

University of Minnesota

**71
72**

Bulletin

OCTOBER 19, 1971

**environmentally related
courses and programs**



HOW TO USE THIS BULLETIN

Contents

SECTION I gives the user a brief overview of the bulletin and a description of the way in which it was prepared.

SECTION II lists the departments or schools that have environmental programs or options and describes special study programs; lists campus groups and centers dealing with environmental work, and briefly describes campus and other local libraries having environmental collections.

SECTION III lists courses at the University that are environmentally related according to a subject classification system.

SECTION IV contains a listing, by department, of faculty members who formally or informally advise students interested in environmental studies, degree programs of environmental relevance, and descriptions of individual courses.

Course Numbering

1-001 to 1-998—open to freshmen and sophomores

3-001 to 3-998—open to juniors and seniors

5-001 to 5-998—open to juniors, seniors, and graduate students

8-001 to 8-998—open to graduate students only

A final digit "0" identifies courses which may be repeated. The number "970" indicates "directed study."

Abbreviations and Symbols

Departmental prefix—3 or 4 letter abbreviated prefix indicating name of department (e.g., Geog for Geography)

Course number—4 digits denoting the course; course number remains the same no matter which quarter offered

Number of credits—listed for each quarter of course in same order as course number(s)

†—all courses before dagger must be completed before credit is given for any quarter

§—no credit given if credit has already been granted for course preceded by this symbol

¶—concurrent registration allowed with course listed after this symbol

#—consent of instructor is required for registration

△—consent of department or school offering the course is required for registration

Class scheduling—students should consult the *Class Schedule* for each quarter to learn the hour and place of specific courses

Please send any comments on this bulletin or suggestions for improving it to:

All-University Council on Environmental Quality
288 Jackson Hall
University of Minnesota
Minneapolis, Minnesota 55455

UNIVERSITY OF MINNESOTA

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Ralph Hopp, Director, Libraries, 499 Wilson Library (West Bank)
John Q. Imholte, Provost, University of Minnesota, Morris
Frank H. Kaufert, Dean, College of Forestry, 110 Green Hall (StP)
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Keith N. McFarland, Acting Dean, College of Home Economics, 200 McNeal Hall (StP)
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Harold Miller, Acting Dean, University Extension, 150 Westbrook Hall
Marshall W. Ryman, Director, Intercollegiate Athletics, 111 Cooke Hall
Stanley Sahlstrom, Provost, University of Minnesota Technical College, Crookston
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Lawrence C. Weaver, Dean, College of Pharmacy, 115 Appleby Hall
James Wernitz, Acting Dean, University College, 317 Walter Library
John Westerman, Director, University Hospitals, B-313 Mayo Memorial Building
William Wright, Associate to the Vice President, Academic Administration for International Programs, 1214 Social Sciences Building
E. W. Ziebarth, Dean, College of Liberal Arts, 215 Johnston Hall

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UNIVERSITY OF MINNESOTA BULLETIN

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The contents of this bulletin and of other University bulletins, publications, or announcements are subject to change without notice.

This bulletin was prepared by the Center for Studies of the Physical Environment (Institute of Technology) and the Center for Urban and Regional Affairs for the All-University Council on Environmental Quality. It differs from other University of Minnesota Bulletins in that rather than being organized along administrative lines, it describes programs and courses relating to environmental studies in the various schools, centers, and departments at the Minneapolis and Saint Paul campuses of the University, and at the Itasca, Cloquet, and Cedar Creek field stations. It will be apparent to the user that this is a first edition and also that many arbitrary decisions have been made regarding the content and organization of the bulletin. Comments are solicited in the effort to improve the bulletin; it is anticipated that a second edition will be prepared during summer 1972.

The preparation and publication of this bulletin was made possible by a grant from the University of Minnesota Center for Curriculum Studies.

ENVIRONMENTALLY RELATED COURSES AND PROGRAMS

I. INTRODUCTION AND GENERAL INFORMATION

Environment is, literally, everything. It is an exceedingly complex and plastic whole which includes both everything known and everything unknown to man. Man has realized that he is but part of this larger whole, and that a complex system of mutual influence operates between the various parts of the total environment. These influences range in degree from the trivial to the profound. Man's increasing ability to effect rapid and large-scale change through his use of other environmental components has led many people to believe that it is imprudent and arrogant, if not dangerous, to exclude anything from the concept of environment.

In his attempt to understand what he perceives, man has divided the single environmental whole into increasingly smaller parts. This reductionist approach has fostered a high degree of specialization among scientists whose respective disciplines channel them into the study of tiny environmental components. None of these parts exist in an isolated state; their relationship to, and interaction with, other parts of the environment can be no less important to their definition than the ascertainment of unique characteristics. Undoubtedly, both kinds of study are necessary and important. It would appear, however, that the study of the interaction of environmental components has been neglected, though not ignored, in favor of the study of isolated parts.

It is the purpose of this bulletin to make available to the student a list of courses and programs that relate to the study of the environment, its problems, and its protection. In the broadest sense, the definition above would suggest that all courses and programs at the University of Minnesota should be included in a bulletin of environmental courses and programs. Necessarily, a somewhat narrower view was taken here.

It is the intent of this bulletin to provide information which will give students the opportunity to interact with as many existing courses and programs as suit their educational objectives. Also described are procedures by which students may design courses and programs for themselves.

In selecting courses, students should realize that course content may not be entirely or directly related to environmental concerns. It is possible, however, that a course which seems to be unrelated may provide a basis for courses more directly involved. In the case of some courses, whose title and description indicate content concerned with the environment, individual instructors may orient their material away from environmental aspects. In this latter case, students are urged to persuade the instructor of the importance of considering these aspects.

Introduction/General Information

Students and other users of the bulletin should be aware of the fact that while course prerequisites and program requirements are listed, some of these prerequisites and requirements are not described here. When this occurs, the appropriate college or school bulletin will have to be consulted.

Human Rights

The Board of Regents has committed itself and the University of Minnesota to the policy that there shall be no discrimination in the treatment of persons because of race, creed, color, sex, or national origin. This is a guiding policy in the admission of students in all colleges and in their academic pursuits. It is also to be a governing principle in University-owned and University-approved housing, in food services, student unions, extra-curricular activities, and all other student and staff services. This policy must also be adhered to in the employment of students either by the University or by outsiders through the University and in the employment of faculty and civil service staff.

II. PROGRAMS, SPECIAL CENTERS AND SERVICES, LIBRARIES

In addition to informing the student about environmental courses offered by the University, it is the intent of this bulletin to guide students who wish to devote much of their work to environmental concerns.

Some departments have already set up programs or program options, some are developing programs, and others simply have none at all. Students should also be aware that opportunities exist whereby they may design their own courses and programs.

This section of the bulletin lists the departmental programs or program options offered in the various colleges or institutes of the University (detailed information about these programs may be found in the next section), and the available mechanisms for students who may wish to design their own programs.

Also in this section are listed some of the University Centers which have programs related to environmental studies. Although centers do not usually offer courses, they are frequently engaged in research and other projects with which interested students, faculty and others might be involved, and in some cases the student may obtain credit for work done.

Finally, some of the information sources and libraries near the University are briefly described.

