for people. Exploration of the profession, from design of gardens, parks, and open spaces to siting buildings, urban design, and planning communities to regional design and visual assessment.

**1021. HISTORY OF ARCHITECTURE.** (4 cr, §Arch 1021; 4 lect hrs per wk)

History and theory of architecture. Survey of architecture from ancient through modern periods.

**1022. HISTORY OF LANDSCAPE ARCHITECTURE.** (4 cr, §Arch 1022; 4 lect hrs per wk)

History and theory of landscape architecture. Survey of landscape architecture from ancient through modern periods.

**1023. HISTORY OF CITIES.** (4 cr, §Arch 1023; 4 lect hrs per wk)

History and theory of urban design. Survey of urban design from ancient through modern periods.

**1024. LANDSCAPE THEORY.** (4 cr; 3 lect and 3 lab hrs per wk)

Analysis of design elements and forms involving direction, shape, proportion, and color, with emphasis on their function in design; perception and our relationship to the environment; the social effects and psychological basis for design.

## Course Descriptions

### **1025. BASIC VISUALIZATION I.** (4 cr; 2 lect and 4 lab hrs per wk; prereq LA major or #)

Perspective drawing, landscape sketching, visual analysis of landscape materials, presentation techniques for plans, sections, elevations, and diagrams.

### **1026. BASIC VISUALIZATION II.** (4 cr; prereq 1025; 6 studio hrs per wk)

Continued refinement of the student's ability to execute acceptable line drawings developed in 1025. Emphasis on aiding students to develop their own technique(s). Continued emphasis on perspective sketching, color sense, psychology of graphic interpretation, mixed media, and printing reproduction processes.

### **1031. INTRODUCTION TO LANDSCAPE ARCHITECTURE.** (4 cr; 4 lect hrs per wk)

Design potential of materials of the landscape; exercises in assessment of land developments and detail landscapes; the role of the landscape architect in shaping the natural and cultural environment; brief historical review of site developments.

### **3001. ENVIRONMENTAL DESIGN: THEORY AND PROCESS.** (4 cr, §Arch 3001)

Interaction of people with the environment, using natural and social sciences and the arts as background for readings, lectures, discussions, and workshop sessions.

### **3002. ENVIRONMENTAL DESIGN: PEOPLE AND ENVIRONMENT.** (4 cr, §Arch 3002; prereq 3001)

Nature and the effects of various tools and processes of environmental change, ranging from buildings and landscapes to economic policies, climate, and myths. Readings, lectures, discussions, and workshop sessions.

### **3003. ENVIRONMENTAL DESIGN: IMPLEMENTATION AND EVALUATION.** (4 cr, §Arch 3003; prereq 3002)

Design projects, discussions, and readings exploring personal abilities to implement and evaluate environmental change.

### **3065. LANDSCAPE CONSTRUCTION: LANDFORM SYSTEMS.** (4 cr; prereq 3081 or #; 2 lect and 4 lab hrs per wk)

Lectures, projects, and exercises on landform systems for landscape architecture. Landform types, representation methods, manipulation techniques, use of survey data, earth work construction concerns, and design standards. Landform performance issues of storm water management, landscape integrity assurance, and economic viability with methods for evaluation.

### **3067. LANDSCAPE CONSTRUCTION: STRUCTURAL SYSTEMS.** (4 cr; prereq 3081 or #; 2 lect and 4 lab hrs per wk)

Lectures, projects, and exercises on the design of structures for landscape architecture. Principles and procedures for structural design, historical applications, properties and use of materials, and design communication. Performance issues of landscape integrity assurance and economic viability with evaluation methods.

### **3069. LANDSCAPE CONSTRUCTION: MECHANICAL SYSTEMS.** (4 cr; prereq 3091 or #; 2 lect and 4 lab hrs per wk)

Lectures, projects, and exercises on the landscape architectural use of storm water management, urban utilities, irrigation, pool and foundation, electrical, and lighting systems. System planning and design, historical applications, and design communication. Mechanical performance issues and evaluation methods for landscape integrity and economic viability.

### **3081-3082-3083. BASIC DESIGN.** (6 cr per qtr; prereq LA student; 2 lect and 10 lab hrs per wk)

Lectures and projects to expand awareness of the design potential of environment, develop processes and graphic techniques for problem solving, and develop methods of presenting ideas verbally and visually. Design of small-scale site systems with simple variables.

### **3091-3092. INTERMEDIATE DESIGN.** (6 cr per qtr; prereq 3083; 2 lect and 10 lab hrs per wk)

Lectures and projects in the design potential of natural land materials, landscape survey and analysis techniques, elements of the environment as they condition design potential, methodologies for solving design problems, methods of expressing landscape form both geographically and through models; design of site systems with simple variations.

### **3093. DETAIL SITE DESIGN.** (6 cr; prereq 3092)

Design of small-scale site systems with complex variables.

### **3094. INDEPENDENT STUDY IN GRAPHICS.**

(1-4 cr; prereq LA student, #)

Independent study of topics, of student's choice, in graphic communication. Proposal must be submitted for approval by LA faculty member.

### **3095. INDEPENDENT STUDY IN PLANTING DESIGN.** (1-4 cr; prereq LA student, #)

Independent study of topics, of student's choice, related to planting design. Proposal must be submitted for approval by LA faculty member.

### **3096. INDEPENDENT STUDY IN HISTORY OR THEORY.** (1-4 cr; prereq LA student, #)

Independent study of topics, of student's choice, related to history and/or theory of landscape architecture. Proposal must be submitted for approval by LA faculty member.

**3097. INDEPENDENT STUDY IN COMPUTER-AIDED DESIGN.** (1-4 cr; prereq LA student, #)  
Independent study of topics, of student's choice, related to use of computers to aid design and analysis. Proposal must be submitted for approval by LA faculty member.

**3098. INDEPENDENT STUDY IN DESIGN.** (1-4 cr; prereq LA student, #)  
Independent study of topics, of student's choice, related to landscape architecture or design theory or practice. Proposal must be submitted for approval by LA faculty member.

**3099. INDEPENDENT STUDY IN TECHNOLOGY.** (1-4 cr; prereq LA student, #)  
Independent study of topics, of student's choice, related to landscape architecture technology. Proposal must be submitted for approval by LA faculty member.

**3101. COMMUNICATING LANDSCAPE QUALITY.** (4 cr; 2 lect and 4 lab hrs per wk; prereq 1025 and 3091)  
Lectures and exercises in drawing techniques focused on developing graphic skills for designers working predominantly with exterior environments.

**3121. ARCHITECTURAL RENDERING: HISTORICAL AND CONTEMPORARY INFLUENCES.** (4 cr; §Arch 3121; prereq ArtS 1101, Arch, LA or Env Des majors or #)  
See Arch 3121 for description.

**3200. LANDSCAPE ARCHITECTURE PRACTICUM.** (1-6 cr; prereq LA student, #; S-N only)  
Approved design, planning, engineering, contracting, or travel experience in application or development of landscape architecture theory. Proposal must be submitted for approval by LA faculty; final written, graphic, and/or oral presentation must be submitted.

**5010. PRINCIPLES OF OUTDOOR RECREATION DESIGN AND PLANNING.** (4 cr, §FR 5233; 4 lect hrs per wk)  
For advanced students associated with design, management, and planning of recreation facilities. Planning and design principles related to recreational land use and development; parks, campsites, water areas, highways, and summer and winter recreational facilities.

**5063. LANDSCAPE CONSTRUCTION: SPATIAL PERFORMANCE.** (4 cr; prereq 3081 or #; 2 lect and 4 lab hrs per wk)  
Lectures, projects, and exercises on the use of space standards, proportions, and dimensions to achieve and evaluate spatial performance in landscape architecture. Spatial accommodation of people and automobiles in the basic array of landscape applications. Land use controls and development standards.

**5099. RCD INTERDISCIPLINARY SEMINAR I.** (4 cr, 5099-5100†, §RCD 5099, §AgEc 5099, §AgET 5099, §Soil 5099; prereq resource and community development sr or #)  
Selected speakers, readings, and discussion topics dealing with resource and community development analysis and implications for resource allocation. Students participate as a team, combining disciplinary skills to analyze complex resource development problems.

**5100. RCD INTERDISCIPLINARY SEMINAR II.** (4 cr, 5099-5100†, §RCD 5100, §AgEc 5100, §AgET 5100, §Soil 5100; prereq 5099 or #)  
(Continuation of 5099) Papers, presentations, and critiques on selected complex resource problems in Seminar I.

**5101. SITE PLANNING AND DESIGN.** (6 cr; 2 lect and 10 lab hrs per wk; prereq 3092)  
Case study analysis and design of site organizational systems.

**5103. URBAN LANDSCAPE DESIGN.** (6 cr; 2 lect and 10 lab hrs per wk; prereq 3092)  
Case study analysis and design of urban environments.

**5105. RECREATIONAL PLANNING AND DESIGN.** (6 cr; prereq 3092; 2 lect and 10 lab hrs per wk)  
Analysis development and presentation of landscape design solutions for diverse recreational land use.

**5107. REGIONAL LANDSCAPE DESIGN.** (6 cr; prereq 3092, 5562; 3 lect and 10 lab hrs per wk)  
Emphasis on large-scale land areas. Analyzing development potential and evolving solutions for integration of divergent land use patterns such as agricultural, residential, commercial, industrial, and recreational.

**5109. SPECIAL PROBLEMS: THESIS PROPOSAL.** (2 cr; hrs ar)  
Individual research resulting in a proposal for thesis project to be developed in LA 5110.

**5110. ADVANCED LANDSCAPE PLANNING AND DESIGN.** (6 cr; prereq terminal qtr of study; 2 lect and 10 lab hrs per wk)  
Advanced studies in area of student's option.

**5117. PLANTING DESIGN: AESTHETIC AND FUNCTIONAL CRITERIA.** (4 cr; prereq 3083 or #, Hort 1021)  
Lectures, presentations, field trips, readings, and projects exploring aesthetic and functional design principles related to the use of plants in the landscape. Exploration of both historic and modern principles through design projects of various scales.

## Course Descriptions

### **5119. PLANTING DESIGN: ECOLOGICAL PRINCIPLES/LAND USE CONCEPTS AND IMPLEMENTATION OF PLANTING DESIGN.** (4 cr; prereq 5117 or #)

Lectures, presentations, field trips, readings and projects related to the principles and practices of using plants in an ecologically sound and environmentally sensitive manner. Principles derived from prairie, northwoods, riverine, and wetland environments. Integration of naturalized materials within a range of environments of various scales.

### **5131. DIRECTED STUDIES IN LANDSCAPE ARCHITECTURE HISTORY AND THEORY.** (1-6 cr; prereq third-yr LA student, Δ)

Advanced independent studies. Student expected to have successfully completed 3000-level independent study courses in previous quarters.

### **5132. DIRECTED STUDIES IN LANDSCAPE ARCHITECTURE DESIGN.** (1-6 cr; prereq third-yr LA student, Δ)

Advanced independent studies. Student expected to have successfully completed 3000-level independent study courses in previous quarters.

### **5133. DIRECTED STUDIES IN LANDSCAPE ARCHITECTURE TECHNOLOGY.** (1-6 cr; prereq third-yr LA student, Δ)

Advanced independent studies. Student expected to have successfully completed 3000-level independent study courses in previous quarters.

### **5134. DIRECTED STUDIES IN EMERGING AREAS OF LANDSCAPE ARCHITECTURE.** (1-6 cr; prereq third-yr LA student, Δ)

Advanced independent studies in areas of student's choice that relate to new or renewed direction in landscape architecture. Student expected to have successfully completed 3000-level independent study courses in previous quarters.

### **5136. GOVERNMENT RECREATION FACILITIES PLANNING.** (4 cr; prereq third-yr LA student or #)

Exploration of design policies in regard to development of specific recreational facilities at federal water resource projects. Lectures, discussions, and field trips in analyzing criteria for organization of federal recreational environments.

### **5140. INTERDISCIPLINARY STUDIES IN LANDSCAPE ARCHITECTURE.** (2-6 cr per qtr; prereq #)

Interdisciplinary research, planning, and/or design project. Topics may include natural resource conservation, downtown revitalization, recreational facilities and programming, energy-efficient design, historic preservation, agricultural land utilization, land reclamation, environments for the aged, computerized land use planning, visual assessment, housing, new towns.

### **5224. CONTEMPORARY ISSUES IN LANDSCAPE ARCHITECTURE.** (4 cr; prereq terminal yr of study; 4 discussion hrs per wk)

Analysis of design principles and design goals in modern society. Review of current site development projects. In-depth investigation into specific areas of land development.

### **5225. LANDSCAPE TECHNOLOGY: WORKING DRAWINGS AND SPECIFICATIONS.** (4 cr; prereq 3072; 3 lect, 3 lab hrs per wk)

Lectures, exercises, and projects in working drawing and specification.

### **5226. PROFESSIONAL PRACTICE.** (4 cr; prereq terminal yr of study)

Professional ethics, responsibility, and relations in business. Office management, preparation of professional communications, estimates, specifications, and contracts. Lectures, written exercises, and office visits.

### **5227. IMPACT ASSESSMENT AND ENVIRONMENTAL MEDIATION.** (5 cr; prereq sr, grad or #; offered at Itasca only)

Lectures in history, laws, and analysis of impact assessment and environmental mediation. Integrated with interdisciplinary emphasis on fieldwork related to a selected issue, actual document preparation, presentation, and individual responsibility.

### **5228. SEMINAR: TOPICS IN CAMPUS PLANNING.** (4 cr; prereq 3093 or #)

Lectures and discussion, presentations, field trips, readings, and paper exploring aspects of contemporary and historic issues in campus planning, the use of energy-efficient buildings, and related issues dealing with efficient land use and site planning.

### **5261. HISTORY OF LANDSCAPE ARCHITECTURE: THE EUROPEAN, ORIENTAL, AND AMERICAN TRADITION.** (4 cr; prereq first-yr LA student; 4 hrs lect and discussion per wk)

Influences and forms that have established a basis for the landscape architecture tradition in Europe, the Orient, and the United States. Emphasis on principles and techniques and on the continuity of design imagination inherent in specific examples of the altered environment.

### **5265. HISTORY OF LANDSCAPE ARCHITECTURE: INDIVIDUAL INFLUENCES.** (4 cr; prereq second-yr LA student; 4 hrs lect and discussion per wk)

Personal influences of noteworthy designers (current and historic), and how such influence precipitated design structures by these creative people within the affective domain of personal expression.

### **5562. INTRODUCTION TO GEOGRAPHIC INFORMATION SYSTEMS.** (4 cr; §Geog 5562; 4 lect hrs per wk)

Basic concepts of geographic information systems structure. Theory and applications for landscape location and resource analysis, and regional planning. Location principles, data structure, and variable attributes.

## Large Animal Clinical Sciences (LACS)

*Offered by the College of Veterinary Medicine*

**3502. ANIMAL HEALTH AND DISEASE.** (5 cr)  
Designed for nonveterinary students to give a broad understanding of veterinary science as it applies to health and disease of domestic animals. Emphasis on basic concepts of disease and common animal diseases that demonstrate these concepts. How stress and management practices aggravate and create new disease conditions.

**5190. ANALYTICAL TECHNIQUES IN VETERINARY MEDICINE I.** (2 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.** (2 cr; prereq 5190, regis vet med 3rd or 4th yr or grad 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. SEMINAR: WORLD FOOD SUPPLY PROBLEMS.** (3 cr, \$AgEc 5790, \$FSen 5643, \$Soc 5675; prereq major in agriculture, veterinary medicine, nutritional sciences, social science field or #; grads by #)

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

**5650. VETERINARY EPIDEMIOLOGY AND STATISTICS.** (4 cr; prereq 10 cr biology, 12 cr chemistry or #)

Principles of epidemiology, ecology, and veterinary public health. Biostatistics applied to the measurement of health and disease in populations.

## Natural Resources and Environmental Studies (NRES)

**1001f. 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.

**1010f. 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.

**3001f. COLLOQUIUM IN NATURAL RESOURCES AND ENVIRONMENTAL STUDIES.**

(1 cr with 4 cr max)

Round table discussions of current topics in Natural Resources and Environmental Studies.

**3050f. EXPERIENCE AND TRAINING IN A FIELD SETTING.** (1-4 cr)

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.

**3099f. PROBLEM SOLVING IN NATURAL RESOURCES AND ENVIRONMENTAL STUDIES I.** (1 cr)

Designed to help students identify and analyze natural resource and environmental problems. The goal will be to identify a problem and develop a solution. Students participate as a team.

**3100f. PROBLEM SOLVING IN NATURAL RESOURCES AND ENVIRONMENTAL STUDIES II.** (3 cr)

Development of a solution to the problem identified in 3099. Discussions reflect diverse aspects of the problem and assignments. Oral and written presentations. Students participate as a team.

## Plant Pathology (PIPa)

**1001. INTRODUCTORY PLANT PATHOLOGY: LECTURE AND INTRODUCTION TO DIAGNOSTIC PROCEDURES AND LABORATORY.** (4 cr; prereq soph, 9 cr plant science)

Biotic and abiotic causes of plant disease. Representative plant diseases of significance in Upper Midwest that illustrate principles of plant pathology. Theory of laboratory and diagnostic techniques.

**3001. INTRODUCTORY PLANT PATHOLOGY: LECTURE, LABORATORY, AND INTRODUCTION TO DIAGNOSIS.** (5 cr, \$5002; prereq soph, 9 cr plant science)

Biotic and abiotic causes of plant disease. Representative plant diseases of significance in Upper Midwest that illustrate principles of plant pathology. Laboratory and diagnostic techniques. "Plant Disease Situation" problem-solving.



## Course Descriptions

### **3090. RESEARCH IN PLANT PATHOLOGY.** (4 cr; prereq 1001 or equiv or #)

Assignment of special problems to undergraduate students who desire opportunity for independent research in plant pathology.

### **5000. PROFESSIONAL EXPERIENCE PROGRAM.** (4 cr; prereq 15 cr in plant pathology, #; 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.

### **5002. INTRODUCTORY PLANT PATHOLOGY FOR ADVANCED STUDENTS.** (5 cr, §3001; prereq 14 cr plant science or #)

**5005. VIRUSES AND BACTERIA IN PLANT DISEASE.** (4 cr; prereq 20 cr biology including botany and biochemistry; offered fall qtr yearly)  
Plant diseases caused by bacteria and viruses with emphasis on effects, symptoms, pathogen identification, and control.

**5006. FUNGI, ALGAE, AND PARASITIC SEED PLANTS IN PLANT DISEASE.** (4 cr; prereq 20 cr biology including botany, biochemistry, and mycology, PIPa 5105; offered winter qtr yearly)  
Fungi, algae, and parasitic seed plants as plant pathogens, representative types with particular reference to the techniques used in their identification and control.

### **5007. AIR POLLUTION AND OTHER ABIOTIC CAUSES OF PLANT DISEASE.** (3 cr; prereq 20 cr biology, including biochemistry; offered spring qtr yearly)

Lectures, assigned readings, and discussions about the characteristics and effects of phytotoxic air pollutants (60%) and water, temperature extremes, soluble salts, mineral elements, allelopathy, and pesticides (40%) as causes of plant disease.

### **5008. INTRODUCTION TO PLANT NEMATOLOGY.** (2 cr; prereq 3001 or 5002 or #; offered spring qtr yearly)

Characteristics, strengths, and weaknesses of plant and soil nematodes as seen through study of the biology and morphology of five important genera of plant parasitic nematodes. Field and laboratory experiences in sampling, processing of soil and plant tissues, identification and counting, and control of plant nematodes.