Programs

Institute of Agriculture

DEGREE PROGRAMS

Agricultural Engineering
Entomology, Fisheries and Wildlife
 Fisheries
 Wildlife
Forestry
Horticultural Science
 Landscape Architecture
Resource and Community Development
 Landscape Architecture
 Recreation Resource Management
 Resource Economics
 Soil and Water Resource Management
Soil Science

The Institute of Agriculture also offers the opportunity to design individual programs under the Resource and Community Development program and other selected majors. For more information contact D. B. White, 280 Coffey Hall, 373-0921.

Programs

College of Biological Sciences

DEGREE PROGRAMS

Biology
Botany
Ecology and Behavioral Biology

COURSE OPTIONS

Independent Study—The student can find opportunities for independent study in courses from a number of departments. A more formal and a more expanded program of independent study, however, is currently under discussion in the college. Any interested students can obtain more details from the college office.

College of Education

COURSE OPTIONS

The College of Education offers limited opportunity for students to prepare to teach in environmentally related courses and programs. Portions of methods courses and workshops in biological education, social studies education, and elementary education are devoted to certain aspects of environmental studies. Further details can be obtained from the appropriate contact people: Roger Johnson, 242 Burton Hall, 373-5793, for the Department of Elementary Education; and Eugene Gennaro (Science Education), 370 Peik Hall, 373-3305, and James Mackey (Social Studies Education), 166 Peik Hall, 373-9721, in the Department of Secondary Education.

General College

COURSE OPTIONS

Package Study in Environmental Control

General Extension Division

COURSE OPTIONS

Evening and Special Classes—There is always the possibility that special classes (either credit or non-credit) and certain conferences and institutes on the subject of ecology may be developed and/or activated during the coming year, but are not, as yet, included in the present listings. To learn of such possibilities, please contact Miss Sinniger, 373-0115.

The Health Sciences

DEGREE PROGRAMS

Environmental Health
Air Pollution
Environmental Biology
Injury Control
Institutional Environmental Health
Occupational Health
Radiological Health
Water Hygiene

College of Liberal Arts

DEGREE PROGRAMS

Geography

Physical Environment Studies

Interdepartmental Major in Urban Studies—Students may graduate with an interdepartmental major in Urban Studies by completing course offerings in a number of departments focusing on the city as the central problem area of intellectual concern. This major can be useful to the student seeking either a base for post-baccalaureate work in planning, or one of the disciplines concerned with the city, or as a generalizing intellectual experience.

The major program consists of at least 75 upper division credits, including at least 36 from the list of urban studies core courses. These courses include:

- Econ 5-661 Economics of Location
- Geog 5-371 Urban Geography
- Geog 5-375/5-376 American Cities: Location and Geographic Design
- Geog 5-732 American Cities: Field Course
- Hist 5-354/5-355/5-356 American Urban History
- Pol 5-316 Introduction to Community Politics
- Pol 5-317 Community Power Structure
- Pol 5-318 Metropolitan Government and Politics
- Soc 5-601 Urban Sociology
- SSci 3-503 Urban Crisis

Consult one of the following advisers for information concerning this major: Theodore Anderson, Sociology; Hyman Berman, History, Social Science; John R. Borchert, Geography; Gene Burd, Journalism; David Cooperman, Sociology; Daniel Gerlaugh, Civil Engineering (Urban Transportation); Hosni Iskander, Architecture (Urban Planning); John Modell, History; Herbert Mohring, Economics; Thomas Scott, Political Science.

Office for Special Learning Opportunities—The curriculum in the College of Liberal Arts is as broad as the interests and competence of the faculty. The range of possibilities places particular burdens on students in the development of special projects and the identification of appropriate ways in which they can be accomplished for credit. It also places before a student a great range of opportunity for the design of a unique academic program, i.e., an interdepartmental major.

The purpose of the Office for Special Learning Opportunities (OSLO) is to help solve these problems and to bring the students and an appropriately individualized curriculum together in an effective way. A student who seeks to develop a major around a particular topic or problem may discuss plans with an adviser in OSLO.

A student who is planning a directed study project may do so with the assistance of an instructor of his choice. In a sense he develops a unique course, in an area in which there is faculty interest but no regular offering. A student who needs assistance in making plans for such a project may contact an adviser in OSLO. Such projects always require the instructor's and the department's approval.

General information about the range of independent study available to students can be picked up in college offices. The OSLO office is located in 105 Johnston Hall, 373-7550.

Programs

COURSE OPTIONS

Independent Study

Y Registration—With instructor and departmental permission, a student may include as part of his regular registration a course which he plans to study on his own, without class attendance. He takes such examinations and submits such work as the instructor requires, but ordinarily has little or no contact with the instructor. The usual registration procedures—fee, deadlines, grades, etc.—apply. His transcript shows the course number plus the suffix Y.

Directed Study and Directed Research—Most departments offer courses designated "Directed Study" (usually numbered 970); some also offer directed research (990): With instructor and department approval, a student may design and complete for credit a study project (1-5 credits; in some departments, to 15 credits) relevant to the discipline and not covered in a regular course. The student works largely on his own, with general assistance and supervision of the instructor. Credit assignments are difficult to determine, but the general guideline is three hours of student work per week over the quarter for each credit. Regular registration procedures and the usual student evaluation methods apply to such study.

Office for Special Learning Opportunities—OSLO offers assistance to students in planning directed study projects and is discussed above in the DEGREE PROGRAMS section.

Institute of Technology

DEGREE PROGRAMS

Aerospace Engineering and Mechanics

Technical Option in Environmental and Biological Systems

Agricultural Engineering

Architecture and Landscape Architecture

Bachelor of Architecture

Master of Architecture

Bachelor of Environmental Design

Bachelor of Landscape Architecture

Chemical Engineering and Materials Science

Eco-Chemical Engineering

Civil and Mineral Engineering

Environmental Engineering

Mechanical Engineering

Environmental Engineering Coherent Program

Engineering Intern Program—Intern programs providing practical work experience in conjunction with regular classes and laboratory work are available in agricultural, civil and mineral, and mechanical engineering. These begin in the third year through cooperation with industrial concerns. During part of their collegiate programs, students in the intern curricula are on a 12-month schedule and spend alternate quarters in industry. While on the work assignments students are paid at regular rates by the company. For information on these programs contact Richard Goldstein, 240 Mechanical Engineering, 373-3042.

COURSE OPTIONS

Environmental Intern Program—The Center for Studies of the Physical Environment is developing an environmental intern program for undergraduate students to work with state and local agencies. These might include, but would not be limited to, the Minnesota Pollution Control Agency, the Department of Natural Resources, the Department of Agriculture, the Highway Department, the Metropolitan Council, the State Planning Agency or the Department of Economic Development. This program will involve employment of a student for as little as but not less than a full academic quarter. The student will receive full academic credit and no salary. For more information contact Dean E. Abrahamson, 243 Space Science Center, 373-4849.

University College

DEGREE PROGRAMS

Urban Studies Program

Intercollegiate Degree Program—In an educational institution such as the University of Minnesota there are always some students who have educational objectives not readily satisfied by the orthodox colleges and schools. University College was established to provide an option for such students.

In many respects University College is not a college. It is essentially a mechanism whereby the student with unique objectives may follow a college program "tailor made" for him.

The intercollegiate degree program has no separate teaching staff nor instructional facilities. It utilizes the time of staff members in all colleges and schools.