### **5015. PLANT NEMATOLOGY.** (4 cr; prereq 5008 or #, offered winter qtr 1989 and alt yrs)

Lectures, assigned readings, and laboratory exercises and experiments with emphasis on identification of plant parasitic nematodes to species; experimental techniques for studying plant nematodes; attraction, movement, and feeding by plant nematodes; and biological, chemical, and physical factors that affect nematode survival and multiplication.

### **5050. FOREST PATHOLOGY.** (4 cr; prereq Biol 1103 or equiv)

Diseases of forest and shade trees; wood decay. Symptoms, etiology, and control. Lectures, laboratory, and fieldwork.

### **5102. FIELD MYCOLOGY.** (5 cr; prereq 3 cr botany or #; offered at Itasca)

General characteristics of fungi, especially those used in identification; cultural and taxonomic procedures and practices.

### **5105. INTRODUCTION TO THE STUDY OF FUNGI.** (4 cr; prereq 3 cr botany or Biol 1001 or #)

Slime molds, lower fungi, Ascomycotina, and Basidiomycotina. Lectures and laboratory exercises include fungal morphology, ecology (the role of fungi in the ecosystem as decomposers and symbionts), genetics, evolution, classification, and identification. Fresh collections, preserved, and living fungi used to illustrate principles.

### **5106. MYCOLOGY: ASCOMYCOTINA--FUNGI IMPERFECTI.** (4 cr; prereq PIPa 5105 or #; offered 1990 and alt yrs)

Lectures, and laboratory exercises on morphology, evolution, species concepts, parasexual cycle, growth; development as it relates to sporulation and identification, classification, use and construction of taxonomic keys, phenetics, cladistics, nomenclature and fungal ecology. Laboratory emphasis on the use of taxonomic keys, identification, application of nomenclatural rules, and the role of fungi in ecosystems. Fungi involved in decomposition, food production and spoilage, grain storage, and plant pathogenesis are used in the laboratory as unknowns and required to illustrate principles. Independent project required.

### **5107. MYCOLOGY: BASIDIOMYCOTINA.** (4 cr; prereq PIPa 5105, 5106 or #; offered 1991 and alt yrs)

Lectures and laboratory exercises on classification, identification, nomenclature, genetics, evolution, ecology, and analyses of taxonomic keys. Symbionts, plant pathogens, saprophytes, and wood decay fungi are provided for laboratory exercises.

### **5109.\* BIOCHEMISTRY AND PHYSIOLOGY OF FUNGI.** (3 cr; prereq 8 cr biochemistry or #; offered 1988 and alt yrs)

Lectures, assigned readings, and discussions of the chemical structure and activities of the fungus cell, including growth, nutrition, regulation of intermediary metabolism and protein and nucleic acid syntheses, sporulation and spore germination, mitochondrial biogenesis, photobiology, mycoviruses, and natural products.

### **5200. POISONOUS PLANTS.** (2 cr; prereq Biol 1011, 3 cr botany)

Plants poisonous to animals and people; plant families and species, symptoms of poisoning, and toxic principles. Lectures and field trips.

**5215.\* INSECTS IN RELATION TO PLANT DISEASES.** (4 cr; prereq 5 cr entomology, 5 cr plant pathology or equiv or #)  
(Same as Ent 5215) Insect transmission and dissemination of plant pathogens; development of plant-insect relationships; habits of principal insect vectors with emphasis on methods of control.

**5500. PLANT DISEASE EPIDEMIOLOGY AND MANAGEMENT.** (4 cr; prereq 3001 or 5050 or #)  
Concepts, principles, and methodology in the quantitative study of plant disease epidemics, their crop losses, and disease management using contemporary technology. Emphasis on computer-based systems analysis techniques and their use in understanding the biology of epidemics and in integrating research for management practices. Case studies from agricultural and horticultural crops.

**5650. CLINICAL PLANT PATHOLOGY.** (2, 4 or 6 cr; prereq 3001 or 5002 or #; offered summer session yearly)  
Field trips, clinical and laboratory experience in diagnosis, prevention, and control of plant diseases affecting field, fruit, and vegetable crops, ornamentals and trees. Field plot experiences.

**5700. PLANT DISEASE CONTROL.** (4 cr; prereq 1001 or #)  
Control of plant diseases utilizing biological and cultural practices, disease resistance, and chemicals in an integrated manner.

## For Graduate Students Only

(For descriptions, see *Graduate School Bulletin*)

**8001. PLANT DISEASE THEORY I: MOLECULAR TO CELLULAR**

**8002. PLANT DISEASE THEORY II: TISSUES TO WHOLE PLANTS**

**8003. PLANT DISEASE THEORY III: POPULATIONS**

**8090. RESEARCH IN PLANT PATHOLOGY**

**8095. ADVANCED PROCEDURES AND RESEARCH IN MYCOLOGY**

**8111. GENETICS OF PLANT PATHOGENS**

**8201. SEMINAR**

## Plant Physiology (PIPh)

Students in the College of Agriculture may be interested in the following courses in plant physiology. With the approval of your adviser, you may use the introductory courses in plant physiology in partial fulfillment of the science requirement. You may take 3000- and 5000-level courses in plant

physiology after you have completed the necessary prerequisites. These courses introduce the field of plant physiology and illustrate how knowledge in this special area of plant science may be used in private and government research and in college and university teaching and research. If you are interested in plant physiology as a professional career, contact one of the faculty members listed in this area in the *Graduate School Bulletin*.

**3131. SURVEY OF PLANT PHYSIOLOGY.** (4 cr, \$5131, \$PBio 3131, \$PBio 5131; prereq Biol 1103 or 3012, BioC 1302 or ¶BioC 1302 or Biol 5001)

Physiological principles underlying processes that occur in living plants with emphasis on higher plants. Growth and development, mineral nutrition, transport, water relations, and metabolism with emphasis on photosynthesis and nitrogen assimilation. For laboratory see PIPh 5132.

**5131. SURVEY OF PLANT PHYSIOLOGY.** (4 cr, \$3131, \$PBio 3131, \$PBio 5131; prereq Biol 1103 or 3012, BioC 1302 or ¶BioC 1302 or Biol 5001)

Same as PIPh 3131 with the addition of a weekly discussion and advanced reading session.

**5132. PLANT PHYSIOLOGY LABORATORY.** (2 cr, \$PBio 5132; prereq 5131 or ¶5131)

Laboratory course to accompany PIPh 3131 and 5131.

**5167.\* PHYSIOLOGY OF THE PLANT CELL.** (3 cr; prereq plant anatomy, inorganic and organic chemistry or biochemistry; offered 1988-89 and alt yrs)

Characteristics of the living state, general aspects of cell metabolism, development of the cell, polarity, differentiation, and irritability of the cell and cellular movements.

**5168.\* EXPERIMENTAL PROTOPLASMATOLOGY.** (3 cr; prereq #; offered 1987-88 and alt yrs)

Physical and physicochemical properties of living protoplasm in plant cells including viscosity, wall attachment, permeability, primary and secondary fluorescence, and vital staining.

**5182.\* PLANT METABOLISM.** (3 cr, \$PBio 5182; prereq 5131, a course in biochemistry)

Plant metabolism including photosynthesis, respiration, and synthesis of macromolecules by plants. Structure-function relations at the plant, cell, and subcellular level. Energy flow in the plant system and regulation of plant metabolism.

**5183.\* WATER, MINERALS, AND TRANSLOCATION.** (4 cr, \$PBio 5183; prereq 5131)

Membrane phenomena and osmotic properties of cells. Uptake, movement, and loss of water in plants including effects of external factors. Translocation of organic substances. Absorption, distribution, and function of inorganic elements.

## Course Descriptions

### **5184.\* PLANT GROWTH AND DEVELOPMENT.** (3 cr, §PBio 5184; prereq 5131)

Survey of plant growth and development ranging from germination to death, with emphasis on physiology, biochemistry, and molecular biology. Developmental processes related to mobilization of macromolecules during germination; cell division and cell extension during axis growth; photomorphogenesis, chloroplast, and microbody ontogeny; flowering, fruit, and seed formation; senescence; and how plant growth substances control these developmental events.

### **5188.\* RESEARCH PERSPECTIVES IN PLANT PHYSIOLOGY.** (Cr ar; prereq Chem 3100, 3101, 8 cr biochemistry, #, Δ)

A laboratory course in which the student undertakes a well-defined research problem of limited scope.

**5723. METHODS OF PLANT ANALYSIS.** (Cr ar; prereq Chem 3100, 3101, 8 cr biochemistry, #) In-depth experimental laboratory approach to microscopic analysis, sample preparation, fractionation, isolation, and measurement of plant compounds employing modern methods of plant physiology. Discrete and independent units in:

**5723. Plant Hormones and Tissue Culture.** (Cr ar; offered when feasible)

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

## For Graduate Students Only

(For descriptions, see *Graduate School Bulletin*)

### **8251. SEMINAR: PLANT PHYSIOLOGY**

### **8281.\* GROWTH AND DIFFERENTIATION OF PLANTS**

### **8310. METHODS IN PLANT PHYSIOLOGY**

Additional courses dealing with topics related to plant physiology are offered by several other University departments. Interested students should consult listings in agronomy, horticultural science, plant pathology, and soil science (College of Agriculture); biochemistry, plant biology, and ecology (College of Biological Sciences); and forest resources (College of Natural Resources).

## Resource and Community Development (RCD)

### **3010. THE MINNESOTA COMMUNITY: ANALYSIS OF ITS ORGANIZATION, CHANGE, AND DEVELOPMENT.** (4 cr; prereq one social science course, #)

Community problem solving and decision making. How local problems are defined, what communities can do in dealing with their problems, and how information (primarily scientific knowledge) may be applied to local problems. Conceptual analysis of communities and their problems. Secondary data analysis as a research technique for use in analysis of community problems in Minnesota.

### **3118. SEMINAR: SOIL AND WATER POLLUTION AND PUBLIC POLICY.** (1 cr, [may be repeated for max 3 cr]; §Soil 3118; S-N only)

Speakers from the University, the public, and state and federal agencies address a current rural soil and water environmental issue, with emphasis on policies and pertinent technical concerns. A new topic examined each time offered.

### **5099. INTERDISCIPLINARY SEMINAR I.** (4 cr, 5099-5100†, §AgEc 5099, §AgET 5099, §FR 5269, §LA 5099, §Soil 5099; prereq resource and community development sr or #)

Selected speakers, readings, and discussion topics dealing with resource and community development analysis and implications for resource allocation. Students participate as a team, combining skills to analyze complex resource problems.

### **5100. INTERDISCIPLINARY SEMINAR II.** (4 cr, 5099-5100†, §AgEc 5100, §AgET 5100, §FR 5270, §LA 5100, §Soil 5100; prereq 5099 or #) (Continuation of 5099) Papers, presentations, and critiques on selected complex resource problems in Seminar I.

**5110. SPECIAL PROBLEMS.** (1-4 cr [may be repeated for max 12 cr]; prereq resource and community development sr, #) Projects, plans, and written reports related to 5100; resource and environmental inventory and analysis.

### **5120. ENVIRONMENTAL PROBLEMS.** (3 cr, §NRES 1010)

Interdisciplinary offering exploring five areas of environmental concern: aspects of environmental design that provide maximum compatibility of human beings with their environment, sources of water pollution and their control, disposal and control of solid wastes from agriculture, minimization of pesticide pollution of the environment, and managed use of forest resources to maintain environmental quality. A televised course involving 22 taped lectures and 10 discussion periods. Report on a specific environmental problem also required. Offered in Extension only.

**5200. COMMUNITY DEVELOPMENT SIMULATION.** (4 cr for undergrad, 3 cr for grad; prereq #)  
Participation in a water and land resource use and a fiscal management simulation of a community development process. Use of gaming simulation techniques in devising, testing, and negotiating alternative strategies of environmental and economic regulation and in assessing their private and social costs.

## Rhetoric (Rhet)

**1101. WRITING TO INFORM AND PERSUADE.** (4 cr, §Comp 1011)  
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.

**1151. WRITING IN YOUR MAJOR.** (4 cr; prereq Rhet 1104 [or College of Natural Resources students only: FR 1104 or ForP 1104 or FW 1104], freshman communication requirement, soph status)  
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.

**1160. COLLEGE READING.** (4 cr)  
Factors for successful college reading; application of psycholinguistic and cognitive reading theories; opportunities for developing expertise in reading comprehension and retention, rapid reading, vocabulary power, and communication skills. Not a basic course. Meets concurrently with 5160.

**1220. PRINCIPLES OF HUMAN COMMUNICATION.** (4 cr)  
Introduction to the elements and contexts of human communication. Readings, discussions, lectures, and experiential assignments; focus on communication that affects interpersonal gatherings and that entertains, persuades, and instructs public audiences.

**1222. PUBLIC SPEAKING.** (4 cr; prereq freshman communication requirement)  
Practical course in fundamentals of effective speechmaking. Emphasis on researching and organizing a speech and communicating with an audience.

**1251. EFFECTIVE LISTENING.** (3 cr)  
Designed to increase listening comprehension by developing four central abilities. Readings, research, theory, and practice.

**1301. HUMANITIES: MODERN THOUGHT AND THE ENLIGHTENMENT.** (4 cr)  
Introduction to humanities tracing the impact of the scientific revolution on human thought. 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; the 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 the concept of Darwin's theory of evolution and its effect on 19th- and 20th-century institutions. Emphasis on the attempts of social philosophers to extrapolate from biological theory to political, cultural, and religious life; scientific and religious ways of knowing; the 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. The impact of Protestantism, democracy, capitalism, and reform movements, including women's rights, on the family ideal.

**1376. HUMANITIES: TOPICS IN HUMANITIES AND LITERATURE.** (4 cr)  
Topics vary from quarter to quarter and are listed in the Class Schedule. For full details, inquire at the department office prior to registration.

**3101. FUNCTIONAL PHOTOGRAPHY.** (4 cr; prereq Design 1501 or Rhet 3562)  
Practical course in basic photographic communication. Techniques of producing 35mm color transparencies for use in group presentations, teaching, publications, and audiovisual productions.

**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.

## Course Descriptions

### **3266. COMMUNICATION, DISCUSSION IN SMALL GROUP DECISION-MAKING.** (4 cr; prereq Rhet 1222 or #)

Role of communication techniques in the small group decision-making process. Emphasis on problem-solving discussion requiring some kind of formal outcome.

### **3270. SPEECH: SPECIAL PROBLEMS.** (1-5 cr; prereq #, Δ)

Supervised reading and research on advanced speech-communication topics not covered in regularly scheduled speech offerings. Because of the advanced and independent nature of this course, the primary burden of development usually rests with the student.

### **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; A-F or S-N)

A brief examination of contemporary social issues as reflected in cultural documents. The 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.

### **3562. WRITING IN YOUR PROFESSION.** (4 cr; prereq freshman communication requirement, 1151, jr or sr status)

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.

### **3572. GRAMMATICAL EDITING FOR TECHNICAL WRITERS.** (2 cr; prereq Tech Comm major; 5 wks long; S-N only)

Students work independently through exercises in grammar and punctuation, learning proofreading marks and correcting manuscripts. Completing the exercises and passing a final exam required to receive credit. Not a remedial grammar course.

### **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.

### **3700. RHETORICAL THEORY: PERSUASION AND THE LITERATURE OF SCIENCE.** (4 cr; prereq freshman 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)

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

### **5160. COLLEGE READING.** (4 cr)

Factors for successful college reading; application of psycholinguistic and cognitive reading theories; opportunities for developing expertise in reading comprehension and retention, rapid reading, vocabulary power, and communication skills.

Completion of a seminal reading-theory textbook, seminar meetings, and paper are required. Meets concurrently with 1160.

### **5165. STUDIES IN ORGANIZATIONAL COMMUNICATION, CONFLICT, AND CHANGE.** (4 cr; prereq freshman communication or equiv or grad status)

The roles of internal and external organizational communication, conflict-problem identification, and change processes. Contemporary theory and research in organizational development. Methods of problem identification and diagnosis. Change processes and applications to actual organizational settings.

### **5170. MANAGERIAL COMMUNICATIONS.** (4 cr; prereq freshman communication or equiv or grad status)

Analysis of a manager's position in an organizational communication network. Focus on the possible forms, contexts, and functions of a manager's communication. Assessing and developing personal competence and confidence in managerial communication. Lectures, discussions, readings, experiential exercises, and field research.

**5180. INTERNSHIP IN TECHNICAL COMMUNICATION.** (2-6 cr; prereq #, Δ)

Designed to give technical communication majors on-the-job experience at the University or in industry or government.

**5257. SCIENTIFIC AND TECHNICAL PRESENTATIONS.** (4 cr; prereq 1222, 3562 or 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 will make and evaluate technical and scientific presentations. Emphasis on seminar reports and professional conference papers.

**5258. INTERVIEWING: DYNAMICS OF FACE-TO-FACE COMMUNICATION.** (4 cr)

Designed to improve intrapersonal and interpersonal skills in interviewing situations. Students learn to understand and use appraisal, reprimand, complaint, persuasion, problem solving, and counseling interview techniques, and participate in a research interview project. Equal emphasis on the interviewer and interviewee roles.

**5375. HUMANITIES: SEMINAR IN AMERICAN AGRARIANISM.** (3 cr; prereq #)

Interdisciplinary seminar in humanities. The roots of the agrarian ideal in European thought and in early America. Individual research into and evaluations of the agrarian tradition in American social and political philosophy, and in history of imaginative literature, fine arts, and popular culture.

**5400. DISSEMINATION AND UTILIZATION OF INFORMATION.** (4 cr; prereq jr, sr or grad status)

Methods and processes of using specialized information. Study of cases and development of materials for application in professional fields. Emphasis on channels for dissemination and utilization.

**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. TECHNICAL WRITING COURSE DEVELOPMENT.** (2 cr; prereq 3562, sr or grad status)

Students plan and develop a technical writing course. Special attention to development of course objectives and syllabus; bibliography of readings on teaching technical writing; textbook selection.

**5541. READINGS IN SCIENTIFIC AND TECHNICAL PROSE.** (2 cr; S-N only; prereq sr or grad status, Δ)

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 revision of manuscripts and improvement in style of writing.

**5571. WRITING FOR SPECIAL PURPOSES.** (2 cr; prereq technical communication major or minor, freshman communication, 3562 or #)

Analysis of and writing practice in a specific genre of practical writing. Content varies from quarter to quarter and includes policy statements, specialized forms, documents not covered in other writing courses.

**5572. PROCEDURES AND POLICIES MANUAL.**

(2 cr; prereq Tech Comm major or minor, freshman 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 Tech Comm major or minor, freshman 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. Designed to serve both real and hypothetical situations.

**5574. ELECTRONIC PUBLISHING.** (2 cr; A-F only; prereq Agri 1200, Rhet 3562, 3572 or grad status)

Preparing copy for publication. Practice copy coding for electronic publishing; use of telecommunications systems; coding and transmitting tables and charts; editing copy and code. Principles of composing and typesetting an article for publication; communicating with typesetters and printers electronically.

**5575. NEWSLETTER.** (3 cr; prereq Tech Comm major or minor, freshman communication requirement, 3562 or grad status or #)

Newsletter design and production. Students will learn to write and edit newsletter articles and gain hands-on experience in typography, graphic design, formatting, layout, and distribution procedures. They will produce the *Tech Communicator* using Macintosh desktop publishing.