The college has no prescribed curriculum, no specific requirements regarding a field of concentration, no fixed number of credit hours on a given subject. Individual departments or colleges may have prerequisite or core course requirements in given fields of concentration. Courses taken by students may be selected from any of the other colleges and schools if such courses are appropriate to the student's objective and he is eligible to take them. The University College student must satisfy the prerequisite and admission policies that apply for any student in a given course. It is not possible for the college office to answer, in terms of specific courses, such questions as: "What are the requirements for obtaining a degree through University College?" "What courses or program must I choose to be admitted to University College?" Each student proposes a program designed to fulfill his particular objectives. Application is made at the University College office, 106 Nicholson Hall.

COURSE OPTIONS

Independent Study—University College has made available to students from every undergraduate college in the University of Minnesota an opportunity for off-campus independent study. A student may earn from 3 to 15 credits by registering for independent study projects under UC 3-075. The student designs his own project and consults with an appropriate faculty member who supervises and evaluates the work.

Living-Learning Center—The Center is a service unit of University College designed to assist students, faculty, and community persons, individually or in small groups, to develop and carry out off-campus field study projects. No credits are granted through the Living-Learning Center.

Programs

Other Program Opportunities That Are Not Attached To Particular Academic Units

ENVIRONMENTAL SCIENCE CENTER

See the description of this center in the next part of this section.

METRO-EXECUTIVE INTERN PROGRAM

This is a program developed by the University YMCA. It is an opportunity for students to become involved with management at the various decision making levels. The project gives them a chance to gain training and background in the whole decision making process and concentrates on relating the impact of large institutional actions to environmental and community concerns.

Students register for 15 credits and spend an entire quarter working in a corporate, academic, or government institution. In some cases they do research and in others they analyze and evaluate various aspects of the corporation's activities. The organizations which participated in the first intern program (offered during winter quarter 1971) were International Multifoods, Cargill, Northern States Power Company, Green Giant, Apache, Center for Urban and Regional Affairs, the Hennepin County Administrator's office, Honeywell, the St. Paul Mayor's office, and the Minneapolis City Coordinator's office. The Metro-Intern Program will be offered again during winter quarter 1972.

Students seeking more information about this program should contact Doug Wallace, YMCA-YWCA, 1425 University Ave. S.E., Minneapolis, Minnesota, 373-9700.

MINNESOTA PUBLIC INTEREST RESEARCH GROUP (MPIRG)

See the description of MPIRG ("Educational Goals") in the next part of this section.

STUDENT-ORIGINATED STUDIES PROGRAM OF THE NATIONAL SCIENCE FOUNDATION (SOS)

In establishing a competitive program for the support of student-originated studies, the National Science Foundation is seeking to advance two basic objectives:

- A. to encourage college students to express in productive ways their concern for the environmental well-being of our Nation; and
- B. to provide support for groups of college and university students who can demonstrate their readiness to assume increased responsibility for their own educational development.

To request Foundation support through the Student-Originated Studies Program (SOS), student groups will submit proposals describing the scientific or technological studies they wish to carry out and giving details as to the funds required for that purpose. In almost every academic institution there are faculty members who are familiar with this "proposal process" who can provide information to interested students. There are also officials in the institution's business office who are experienced in estimating the cost of projects. Student groups are free to seek their assistance.

Other Program Opportunities

Guidelines of the Student-Originated Studies Program are being kept as brief and straightforward as possible to encourage diversity and flexibility in the supported projects within the general framework outlined below:

- Each project proposed is to deal with a problem or a set of associated problems related to the *environment*—physical, biological, and/or social.

- The approach to understanding the problem(s) and the search for solution are to be *interdisciplinary* or *multidisciplinary* in nature, hence,

- Each proposed study or set of studies is to be conducted by a *group* of students (a minimum of 5 students, but usually not more than 15)—primarily made up of undergraduates, although some graduate students may be included within each group.

- Projects proposed are to be *student-* originated, *student-*planned, and *student-*directed, and are to be carried out under the leadership of one of the undergraduate students in the group (hereinafter referred to as the *Student Project Director*). In discharging his duties, the Student Project Director may be assisted by a *Steering Committee* chosen from and by the group of participants. The extent to which each group seeks consultation with one or more college faculty members or members of the community at large is a matter for decision by the students, but it is required that there be associated with each group a specifically named *Project Adviser* who is a member of the faculty of the host institution.

- Support of projects will be provided by grants to 4-year colleges and universities which agree to serve as *host* and as *fiscal agent* for the project.

- Projects are to be planned to occupy fully the time of the student investigators for an uninterrupted period of 10-12 weeks. This means that most projects will be conducted during the summer (in this specific case, the summer of 1972) although other times may be possible in those institutions that schedule 10-12 week periods for individual work or independent study during the academic year.

- Proposals for the SOS competition will be received by the Foundation during October 1971. It is unlikely that sufficient funds will be available to consider proposals received after November 1. The awards resulting from this competition will be announced as soon as possible after February 25, 1972. Therefore, projects may be scheduled to operate during any 10-12 week period available to the students for full-time participation between June 1, 1972 and May 31, 1973.

- Each group will be expected to file a final report of its activities and accomplishments, and to be represented at an SOS Symposium in December 1972. For projects completed by October 1, 1972, final reports will be due on or before December 31, 1972.

In Summary, projects are to deal with problems related to the physical, biological, and/or social environment, are to be student-originated and student-managed, and are to be carried out (in most cases, during the summer) by an interdisciplinary or multidisciplinary group under the leadership of a Student Project Director, with consultation provided by a Project Adviser who is a member of the faculty of the host (grantee) institution.

Complete information can be received by sending for: *Student-Originated Studies—Proposal Guide*, NSF Pub. E71-U-5, National Science Foundation, Washington, D.C. 20550.

Special Centers and Services

Special Centers and Services

DEPARTMENT OF CONFERENCES AND INSTITUTES

Nolte Center for Continuing Education
University of Minnesota
Minneapolis, Minnesota 55455
Phone: (612) 373-3151

For people and organizations who need continuing education, the Department of Conferences and Institutes (C&I) with support from the University of Minnesota academic faculty assists groups in developing and presenting continuing education programs.

The Department has a professional staff to assist interested parties in the planning, publicizing, administration and evaluation of continuing education programs.

ENVIRONMENTAL AFFAIRS, INSTITUTE OF AGRICULTURE

Donald B. White
Coordinator of Environmental Affairs
280 Coffey Hall
Institute of Agriculture
University of Minnesota
St. Paul, Minnesota 55101
Phone: (612) 373-0921

The Coordinator of Environmental Affairs, Institute of Agriculture is responsible for coordination, planning and leadership of environmental programs in teaching, research and continuing education in the Institute. Particular attention is given to interdisciplinary programs.

In addition, an Institute of Agriculture Council for Environmental Affairs was established to provide leadership and planning in the area of environmental affairs. The Council functions in an advisory capacity, and as a forum for discussion and sponsorship of environmental programs. Council members represent the three colleges in the Institute.

Membership includes:

College of Agriculture	
Landis Boyd	373-1305
Lloyd Smith	373-1708
John Waelti	373-1604
College of Forestry	
Arnett Mace	373-0840
John Tappeiner	373-0826
College of Home Economics	
R. Owens	373-1549
Lura Morse	373-1542
Agricultural Extension Service	
Lowell Hanson	373-1771

ENVIRONMENTAL HEALTH RESEARCH AND TRAINING CENTER

Director: C. Straub
1108 Mayo
Phone: 373-8122

Special Centers and Services

ENVIRONMENTAL SCIENCE CENTER

Contact: Robert Collins
Environmental Science Center
4800 Glenwood Avenue
Golden Valley, Minnesota 55422
Phone: 544-8971

The Environmental Science Center offers a variety of in-service programs for teachers and the public throughout the metropolitan area. In addition, the Center is very active in curriculum development and scientific research related to the natural environment.

At the present time some of the state colleges offer graduate credit for courses and programs completed at the Center. The University of Minnesota presently does not offer graduate credit but may give undergraduate credit; however, this must be decided by the respective department concerned.

It is the hope and intent of the Center that in-service teachers *and* undergraduates will participate jointly in the services offered in an effort to improve teacher training in environmental education.

LIMNOLOGY RESEARCH CENTER

Director: Herbert Wright
207a Pillsbury Hall
Phone: 373-4508

MINNESOTA PUBLIC INTEREST RESEARCH GROUP (MPIRG)

Campus Office: 225 Coffman Union
Phone: 376-7554

MPIRG is a nonprofit, nonpartisan organization representing the concerns of Minnesota college students and working for constructive social change benefiting all Minnesota citizens.

Areas of MPIRG concern will include consumer protection, resource planning, occupational safety, protection of natural areas and environmental quality, delivery of health care, community housing problems, and similar matters of urgent and long-range concern.

MPIRG has been funded by Minnesota college students through collection of a special fee of one dollar per quarter or three dollars per year. Students have petitioned their college administrations to act as collecting agents in assessing this fee for MPIRG. The MPIRG fee is refundable to students who do not wish to support MPIRG's activities.

MPIRG is directed by a state-wide board of student-elected representatives. The student board of directors holds open meetings at least once a month and sets policy for the organization. The MPIRG student board is responsible for handling all funds received by MPIRG and an independent accounting of MPIRG finances will be annually made and published.

Any enrolled, fee-paying student can seek election to the MPIRG board of directors—at least one representative for each school participating in MPIRG; for the larger schools, one representative for each five thousand students on campus.

The MPIRG student board of directors hires a professional staff consisting of ten to fifteen full-time positions. The professional staff is made up of a balanced team of lawyers, natural and social scientists, and engineers and other experts in applied science.

Special Centers and Services

After careful investigation of selected problem areas, the MPIRG professional staff and student participants work together in coordinated programs that involve publication of research findings and recommendations for public action, active representation before government administrative and regulatory agencies, law reform through legislative action, and, where necessary, legal action through the courts.

Educational Goals: Whether as part of their regular course programs for academic credit, as volunteer participants, or on a part-time basis for minimal pay, students are involved in real-life learning experiences—exploring the possibilities and difficulties of legal social change. Students work with the MPIRG professionals at all levels of MPIRG activity, from initial research, information-gathering, and drafting of reports to representation before public forums and interaction with community groups.

CENTER FOR POPULATION STUDIES

Director: Harry Forman
4208 Powell Hall
Minneapolis Campus
Phone: 373-9656

CENTER FOR STUDIES OF THE PHYSICAL ENVIRONMENT

Director: Dean E. Abrahamson
Center for Studies of the Physical Environment
245 Space Science Center
Institute of Technology
University of Minnesota
Minneapolis, Minnesota 55455
Phone: 373-4849

In creating the Center for Studies of the Physical Environment, the Board of Regents was guided by an Institute of Technology proposal that called for the Center to: (1) act as a forum in which, for example, proposed courses could be discussed; (2) act as a clearinghouse in relation to research and training programs; (3) develop and coordinate a series of seminars on environmental problems; (4) be the logical forum through which interdisciplinary research programs could be developed and coordinated.

The Center is not an academic department and does not offer degrees, although assistance is provided to graduate and undergraduate students who may wish to design a minor or supporting program in environmental studies.

As part of the Center's program of education and communication, it distributes a newsletter, *environ*. More information about the Center for Studies of the Physical Environment and its newsletter may be obtained from the office.

CENTER FOR STUDIES IN TECHNOLOGICAL DEVELOPMENT AND SOCIAL CHANGE

Director: Robert T. Holt
1920 Washington Avenue South
Minneapolis, Minnesota
Phone: 373-5916

CENTER FOR URBAN AND REGIONAL AFFAIRS

Director: John Borchert
Center for Urban and Regional Affairs
311 Walter Library
University of Minnesota
Minneapolis, Minnesota 55455
Phone: 373-7833

The Regents established the Center for Urban and Regional Affairs (CURA) to help make the University more responsive to the needs of the larger community, and to increase the constructive interaction between faculty and students, on the one hand, and those dealing directly with major public problems, on the other hand.

The specific projects of the Center are selected within a half-dozen broad problem areas. These reflect the major lags in the evolution of the American urban system in this generation: housing, human relations, urban transportation, waste management, local government reorganization, and the diffusion of information about these topics. These problems cut across a wide and changing array of disciplines and colleges.

The Center's role is to help to coordinate and stimulate projects in these problem areas. It works through the faculty and students of all academic units of the University. All CURA programs are pilot, experimental, or short-term. The goal is to probe and evaluate, to complete short-term projects, discard unsuccessful ones, and help to build successful ones into the appropriate part of the academic structure. CURA will not develop permanent faculty or research staff, or offer degrees; and it confines itself to projects for which there is currently no other practical administrative home.

The Center also publishes a newsletter, the *CURA Reporter*. Information about both the newsletter and the Center may be obtained from the CURA office.

WATER RESOURCES RESEARCH CENTER

Director: William Walton
107 Hubbard Building
2675 University Avenue
St. Paul, Minnesota 55114
Phone: 646-6309

LIBRARIES

UNIVERSITY LIBRARIES

The University's collection is so enormous, so diverse, and so dispersed that the best approach is through the main card catalog at Wilson Library. For information about the collection, one may call:

Catalog Information Desk 373-9985
Reference Services Department 373-3082

Several of the small University libraries hold environmentally related collections either as part of their permanent collections or as reserve materials for courses or research groups. These include:

Architecture Library (160 Architecture, 373-2203)
Bio-Medical Library (Diehl Hall, 373-2565)
Engineering Library (128 Main Engineering, 373-2957)

Special Centers and Services

Entomology Library (375 Entomology, Fisheries & Wildlife, 373-1741)
Forestry Library (203 Green Hall, 373-1407)
Geology Library (204 Pillsbury, 373-4052)
Mines and Metallurgy Library (132 Chemical Engineering, 373-2313)
Plant Pathology Library (202 Plant Pathology, 373-0852)
Urban Transportation Literature Collection (195 Experimental Engineering, 373-2509)

This list is not represented as being complete; other departmental libraries may have holdings of similar materials.

BULLETIN ROOM, AGRICULTURAL EXTENSION SERVICE

3 Coffey Hall
Institute of Agriculture
University of Minnesota
St. Paul, Minnesota 55101
Phone: 373-1615

The Bulletin Room distributes material for the Agricultural Extension Service, for the most part, but for other arms of the Institute of Agriculture also. An annual list of available materials is available.

ENVIRONMENTAL LIBRARY OF MINNESOTA (ELM)

Basement—Southeast Branch, Minneapolis Public Library
1222-4th St. S.E., Minneapolis, Minnesota 55414
Phone: 331-8025
Hours: Weekdays 1:00 to 10:00 p.m.
Saturday and Sunday 1:00 to 6:00 p.m.