# Course Descriptions

**5581. DOCUMENT DESIGN.** (4 cr; A-F only; prereq 3562, sr or grad status, #)

Designing document to meet user's need, completing draft, and evaluating effectiveness. Forms and software documentation (user guides, reference manuals, tutorials, and input sheets) for databases, decision aids, computer-aided instruction, on-line programs, or visual displays. Mandatory lab time as part of project team of programmers, subject matter specialists, and communication specialists.

**5600. TRANSFER OF TECHNOLOGY.** (4 cr; prereq work experience in scientific communication 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.

**5700. COMMUNICATION IN TECHNOLOGICAL AND ENVIRONMENTAL IMPACT ASSESSMENT.** (4 cr; prereq sr or grad status, one course in statistics, #)

Theories and processes involved in technological assessment and environmental impact statement preparation. Case studies of technology assessments, forecasts, and environmental impact statements. Term project on planning of process and project management in an actual impact assessment.

## For Graduate Students Only

(For descriptions, see *Graduate School Bulletin*)

**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**

**8500. QUALITATIVE RESEARCH: STRATEGIES IN TECHNICAL COMMUNICATION**

**8510. THEORY AND PRACTICE IN DESIGNING MESSAGES**

**8777. THESIS CREDITS: MASTERS**

## 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 in sociology, economics, anthropology or political science or #)  
Relationship of population, technology, and organization structure to levels of modernization among Latin American nations. Differentiation, diffusion, innovation, and social conflict as precipitants of social change.

**3671. COMPARATIVE RURAL SOCIETIES: LATIN AMERICAN.** (4 cr; prereq 8 cr in sociology, anthropology, economics or political science or #)  
Social and cultural change in Latin America. Demographic and ecological characteristics, institutional structure and its accompanying associations; linkages with outside and world views.

**5651. RURAL SOCIAL INSTITUTIONS.** (4 cr; prereq any 3xxx sociology course or equiv or #; offered alt yrs)  
Factors in the rural environment that condition the functioning of rural social institutions—family, school, church, local government, health, welfare.

**5661. RURAL COMMUNITY ANALYSIS.** (4 cr; intended for persons in rural community organization, rural teaching, extension work, and related fields; prereq any 3xxx sociology 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, \$FScN 5643, \$PIPa 5220, \$LACS 5280; prereq major in agriculture, veterinary medicine, nutritional sciences, social science field or #; grad students by Δ only)  
Multidisciplinary approach to 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)

**5009f. UNDERGRADUATE SENIOR THESIS: SCIENCE IN AGRICULTURE.** (1-5 cr)  
In-depth undergraduate research and thesis experience for senior students (9 credits total required for Science in Agriculture major). Research to be conducted under the supervision of a COA faculty member; recommended course length is one full academic year. The research experience culminates with a written, bound thesis and oral presentation of research results.

## Soil Science (Soil)

### 1020. THE SOIL RESOURCE. (4 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.

### 3104. COMPUTER APPLICATIONS IN SOIL SCIENCE. (2 cr)

General understanding of microcomputer hardware and software. Practical problem-solving modules in soil science. Hands-on experience in computer laboratory.

### 3118f. SEMINAR: SOIL AND WATER POLLUTION AND PUBLIC POLICY. (1 cr [may be repeated for max 3 cr]; S-N only)

Speakers from the University, the public, and state and federal agencies address a current rural soil and water environmental issue, with emphasis on policies and pertinent technical concerns. A new topic examined each time offered.

### 3125. BASIC SOIL SCIENCE. (4 cr; §1020, §1122; prereq Chem 1001 or 1004)

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

### 3225. PHYSICAL SOIL MANAGEMENT AND CONSERVATION. (4 cr)

Physical characteristics of soil related to plant growth and development. Soil conservation: water and wind conservation practices (rural and urban); economical, social, and policy considerations; conservation strategies. Erosion and conservation in the world.

### 3416. SOIL FERTILITY. (4 cr; prereq 3125)

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

### 3417. SOIL FERTILITY LABORATORY. (1 cr; §Soil 3416)

Introduction to diagnostic techniques through measurement of specific soil fertility parameters. Laboratory and recitation.

### 3419. FERTILIZER TECHNOLOGY. (2 cr; prereq 3416 or #)

Introduction to the theory and principles of fertilizer manufacture, fertilizer mixing, and fertilizer application procedures used in agronomic and horticultural operations.

### 3520. SOIL MORPHOLOGY, CLASSIFICATION, AND GENESIS. (4 cr; prereq 1020 or 3125)

Field observation and identification of the morphological characteristics of soils. Interpretation of soil profiles for water-related characteristics. Identification of soil landscapes and the influence of soil-forming factors on soil morphology. Lecture and field laboratory.

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

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

### 5000. PROFESSIONAL EXPERIENCE PROGRAM. (4 cr; prereq 12 cr in soils and #; not for grad cr; Extension regis only)

Up to 12 weeks of experience in a position related to soil science. Evaluation of work experience by employer and faculty adviser in consultation with student and employer.

### 5099. RCD INTERDISCIPLINARY SEMINAR I.

(4 cr; 5099-5100†, §AgEc 5099, §AgET 5099, §LA 5099, §RCD 5099; prereq sr or #)

Selected speakers, readings, and discussion topics dealing with resource and community development analysis and implications for resource allocation. Discussions reflect diverse disciplinary contributions.

### 5100. RCD INTERDISCIPLINARY SEMINAR II.

(4 cr; 5099-5100†, §AgEc 5100, §AgET 5100, §RCD 5100; prereq 5099)

Designed to help students develop the ability to identify and analyze resource development problems. Discussions reflect diverse disciplinary contributions. Students participate as members of a team, combining disciplinary skills. Guest speakers and student assignments.

### 5104. AGRICULTURAL SYSTEMS ANALYSIS AND MODELING. (4 cr; §PIPa 5104, §AgEc 5104, §AnSc 5104; prereq Math 1142 or #)

Introduction to bioeconomic modeling as preparation for interdisciplinary agricultural systems analysis. Basic concepts; deterministic and stochastic models; delays, feedback, and clockwork; data acquisition; model verification and validation; role of models for agroecosystem management.

### 5114. SPECIAL PROBLEMS IN SOILS. (1-5 cr

[may be repeated for max 10 cr]; prereq 3125 or #)

Research, readings, and instruction.

### 5228. SEMINAR: CLIMATOLOGY, METEOROLOGY, AND AGRICULTURE. (1 cr per qtr [max 3

cr]; prereq #; offered fall, winter, and spring)

Round table discussions and assigned readings.



## Course Descriptions

**5230. SOIL-PLANT-WATER RELATIONS.** (3 cr; prereq 3125, Biol 1103)

Water flow in soil-plant-atmosphere continuum; emphasis on soil-root interface. Influence of soil physical and biological properties on growth and function of plant root systems; transpiration and factors affecting water transport in plants. Dynamic properties of soils affecting water flow and soil water management.

**5232. SOIL PHYSICS.** (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. Lectures, laboratory, and problem-solving sessions.

**5240. MICROCLIMATOLOGY (SOILS).** (3 or 4 cr; prereq Math 1111, 10 cr physics or #)

Meteorology and climatology in relation to the soil-atmosphere interface, with emphasis on the microclimate, physical processes taking place within the microclimate, modification of the microclimate description of meteorological instruments, and use of weather data.

**5310. SOIL CHEMISTRY.** (4 cr; prereq 3125, analytical chemistry or #)

Composition of soil mineral and organic matter. Solubility models applied to mineral stability. Oxidation reduction, acidity and pH, ion exchange. Acid, alkaline, calcareous, and alkali soils. Lecture and lab.

**5340. ORGANIC AND PESTICIDAL RESIDUES.** (5 cr; prereq 3125, sr or #)

The fate of crop residues, animal wastes, sewage materials, petroleum hydrocarbons, detergents, and pesticides in soils with emphasis on the chemical, physical, and biological factors of the soil that influence decomposition or persistence.

**5360. SOIL CLAY MINERALOGY.** (4 cr; prereq sr or grad)

Origin, extent, importance, and identification of soil clay minerals. Crystalline and non-crystalline. Pedologic implications.

**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. Lectures, recitation, and clinic.

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

Introduction to diagnostic techniques through measurement of 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. MORPHOLOGY, CLASSIFICATION, AND GENESIS OF SOILS.** (4 cr, §3520; not open to soil science and soil and water science majors; prereq 1020 or 3125)

Field observation and identification of the morphological characteristics of soils. Interpretation of soil profiles for water-related characteristics. Identification of soil landscapes and the influence of soil-forming factors on soil morphology. Lecture and field laboratory.

**5515. SOIL DEVELOPMENT, CLASSIFICATION, AND GEOGRAPHY.** (4 cr; prereq 3520 or #)

Soil profile characteristics; influence of parent material, climate, topography, vegetation, and time on soil development; system of soil classification, and geographical distribution of soil orders.

**5550. PEATLANDS: FORMATION, CLASSIFICATION, AND UTILIZATION.** (3 cr; prereq 1020 or 3125 or #)

Formation, properties, and management of peatlands important to crop, forestry, and energy production in this state and worldwide. Lecture.

**5560. USES AND INTERPRETATION OF SOIL SURVEY INFORMATION.** (3 cr; prereq 3520 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 information can be used to the fullest extent by both laypersons and the scientific community.

**5610. SOIL BIOLOGY.** (4 cr; prereq 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. Lectures, laboratory, and weekly discussion.

**5710. ADVANCED FOREST SOILS.** (3 cr [4 cr with paper]; prereq 1020 or 3125, FR 5114)

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

### For Graduate Students Only

(For descriptions, see *Graduate School Bulletin*)

**8111. COLLOQUIA IN SOIL SCIENCE**

**8122. ADVANCED SOIL SCIENCE**

**8124. RESEARCH PROBLEMS IN SOILS**

**8128. SEMINAR**

**8250. FLUID FLOW IN SOILS**

**8330. ADVANCED SOIL CHEMISTRY**

**8630. NITROGEN FIXATION**

**8632. SOIL MICROBIOLOGY AND PLANT GROWTH**

## 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 designed primarily for graduate students needing statistics as a research technique.

**5101. INTRODUCTION TO DECISION THEORY.**

(4 cr; prereq Econ 5111 or Math 1142 or 1211 or #) Elements of probability; basic concepts in statistical decision theory; relationship to game theory and other types of decision problems; prediction and inference.

**5121w-5122w,s. THEORY OF STATISTICS.** (4 cr per qtr, §5131-5132-5133; prereq Math 1231 or 1331 or 1621)

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

**5131f-5132w-5133s. THEORY OF STATISTICS.** (4 cr per qtr, §5121-5122; prereq Math 3211 or 3411)

5131: Probability models, univariate and bivariate distributions, independence, and basic limit theorems. 5132-5133: Statistical decision theory, sampling, estimation, testing hypotheses, parametric and nonparametric procedures for one-sample and two-sample problems, regression, and analysis of variance. Treatment more mathematical than that in 5121-5122.

**5161f-5162w-5163s. APPLIED STATISTICAL METHODS.** (4 cr per qtr, §5201, §5301, §5302, §5421; prereq ¶5131, admission to grad study in statistics 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 5021 or 5121 or 3091 or #)

Simple random, systematic, stratified, and unequal probability sampling. Ratio and regression estimation. Multistage and cluster sampling.

**5211. THEORY OF SAMPLE SURVEYS.** (4 cr; prereq 5122 or 5133)

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

**5271-5272. BAYESIAN DECISION-MAKING.** (4 cr per qtr, §Econ 5271-5272; prereq ¶5122 or ¶5132 for 5271; Econ 1002, Stat 5122 or 5132 for 5272; 5271 recommended for 5272)

5271: Axioms for personal probability and utility. Elements of statistical decision theory. Bayesian analysis of linear models. 5272: Expected utility models for economic decisions made under conditions of uncertainty. Application to portfolio selection, forward and futures trading, betting, contingency markets, and business planning.

**5301f,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,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.

**5401s. INTRODUCTION TO MULTIVARIATE METHODS.** (4 cr; prereq 5302 or 5133)

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, and profile analysis.

## Course Descriptions

### **5421. ANALYSIS OF CATEGORICAL DATA.**

(4 cr, \$5162; prereq 5301 or 5302 or 5133 or #)  
Varieties of categorical data, cross-classifications and contingency tables, tests for independence. Multidimensional tables and log-linear models, maximum-likelihood estimation, and tests of goodness of fit. Analysis of Markov chain data. Smoothing counts.

### **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*

### **1120. COMPARATIVE VERTEBRATE MORPHOLOGY.** (6 cr; not open to vet med students; prereq Biol 1106 or #)

Comprehensive treatment of morphology, embryogenesis, and phylogeny of vertebrate organ systems; emphasis on structure-function relationships. Lectures complemented by extensive individual student dissections of various organ systems of representative animals from each major vertebrate class, including lamprey, shark, perch (Fishes); mudpuppy, frog (Amphibia); turtle (Reptilia); pigeon (Aves); dog (Mammalia).

### **5120. COMPARATIVE VERTEBRATE MORPHOLOGY.**

Same as VB 1120.

### **5140. VERTEBRATE MICROANATOMY.** (1-6 cr; prereq 5120 or #)

The microscopic structure and cytochemical and functional aspects of cells, tissues, and organs of representative examples of vertebrates. Four units: basic tissues (2 cr); gastrointestinal tract (1 cr); respiratory and integumentary systems (1 cr); 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 physiology or equiv, #; offered even yrs) Physiology of wild and domestic birds.

### **5330. WILD BIRD MEDICINE.** (2 cr; prereq vet med [3rd or 4th yr] or grad or #)

Brief summary of important aspects of avian anatomy and physiology. Survey of diseases common to wild birds and surgical repair of common injuries and fractures.

## Veterinary Medicine, College of (CVM)

*Offered by the College of Veterinary Medicine*

### **1100. ORIENTATION TO VETERINARY MEDICINE.** (1 cr)

History of the veterinary profession, careers within the profession, and employment trends. Resources available to those interested in a career in the profession, including the College of Veterinary Medicine and the animal health technology courses offered in Minnesota.

### **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; not open to vet med students; prereq 10 cr chemistry, 4 cr biological sciences)

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.

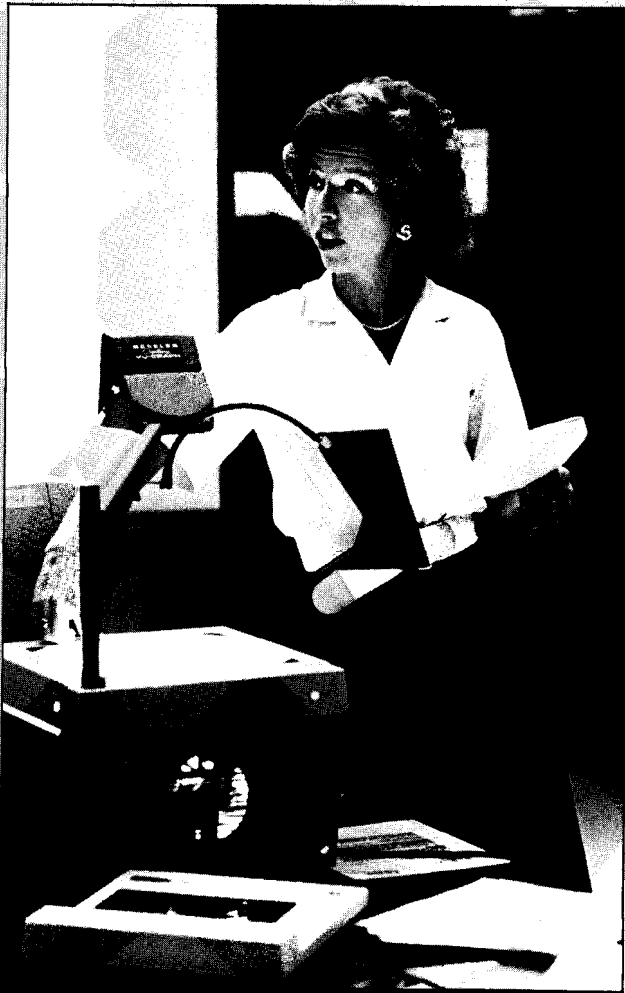
### **5603. PARASITES OF WILDLIFE.** (2 cr; prereq 5601, 5602 or #; offered alt odd yrs)

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; not open to vet med students; prereq Biol 1106, AnSc 1100, VPB 3103 or equiv)

General anatomy; physiology of digestion and reproduction; prevention and control of the more important diseases affecting poultry.

# Administration and Faculty



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# Administration and Faculty

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## *University Regents*

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Wendell R. Anderson, Wayzata  
M. Elizabeth Craig, Minnetonka  
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Jean B. Keffeler, Minneapolis  
Alan C. Page, Minneapolis  
Mary J. Page, Olivia  
David K. Roe, Minneapolis  
Darrin M. Roshka, Owatonna  
Stanley D. Sahlstrom, Crookston  
Mary T. Schertler, St. Paul

## *University Administrators*

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Leonard V. Kuhl, Senior Vice President for  
Academic Affairs and Provost  
William P. Donohue, Acting Vice President  
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Cherie R. Perlmutter, Acting Vice President  
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## *College of Agriculture Administrators*

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Laurie S. Hayes, Acting Assistant Dean, Academic  
and Student Affairs  
Delane E. Welsch, Assistant Dean, International  
Agricultural Programs  
Coordinator, Administrative and Student Affairs  
Jean Underwood, Coordinator, Career Services  
Mark Hill, Coordinator, Prospective Student Services

## *College of Agriculture Faculty*

### **Agricultural and Applied Economics**

*Professor Emeritus*  
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Willard W. Cochrane, Ph.D.  
Kenneth Egertson, M.S.  
Selmer A. Engene, Ph.D.  
Paul R. Hasbargen, Ph.D.  
\*John D. Helmsberger, Ph.D.  
Clifford G. Hildreth, Ph.D.  
John S. Hoyt, Ph.D.

Harald R. Jensen, Ph.D.  
Lee R. Martin, Ph.D.  
Philip M. Raup, Ph.D.  
Gordon D. Rose, Ph.D.  
Frank J. Smith, Ph.D.  
Robert W. Snyder, Ph.D.

*Regents Professor*  
Vernon W. Ruttan, Ph.D.

*Professor*  
Michael Boehlje, Ph.D., *head*  
Dale C. Dahl, Ph.D.  
Reynold P. Dahl, Ph.D.  
K. William Easter, Ph.D.  
Vernon R. Eidman, Ph.D.  
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Jean Kinsey, Ph.D.  
Wilbur R. Maki, Ph.D.  
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Terry L. Roe, Ph.D.  
G. Edward Schuh, Ph.D.  
Benjamin H. Senauer, Ph.D.  
Thomas F. Stinson, Ph.D.  
Wesley B. Sundquist, Ph.D.  
Kenneth H. Thomas, Ph.D.  
John J. Waelti, Ph.D.  
Arley D. Waldo, Ph.D.  
Delane E. Welsch, Ph.D.

*Associate Professor*  
Jeffrey D. Apland, Ph.D.  
Bud Crewdson, M.S.  
Jeremiah E. Fruin, Ph.D.  
Richard A. Levins, Ph.D.  
Glenn D. Pederson, Ph.D.  
C. Ford Runge, Ph.D.  
Harald von Witzke, Ph.D.  
Carole B. Yoho, M.S.