As its name suggests, ELM collects materials on all aspects of the environment with special emphasis on local problems and current issues. The collection was formed through the substantial donations of local groups and individuals with environmental interests. Having no reliable source of funds, ELM depends upon donations of materials and money. The work of maintaining the collection is done by interested volunteers, a group which is composed of students, faculty, and various other community people.

The collection includes a wide variety of materials from government documents, periodicals and newspaper files, to slides and audio tapes.

MINNESOTA DEPARTMENT OF HEALTH LIBRARY

717 S.E. Delaware St.
Minneapolis, Minnesota 55440
Librarian—Mrs. Eleanor C. Lawson
Phone: 378-1150, ext. 240

The collection has been developed with the needs of public health professionals in mind. Consequently it is essentially a technical library with technical, as opposed to popular, literature. It is a reference collection only; it extends no loan privileges. The library subscribes to some 250 periodicals, and the library staff writes a weekly mimeographed subject index of new articles of public health significance.

MINNESOTA POLLUTION CONTROL AGENCY (MPCA)

The MPCA library collection is housed in the Minnesota Department of Health Library and is attended by Mrs. Lawson and her staff.

III. SUBJECT INDEX

This section can be extremely useful; however, its limitations must be acknowledged. On the basis of the course title and description, each course was arbitrarily assigned to one or two subject categories. The accuracy of this designation in each case is unknown. It is hoped that students who take the courses listed here will evaluate them and make recommendations as to the appropriateness of the subject words.

Subjects

- Air
- Animal Science *see Environmental Implications—Animal Science*
- Attitudes *see Culture/Attitudes*
- Behavior
- Biology
- Business *see Environmental Implications—Business*
- Cedar Creek *see Field Stations—Cedar Creek*
- Climatology *see Meteorology/ Climatology*
- Cloquet *see Field Stations—Cloquet*
- Communication
- Community *see Urban/Community*
- Consumer Protection
- Cost-Benefit *see Economics/Cost-Benefit*
- Culture/Attitudes
- Directed Study
- Ecology
- Economics/Cost-Benefit
- Energy
- Environment: Survey Courses
- Environmental Health
- Environmental Implications—
 - Animal Science
 - Business
 - Forest
 - Geography
 - Law
 - Technology
- Evening
- Field Stations—
 - Cedar Creek
 - Cloquet
 - Itasca
- Fisheries
- Food
- Forest *see also Environmental Implications—Forest*
- Genetics/Heredity
- Geography *see Environmental Implications—Geography*
- Geology
- Heredity *see Genetics/Heredity*
- Insects and Insect Control
- Ionizing Radiation *see Radiation (Ionizing)*
- Itasca *see Field Stations—Itasca*
- Landscape Design
- Law *see Environmental Implications—Law*
- Limnology
- Measurement *see Monitoring & Measurement/Sampling*
- Meteorology/Climatology
- Micro-Organisms
- Monitoring & Measurements/
Sampling
- Noise
- Planning
- Plants
- Pollutants & Pollution
- Population
- Public Health *see Environmental Health*
- Public Policy
- Radiation (Ionizing)
- Resources
- Sampling *see Monitoring & Measurements/Sampling*
- Soils
- Solid Waste
- Technology *see Environmental Implications—Technology*
- Transportation
- Urban/Community
- Water
- Wetland
- Wildlife

Subject Index

AIR

- FBio 1-101. Introduction to Air and Water Quality
- ME 5-613/5-614. Principles of Particle Technology
- PubH 5-180. Topics in Air Pollution
- PubH 5-181. Introduction to the Air Pollution Problem
- PubH 5-182. Air Pollution Controls and Surveys
- PubH 5-183. Problems of Air Pollution Control
- PubH 5-184. Air Analysis
- PubH 5-212. Ventilation Control of Environmental Hazards

ANIMAL SCIENCE *see Environmental Implications—Animal Science*

ATTITUDES *see Culture/Attitudes*

BEHAVIOR

- Anth 5-115. Economic Anthropology
- ChEn 5-751/5-752/5-753. Biological Engineering Analysis
- Ecol 5-022. Animal Behavior
- Ecol 5-023. Behavioral Adaptations
- Ecol 5-815. Field Ethology

BIOLOGY

- Biol 1-011. An Introduction to Biology
- GC 1-131. Biological Sciences, Principles
- PubH 5-171. Environmental Microbiology
- PubH 5-177. Environmental Biology
- PubH 5-178. Vectors and Parasites in Human Diseases
- PubH 5-179. Public Health Biology—Field Investigations
- PubH 8-248. Water Quality Investigation and Research Techniques
- PubH 8-249. Water Quality Research

BUSINESS *see Environmental Implications—Business*

CEDAR CREEK *see Field Stations—Cedar Creek*

CLIMATOLOGY *see Meteorology/Climatology*

CLOQUET *see Field Stations—Cloquet*

COMMUNICATION

- Jour 3-021. Mass Communication and the News
- Jour 5-133. Science Communication
- Jour 5-143. Interpretation of Science and Technology
- Jour 5-144. Urban Journalism
- Jour 5-501. Communication and Public Opinion
- Jour 5-721. Mass Media in a Dynamic Society

COMMUNITY *see Urban/Community*

CONSUMER PROTECTION

- PubH 5-213. Public Health Aspects of Toxic Products

COST-BENEFIT *see Economics/Cost-Benefit*

CULTURE/ATTITUDES

- Anth 5-115. Economic Anthropology
- Anth 5-116. Cultural Ecology
- Anth 5-151. Cultural Change and Development
- Anth 5-152. Anthropology of Social Movements
- Geog 3-361. Environmental Evaluation and Adaptation
- Geog 5-811. Environmentalism, Environment, and the Quality of Life

Subject Index

- Hum 1-009. Science and Humanities
- Hum 3-049. Science and Humanities
- SSci 3-101/3-102/3-103. The Meaning of Humanity/Society and Technology/Community
- SSci 3-503. Urban Crisis

DIRECTED STUDY

Directed Study options are available in essentially all departments of the University.

- Arch 3-081/3-082/3-083. Architectural Design I
- Arch 3-091/3-092/3-093. Architectural Design II
- BA 3-999. Independent Study
- Ecol 5-028. Advanced Ecosystem Analysis
- Econ 3-041. Current Issues Workshop
- Econ 5-131. Systems and Program Analysis
- Ent 5-904. Special Problems in Entomology.
- FW 5-396. Special Problems in Vertebrate Ecology
- GC 1-921/1-922/1-923/1-924. Environmental Problems
- LA 3-081/3-082/3-083. Landscape Architectural Design I
- LA 3-091/3-092/3-093. Landscape Architectural Design II
- LA 5-111/5-112/5-113. Landscape Architectural Design
- PubH 5-150. Topics in Environmental Health
- PubH 5-170. Topics in Environmental Biology
- PubH 5-179. Public Health Biology—Field Investigations
- PubH 5-180. Topics in Air Pollution
- PubH 5-183. Problems of Air Pollution Control
- PubH 5-190. Topics in Injury Control
- PubH 5-210. Topics in Occupational Health
- PubH 5-220. Topics in Food Sanitation
- PubH 5-248. Water Quality Investigation and Research Techniques
- PubH 5-249. Water Quality Research
- RCD 5-110. Special Problems in Resource and Community Development
- UC 3-075. Independent Study
- VMic 5-410. Problems in Veterinary Bacteriology and Public Health
- Zool 5-819. Natural History of the Vertebrates