*Assistant Professor*  
Karen M. Brooks, Ph.D.  
Theodore Graham-Tomasi, Ph.D.  
William F. Lazarus, Ph.D.  
John Lawrence, Ph.D.  
Scott Loveridge, Ph.D.  
Kent Olson, Ph.D.  
Claudia Parliament, Ph.D.  
JoAnn Paulson, Ph.D.  
Stanley Stevens, Ph.D.  
Steven Taff, Ph.D.  
Yacov Tsur, Ph.D.

### **Agricultural Education**

*Professor Emeritus*  
R. Paul Marvin, Ph.D.

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*\*\*Kraft General Foods Chair in Food Science*

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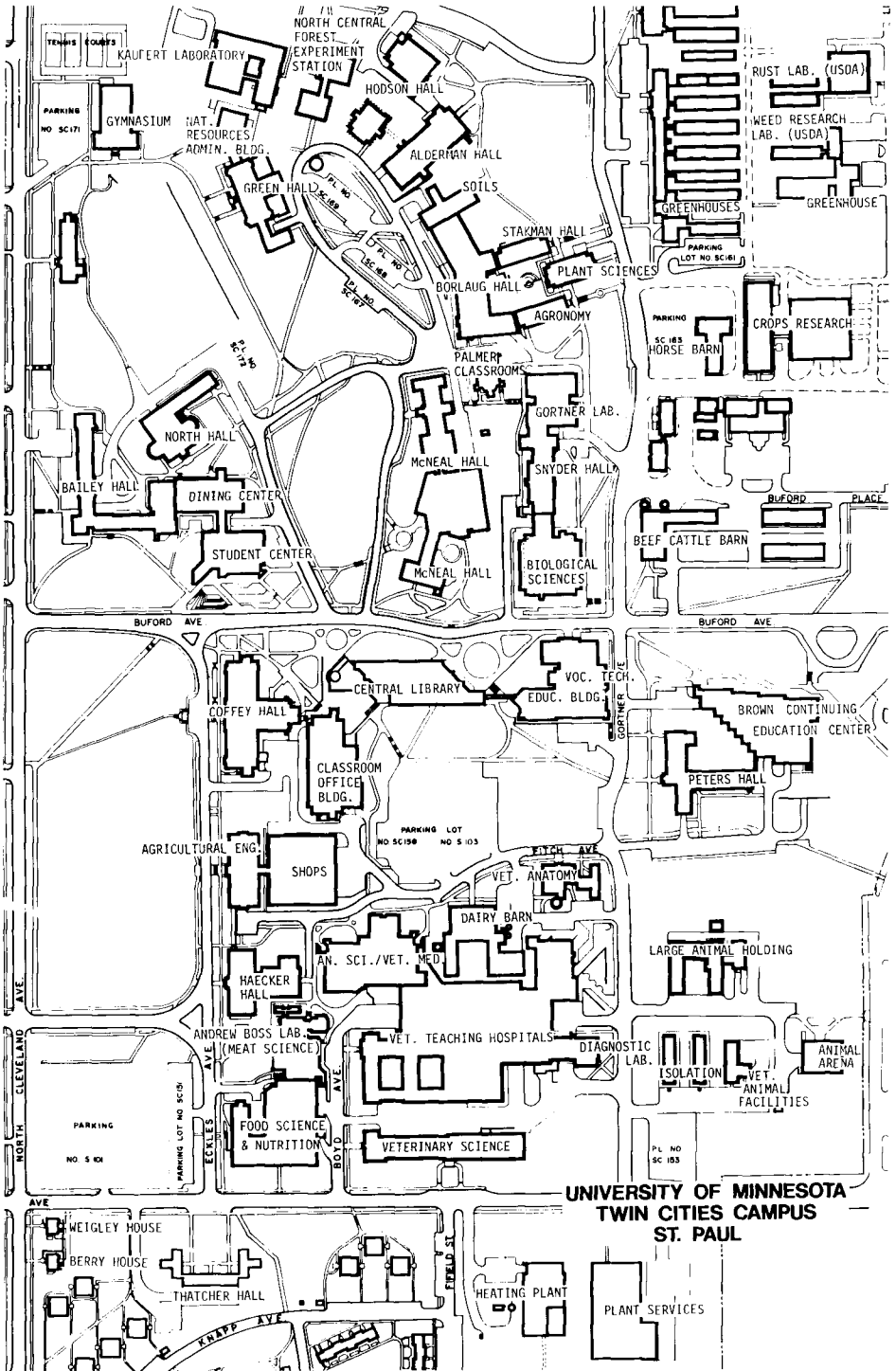
Michael J. Sadowsky, Ph.D.

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

# BUILDING ABBREVIATIONS AND BUILDING ACCESSIBILITY INFORMATION

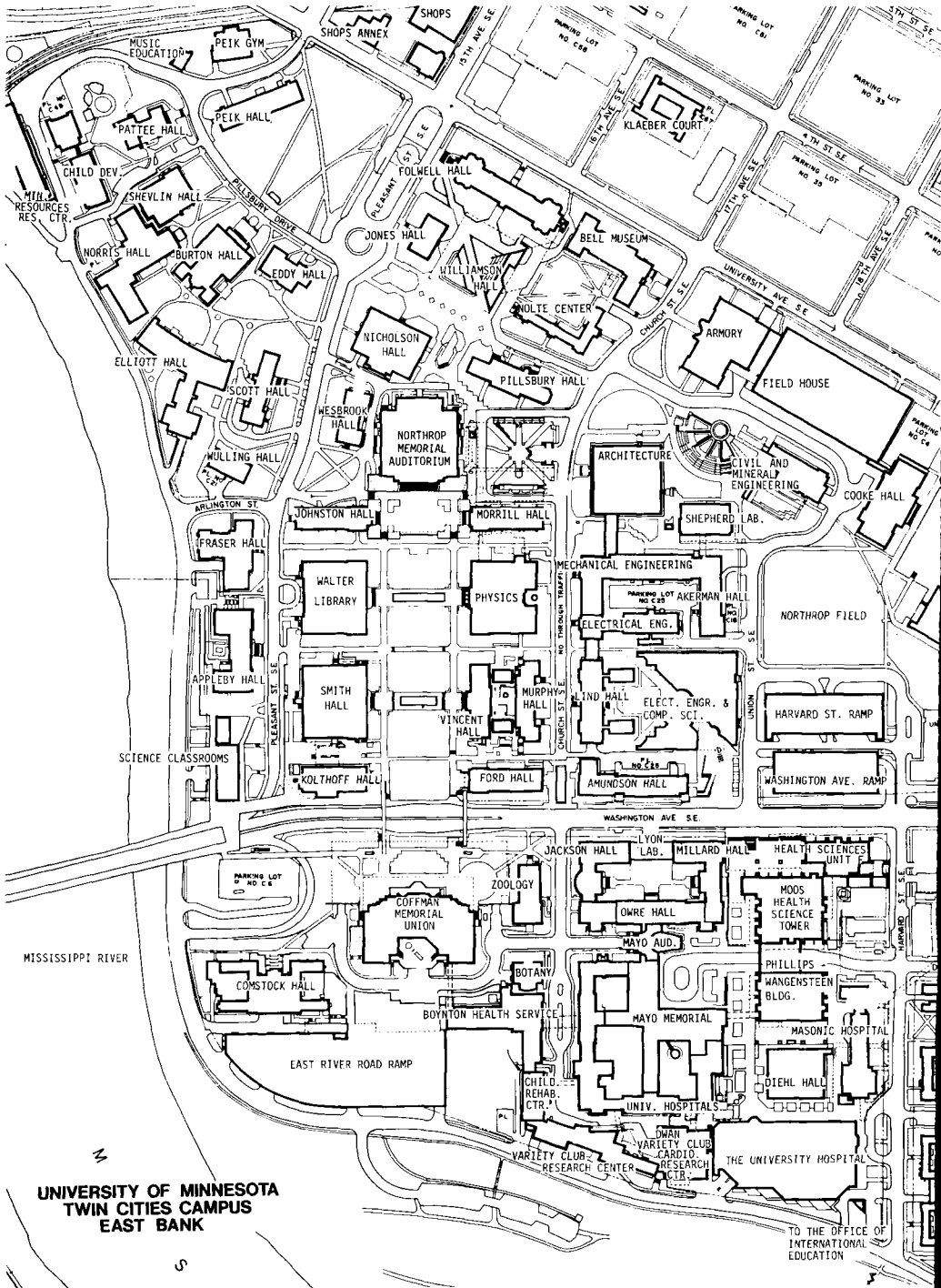
## ST PAUL

- ABLMS, Andrew Boss Laboratory-Meat Science ⌚\*  
 AgEng, Agricultural Engineering ☐\*  
 AgEngShop, Agriculture Engineering Shop ⌚  
 Agr, Agronomy ■  
 AgGhCl, Agronomy Greenhouse Classroom ⌚  
 AgrPGGh, Agronomy/Plant Genetics Greenhouse  
 AlderH, Alderman Hall ⌚\*  
 AnAren, Animal Arena  
 AnScVM, Animal Science, Veterinary Medicine ☐\*  
 BCB, Beef Cattle Barn ⌚  
 Berry, Berry House (1304 Cleveland Ave N) ☐  
 BioSci, Biological Sciences Center ☐\*  
 BorH, Borlaug Hall ⌚\* L  
 CentLib, St. Paul Campus Central Library ⌚\*  
 ClaOff, Classroom Office Bldg ⌚\*  
 CoffH, Coffey Hall ⌚\*  
 DinC, Dining Center ⌚\*  
 EBCEC, Earle Brown Continuing Education Center ⌚\* L  
 FScN, Food Science and Nutrition ⌚\*  
 GorL, Gortner Laboratory of Biochemistry ⌚\*  
 GrnH, Green Hall ⌚\* L  
 Gym, Gymnasium ■  
 HckrH, Haecker Hall ☐  
 HodsonH, Hodson Hall ⌚\*  
 KaufL, Kaufert Laboratory ⌚\*  
 McNH, McNeal Hall ⌚\* L  
 NatResAd, Natural Resources Administration Building ⌚\* L  
 NorH, North Hall ■  
 PalmC, Palmer Classroom Building ☐  
 PetH, Peters Hall ☐  
 PISci, Plant Sciences ■  
 SnH, Snyder Hall  
 Soils ⌚\*  
 StakH, Stakman Hall of Plant Pathology ■  
 StCen, Student Center ⌚\* L  
 VetA, Veterinary Anatomy ☐  
 VetDL, Veterinary Diagnostic Laboratories ■  
 VetS, Veterinary Science ■  
 VetTchHos, Veterinary Teaching Hospitals ☐  
 VoTech, Vocational-Technical Education ⌚\* L  
 Weigley, Weigley House (1316 Cleveland Ave N)