ECOLOGY

- Ecol 3-001. Introduction to Ecology
- Ecol 3-004. Fundamentals of Ecology
- Ecol 3-101. Ecology for Engineers and Physical Scientists
- Ecol 5-014. Ecology of Plant Communities
- Ecol 5-015. Structure and Function of Ecosystems
- Ecol 5-018. Wetland Ecology
- Ecol 5-019. Quaternary Paleocology
- Ecol 5-029. Population Ecology
- Ecol 5-812. Aquatic Ecology
- Ecol 5-814. Community Structure and Function
- Ecol 5-816. Ecology of Freshwater Algae
- Ecol 5-817. Vertebrate Ecology
- Ecol 8-002. Quantitative Aspects of Ecological Systems
- Ent 5-400. Experimental Ecology
- FBio 3-101. Forest Ecology
- FW 5-552. Wildlife Ecology and Management II

Subject Index

GC 1-112. Science in Context: Man and His Environment

Zool 5-170. Physiological Ecology

Zool 5-814. Natural History of Invertebrates

Zool 5-819. Natural History of Vertebrates

ECONOMICS/COST-BENEFIT

AgEc 3-610. Community Resource Development

AgEc 8-264. Resource Economics

Anth 5-115. Economic Anthropology

Econ 1-041. Consumer Economics

Econ 3-041. Current Issues Workshop

Econ 3-131. Welfare Economics

ENERGY

AgEn 3-050. Soil-Plant Relations in Agricultural Engineering

Ecol 1-004. Ecology and Man

ME 5-603. Thermal Environmental Engineering

ME 5-605. Refrigeration

ENVIRONMENT: SURVEY COURSES

Arch & LA 1-001. Environmental Design: Man and Environment

Arch & LA 1-002. Environmental Design: Tools and Processes

Arch & LA 1-003. Environmental Design: Implementation and Evaluation

Arch 3-064/3-065. Environmental Management and Control

Biol 1-011. An Introduction to Biology

Biol 3-041. Ecology

Biol 3-051. Biology and the Future of Man

CE 3-500. Introduction to Environmental Engineering

CE 5-505. Management of the Aquatic Environment

Ecol 1-003. The Final Crisis

Ecol 1-004. Ecology and Man

Ecol 3-001. Introduction to Ecology

Ecol 3-004. Fundamentals of Ecology

Ecol 3-101. Ecology for Engineers and Physical Scientists

FBio 1-101. Introduction to Air and Water Quality

GC 1-112. Science in Context: Man and His Environment

GC 1-921/1-922/1-923/1-924. Environmental Problems

Geo 1-007. Environmental Geology

Geo 1-008. Geology and Man

Geog 1-401. Physical Geography

Geog 3-355. Environmental Alterations

ME 5-612. Environmental Engineering

PubH 3-151. Introduction to Environmental Health

PubH 5-151. Environmental Health

PubH 5-177. Environmental Biology

RCD 1-010. Issues in the Environment

SSci 3-402. Ecology, Technology, and Society

SSci 3-981. Societies of the Future

SSci 5-101. Recognizable Goals and Constraints of a Steady-State Earth

ENVIRONMENTAL HEALTH

AgEn 3-800. Rural Sanitation and Water Supply

ME 5-607. Industrial Ventilation and Contamination Control

PubH 3-151. Introduction to Environmental Health

- PubH 5-150. Topics in Environmental Health
- PubH 5-151. Environmental Health
- PubH 5-170. Topics in Environmental Biology
- PubH 5-171. Environmental Microbiology
- PubH 5-177. Environmental Biology
- PubH 5-181. Introduction to the Air Pollution Problem
- PubH 5-190. Topics in Injury Control
- PubH 5-191. Principles and Methods of Injury Control
- PubH 5-200. Topics in Radiological Health
- PubH 5-201. Measurement and Application of Ionizing Radiation
- PubH 5-202. Environmental Radioactivity
- PubH 5-210. Topics in Occupational Health
- PubH 5-211. Industrial Hygiene Engineering
- PubH 5-213. Public Health Aspects of Toxic Products
- PubH 5-214. Agricultural Occupational Health
- PubH 5-220. Topics in Food Sanitation
- PubH 5-222. Food Sanitation
- PubH 5-241. Environmental Health Aspects of Water Supply
- PubH 5-244. Environmental Aspects of Liquid Waste Disposal
- PubH 8-211. Health Survey of Manufacturing Processes
- VM 3-502. Animal Hygiene
- VMic 5-210. Veterinary Epidemiology
- VMic 5-320. Comparative Medicine and Public Health
- VMic 5-410. Problems in Veterinary Bacteriology and Public Health

ENVIRONMENTAL IMPLICATIONS

Animal Science

- AnSc 1-401. Principles of Animal Nutrition
- AnSc 1-520. Milk Production
- AnSc 5-601. Swine Production
- AnSc 5-603. Beef Cattle Production
- AnSc 5-604. Dairy Farm Management
- AnSc 5-605. Commercial Poultry Production
- Ecol 5-022. Animal Behavior
- Ecol 5-023. Behavioral Adaptations

Business

- Econ 1-041. Consumer Economics
- Econ 3-351. Economics of Science and Technology
- Econ 5-131. Systems and Program Analysis
- IR 3-010. Human Relations in Industry
- Mgmt 3-001. Fundamentals of Management
- Mgmt 3-004. Business Policy: Strategy Formulation and Implementation
- Mgmt 8-010. Corporate Strategy: Design and Implementation
- Mktg 8-820. Seminar: Social and Economic Aspects of Marketing
- PA 8-204. Public Economy

Forest

- FBio 5-100. Silviculture
- FRD 5-210. Multiple Use
- FRD 5-212. Forest Economics
- FRD 5-230. Forest Fire
- FRD 5-234. Forest Protection

Subject Index

Geography

- Geog 1-401. Physical Geography
- Geog 3-101. Geography of the United States and Canada
- Geog 3-111. Geography of Minnesota
- Geog 3-351. North American Research Management

Law

- Law 5-201. Land Use Planning
- Law 5-606. Administrative Law

Technology

- AgEn 5-740. Environmental Control for Agricultural Production
- Arch & LA 1-022. History of Environmental Development: Landscape Architecture
- Arch & LA 1-023. History of Environmental Development: Planning
- Arch 3-081/3-082/3-083. Architectural Design I
- Arch 3-091/3-092/3-093. Architectural Design II
- Arch 5-137. Planning Urban Function and Structure
- Arch 5-138. Planning Theory and Methodology
- CE 3-200. Introduction to Transportation Engineering
- CE 3-500. Introduction to Environmental Engineering
- Hum 1-009. Science and Humanities
- Hum 3-049. Science and Humanities
- LA 3-081/3-082/3-083. Landscape Architectural Design I
- LA 3-091/3-092/3-093. Landscape Architectural Design II
- ME 5-603. Thermal Environmental Engineering
- ME 5-605. Refrigeration
- ME 5-612. Environmental Engineering
- PubH 3-151. Introduction to Environmental Health
- PubH 5-151. Environmental Health
- Soc 3-803. Technology and Science
- Soc 5-301. Social Movement in a Changing Society
- SSci 3-101/3-102/3-103. The Meaning of Humanity/Society and Technology/Community
- SSci 3-981. Societies of the Future
- SSci 5-101. Recognizable Goals and Constraints of a Steady-State Earth

EVENING

- Biol 3-051. Biology and the Future of Man
- Ecol 1-003. The Final Crisis
- Ecol 1-004. Ecology and Man
- Ecol 3-001. Introduction to Ecology
- FSci 1-010. Man's Food
- GC 1-112. Science in Context: Man and His Environment
- Geo 1-007. Environmental Geology
- Geo 1-008. Geology and Man
- Geog 3-361. Environmental Evaluation and Adaptation
- PubH 5-151. Environmental Health
- PubH 5-171. Environmental Microbiology
- PubH 5-181. Introduction to the Air Pollution Problem
- PubH 5-182. Air Pollution Controls and Surveys
- PubH 5-211. Industrial Hygiene Engineering
- PubH 5-241. Environmental Health Aspects of Water Supply

Subject Index

- PubH 5-244. Environmental Aspects of Liquid Waste Disposal
- SSci 3-402. Ecology, Technology and Society

FIELD STATIONS

Cedar Creek

- Ecol 5-017. Ecology Life Histories of Plants
- Ecol 5-028. Advanced Ecosystem Analysis

Cloquet

- FRD 5-210. Multiple Use
- FRD 5-234. Forest Protection

Itasca

- Ecol 5-018. Wetland Ecology
- Ecol 5-019. Quaternary Paleocology
- Ecol 5-026. Environmental Measurement and Analysis III
- Ecol 5-812. Aquatic Ecology
- Ecol 5-813. Advanced Limnology
- Ecol 5-814. Community Structure and Function
- Ecol 5-815. Field Ethology
- Ecol 5-816. Ecology of Freshwater Algae
- Ecol 5-817. Vertebrate Ecology
- Ecol 5-818. Quantitative Ecology
- Ecol 5-819. Soils and the Ecosystem
- Ent 5-020. Field Entomology
- Ent 5-130. Aquatic Entomology
- Ent 5-904. Special Problems in Entomology
- FBio 3-101. Forest Ecology
- FW 5-396. Special Problems in Vertebrate Ecology
- Soil 5-532. Soils and the Ecosystem
- Zool 5-814. Natural History of Invertebrates
- Zool 5-819. Natural History of the Vertebrates

FISHERIES

- FW 3-050/3-051. Principles of Fisheries and Wildlife Management
- FW 5-451. Ecology of Fishery Populations
- FW 5-452. Fishery Management
- FW 5-453. Techniques of Fishery Biology
- FW 8-450. Fisheries Resources of the United States

FOOD

- AgEc 5-790. Seminar: World Food Supply Problems
- AgEn 5-130. Food Engineering I
- AgEn 5-140. Food Engineering II
- FSci 1-010. Man's Food
- FSci 5-120. Food Microbiology
- FSci 5-122. Sanitation and Process Microbiology
- FW 8-450. Fisheries Resources of the United States
- HE 5-381. World Food Supply Problems
- PIPa 5-220. World Food Supply Problems
- PubH 5-220. Topics in Food Sanitation
- PubH 5-222. Food Sanitation
- Soc 5-675. World Food Supply Problems
- VM 5-790. World Food Supply Problems

Subject Index

FOREST *see also Environmental Implications—Forest*

- FBio 3-101. Forest Ecology
- FRD 5-230. Forest Fire
- FRD 5-234. Forest Protection
- FRD 5-237. Forest Meteorology and Hydrology
- FW 3-167. Techniques of Forest Wildlife Management

GENETICS/HEREDITY

- GCB 1-101. Heredity and Human Society
- GCB 3-002. Human Genetics, Social Affairs

GEOLOGY

- Geo 1-001. Physical Geology
- Geo 1-002. Historical Geology

HEREDITY *see Genetics/Heredity*

INSECTS AND INSECT CONTROL

- Ent 1-005. Economic Entomology
- Ent 5-020. Field Entomology
- Ent 5-130. Aquatic Entomology
- Ent 5-250. Principles of Economic Entomology
- Ent 5-400. Experimental Ecology
- PubH 5-178. Vectors and Parasites in Human Diseases

IONIZING RADIATION *see Radiation (Ionizing)*

ITASCA *see Field Stations—Itasca*

LANDSCAPE DESIGN

- LA 1-115/1-116. Theory of Landscape Form and Structure
- LA 5-262. History and Literature of Landscape Architecture
- Hort 1-024. Theory of Landscape Design
- Hort 5-013. Advanced Landscape Design

LAW *see Environmental Implications—Law*

LIMNOLOGY

- Ecol 5-813. Advanced Limnology
- Ecol 5-816. Ecology of Freshwater Algae
- Geo 5-601. Limnology
- PubH 5-177. Environmental Biology
- PubH 5-179. Public Health Biology—Field Investigations
- PubH 8-248. Water Quality Investigation and Research Techniques
- PubH 8-249. Water Quality Research

MEASUREMENT *see Monitoring & Measurements/Sampling*

METEOROLOGY/CLIMATOLOGY

- Ecol 5-024/5-025/5-026. Environmental Measurement and Analysis, I/II/III, respectively
- FRD 5-237. Forest Meteorology and Hydrology
- GC 1-111. Science in Context: Weather and Climate
- Geog 1-425. Introduction to Meteorology
- Geog 5-421. Climatology
- Geog 5-422. Advanced Climatology
- Geog 5-433. Dynamic and Synoptic Climatology
- Soil 1-262. Introduction to Meteorology
- Soil 5-240. Microclimatology (Soils)

MICRO-ORGANISMS

- MicB 5-105. Biology of Microorganisms
- PubH 5-171. Environmental Microbiology
- VMic 5-410. Problems in Veterinary Bacteriology and Public Health

MONITORING AND MEASUREMENTS/SAMPLING

- Ecol 5-024/5-025/5-026. Environmental Measurement and Analysis I/II/III
- Ecol 5-818. Quantitative Ecology
- Ecol 8-002. Quantitative Aspects of Ecological Systems
- FW 5-453. Techniques of Fishery Biology
- PIPh 5-702/5-703. Measurement of Plant-Environment Interactions
- PubH 5-171. Environmental Microbiology
- PubH 5-179. Public Health Biology—Field Investigations
- PubH 5-182. Air Pollution Controls and Survey
- PubH 5-184. Air Analysis
- PubH 5-201. Measurement and Application of Ionizing Radiation
- PubH 5-202. Environmental Radioactivity
- PubH 5-203. Low Level Radioactivity and Radiation Measurements
- PubH 5-241. Environmental Health Aspects of Water Supply
- PubH 5-244. Environmental Aspects of Liquid Waste Disposal
- PubH 8-201. Radiation Dosimetry
- PubH 8-202. Radiation Dosimetry Laboratory
- PubH 8-248. Water Quality Investigations and Research Techniques
- PubH 8-249. Water Quality Research

NOISE

- AEM 5-687. Introduction to Acoustic Propagation
- CDis 5-704. Noise and Hearing