### CODES:

- ⌚ = accessible building
- ☐ = partially accessible
- = inaccessible building
- \* = elevator
- L = adapted restroom

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**UNIVERSITY OF MINNESOTA  
TWIN CITIES CAMPUS  
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TO THE OFFICE OF  
INTERNATIONAL  
EDUCATION

# BUILDING ABBREVIATIONS AND BUILDING ACCESSIBILITY INFORMATION

## MINNEAPOLIS

### East Bank

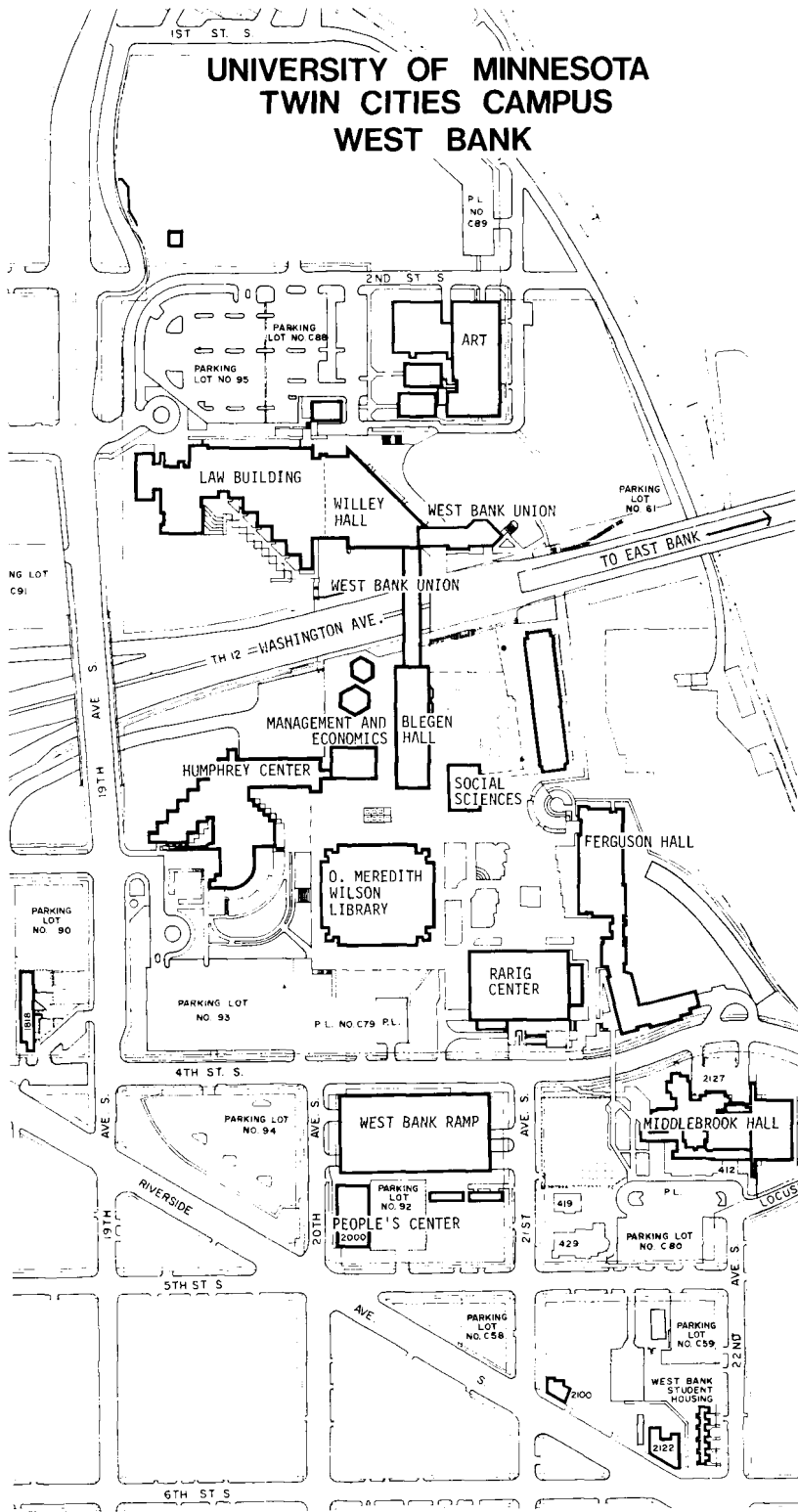
- AkerH, Akerman Hall ☐  
 AmundH, Amundson Hall ☐ \* L  
 ApH, Appleby Hall ■ \*  
 Arch, Architecture ☐ \* L  
 Armory ☐  
 BellMus, Museum of Natural History ☐ \* L  
 BFAB, Bierman Field Athletic Building ☐ \* L  
 Botany ☐  
 BoynHS, Boynton Health Service ☐ \* L  
 BuH, Burton Hall ☐ \* L  
 CenH, Centennial Hall  
 ChDev, Child Development ☐ \*  
 ChRC, Children's Rehabilitation Center ☐ \*  
 L  
 CivMinE, Civil and Mineral Engineering ☐ \*  
 L  
 CMU Coffman Memorial Union ☐ \* L  
 ComH, Comstock Hall ☐  
 CookeH, Cooke Hall ■  
 DiehlH, Diehl Hall ☐ \*  
 DVCCRC, Dwan Variety Club  
 Cardiovascular  
 Research Center ☐ \* L  
 EddyH, Eddy Hall ■  
 EdHAn, Eddy Hall Annex  
 EE/CSsci, Electrical Engineering/Computer  
 Science Building ☐ \* L  
 ElectE, Electrical Engineering ☐  
 EltH, Elliott Hall ☐ \* L  
 FieldHse, University Field House  
 FolH, Folwell Hall ☐ \* L  
 FordH, Ford Hall ☐ \* L  
 FraserH, Fraser Hall ☐  
 FronH, Frontier Hall ☐ \*  
 HL, St. Anthony Falls Hydraulic Laboratory  
 (Hennepin Island)  
 HSUnitF, Health Sciences Unit F ☐ \* L  
 Jach, Jackson Hall ☐ \*  
 JOAd, Jackson-Owre Addition ☐ \*  
 JohH, Johnston Hall ☐ \* L  
 JonesH, Jones Hall ■  
 KlaCt, Klaeber Court ☐  
 KoltH, Kolthoff Hall ☐ \* L  
 LindH, Lind Hall ☐ \* L  
 LyonL, Lyon Laboratories  
 Mayo, Mayo Memorial ☐ \* L  
 MechE, Mechanical Engineering ☐ \* L  
 MirdH, Millard Hall ☐ \*  
 MMA, Mayo Memorial Auditorium ☐  
 MoosT, Moos Health Sciences Tower ☐ \* L  
 MorH, Morrill Hall ☐ \* L  
 MRRC, Mineral Resources Research  
 Center ■  
 MurH, Murphy Hall ■  
 MusEd, Music Education ■  
 NichH, Nicholson Hall ☐ \* L  
 NMA, Northrop Memorial Auditorium ☐ \* L  
 NorrisH, Norris Hall ☐ L  
 OwreH, Owre Hall ☐ \* L  
 PeikG, Peik Gym ☐  
 PeikH, Peik Hall ☐ \*  
 Phys, Tate Laboratory of Physics ☐ \*  
 PiH, Pioneer Hall ☐  
 PillsH, Pillsbury Hall ☐  
 PtH, Pattee ☐ \*  
 PWB, Phillips Wangensteen Building ☐ \* L  
 SaH, Sanford Hall ■  
 SciCB, Science Classroom Building ☐ \*  
 ScottH, Scott Hall ■  
 ShepLab, Shepherd Laboratories ☐ \*  
 ShevH, Shevlin Hall ☐  
 SmithH, Smith Hall ☐ \*  
 Stad, Stadium ☐ L  
 TerH, Territorial Hall ■  
 UHosp, University Hospital ☐ \* L  
 VinH, Vincent Hall ☐ \*  
 WaLib, Walter Library ☐ \* L  
 WesH, Westbrook Hall ■  
 WmsA, Williams Arena ☐ L  
 WmsonH, Williamson Hall ☐ \* L  
 WullH, Wulling Hall ☐ \*  
 Zoology ☐ \* L

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## MINNEAPOLIS

### West Bank

AndH, Anderson Hall Ⓐ\*

ArtB, Art Building (2020 Washington Ave S)



BlegH, Blegen Hall Ⓐ\* L

FergH, Ferguson Hall Ⓐ\* L

HHH Ctr, Humphrey Center Ⓐ\* L

Law, Law Building Ⓐ\* L

MdbH, Middlebrook Hall Ⓐ\* L

Mgmt/Econ, Management/Economics  
Building Ⓐ\*

OMWL, O Meredith Wilson Library Ⓐ\* L

PeoCtr, People's Center (2000 5th Street)

RarigC, Rarig Center Ⓐ\* L

SocSci, Social Sciences Building Ⓐ\*

WBU, West Bank Union ⒶL

WilleyH, Willey Hall Ⓐ\* L

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Ⓐ = accessible building

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For a map, *Guide for the Handicapped*, and further information, contact Physical Planning at 624-5765 or Office for Students with Disabilities at 624-4037.



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# Notes

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