PLANNING

- AgEc 3-610. Community Resource Development
- AgEc 8-264. Resource Economics
- AgEn 1-050. Water Supply and Irrigation in Developing Countries
- CE 5-505. Management of the Aquatic Environment
- CE 5-510. Solid Waste Management
- LA 1-115/1-116. Theory of Landscape Form and Structure
- RCD 5-100. Interdisciplinary Seminar I
- RCD 5-101. Interdisciplinary Seminar II

PLANTS

- AgEn 3-050. Soil-Plant Relations in Agricultural Engineering
- Biol 3-012. Plant Biology
- Bot 1-012. Plants Useful to Man
- Bot 3-071. Plants and Human Affairs
- Ecol 5-014. Ecology of Plant Communities
- Ecol 5-016. Ecological Plant Geography
- Ecol 5-017. Ecological Life Histories of Plants
- PIPh 5-702. Measurement of Plant Environment Interactions
- PIPh 5-703. Measurement of Plant Environment Interactions
- PubH 5-177. Environmental Biology

POLLUTANTS AND POLLUTION

- AgEn 5-810. Agricultural Waste Management
- AgEn 5-910. Agricultural Waste Management Engineering I
- AgEn 5-920. Agricultural Waste Management Engineering II

Subject Index

- BA 3-001. Social Concerns of Business
- BA 3-999. Independent Study
- CE 5-510. Solid Waste Management
- ChEn 5-904. Special Topics in Pollution Control
- PubH 5-177. Environmental Biology
- PubH 5-179. Public Health Biology—Field Investigations
- PubH 5-180. Topics in Air Pollution
- PubH 5-181. Introduction to the Air Pollution Problem
- PubH 5-182. Air Pollution Controls and Surveys
- PubH 5-183. Problems of Air Pollution Control
- PubH 5-200. Topics in Radiological Health
- PubH 5-202. Environmental Radioactivity
- PubH 5-213. Public Health Aspects of Toxic Products
- PubH 5-241. Environmental Health Aspects of Water Supply
- PubH 5-244. Environmental Aspects of Liquid Waste Disposal
- PubH 8-248. Water Quality Investigation and Research Techniques
- PubH 8-249. Water Quality Research
- RCD 1-010. Issues in the Environment
- Soil 3-118. Seminar: Soil Pollution and Public Policy
- Soil 3-418. Seminar: Leaching and Runoff of Fertilizers
- Soil 5-340. Organic and Pesticidal Residues

POPULATION

- AgEc 5-790. Seminar—World Food Supply Problems
- Ecol 5-027. Human Population, Environment and Resources
- Ecol 5-029. Population Ecology
- Soc 5-551. World Population Problems
- Soc 5-555. Population Theory
- Soc 5-675. World Food Supply Problems
- VM 5-790. World Food Supply Problems

PUBLIC HEALTH *see Environmental Health*

PUBLIC POLICY

- BA 3-001. Social Concerns of Business
- BA 3-999. Independent Study
- Biol 5-951. The Biologist as Scientist, Educator, and Citizen
- Econ 3-131. Welfare Economics
- Econ 5-131. Systems and Program Analysis
- FRD 5-250. Forest Policy
- Law 5-215. Environmental Regulation
- Law 5-807. Seminar: Natural Resources—Conservation and Management
- Mgmt 3-005. Government and Business
- PA 8-130. Seminar: Science, Technology, and Public Policy
- PA 8-140. Seminar: Natural Environmental Policy
- PA 8-204. Public Economy
- Pol 1-025. World Politics
- Pol 1-031. American Public Policy
- Pol 5-308. Legislative Process
- Pol 5-309. Judicial Process
- Pol 5-321. Government and Economic Order
- Pol 5-322. American Social Policy
- Pol 5-328. Metropolitan Government and Politics
- Pol 5-877. Comparative Foreign Policy

- Soc 5-551. World Population Problems
- Soc 5-555. Population Theory
- Soc 5-605. Urbanization and Social Policy
- Soil 3-118. Seminar: Soil Pollution and Public Policy
- SSci 3-981. Societies of the Future
- SSci 5-101. Recognizable Goals and Constraints of a Steady-State Earth
- Tran 5-196. Transportation Regulation and National Policy III

RADIATION (IONIZING)

- PubH 5-200. Topics in Radiological Health
- PubH 5-201. Measurement and Application of Ionizing Radiation
- PubH 5-202. Environmental Radioactivity
- PubH 5-203. Low Level Radioactivity and Radiation Measurements
- PubH 8-201. Radiation Dosimetry
- PubH 8-202. Radiation Dosimetry

RECREATION

- FRD 5-232. Management of Recreational Lands
- Hort 5-010. Principles and Outdoor Recreation Design and Planning
- Hort 5-105, 5-106. Recreation Planning and Design I and II

RESOURCES

- AgEc 3-610. Community Resource Development
- AgEc 8-264. Resource Economics
- AgEn 1-050. Water Supply and Irrigation in Developing Countries
- Bot 1-012. Plants Useful to Man
- Bot 3-071. Plants and Human Affairs
- CE 5-420. Introduction to Water Resources Management
- Ecol 1-004. Ecology and Man
- Ecol 5-027. Human Population, Environment and Resources
- FRD 1-201. Conservation of Natural Resources
- FRD 5-212. Forest Economics
- GC 1-113. Science in Context: Utilization of Natural Resources
- Geog 3-351. North American Resource Management
- RCD 5-100. Interdisciplinary Seminar I
- RCD 5-101. Interdisciplinary Seminar II
- Soil 5-540. Soil Resources and Land Use
- Soil 5-550. Organic Soils

SAMPLING *see Monitoring and Measurements/Sampling*

SOILS

- AgEn 3-050. Soil-Plant Relations in Agricultural Engineering
- AgEn 3-405. Soil and Water Management
- Ecol 5-819. Soils and the Ecosystem
- Soil 1-122. Introductory Soil Science
- Soil 3-118. Seminar: Soil Pollution and Public Policy
- Soil 3-218. Seminar: Soil Drainage and Irrigation
- Soil 3-220. Soil and Water Management and Conservation
- Soil 3-418. Seminar: Leaching and Runoff of Fertilizers
- Soil 3-528. Seminar: Use and Interpretation of Soil Surveys
- Soil 5-114. Special Problems in Soils
- Soil 5-220. Soil and Water Management and Conservation
- Soil 5-240. Microclimatology (Soils)
- Soil 5-340. Organic and Pesticidal Residues

Subject Index

- Soil 5-512. Soil Geography
- Soil 5-532. Soils and the Ecosystem
- Soil 5-540. Soil Resources and Land Use
- Soil 5-550. Organic Soils

SOLID WASTE

- CE 5-510. Solid Waste Management

TECHNOLOGY *see Environmental Implications—Technology*

TRANSPORTATION

- CE 3-200. Introduction to Transportation Planning
- IT 5-XXX/X-XXX/X-XXX. New Concepts in Urban Transportation
- Tran 3-054. Fundamentals of Transportation
- Tran 5-134. Transportation and Business Logistics
- Tran 5-196. Transportation Regulation and National Policy III

URBAN/COMMUNITY

- Arch & LA 1-022. History of Environmental Development: Landscape Architecture
- Arch & LA 1-023. History of Environmental Development: Planning
- Arch 5-137. Planning Urban Function and Structure
- Arch 5-138. Planning Theory and Methodology
- Geog 8-410. Physical Environment Problems in Metropolitan Areas
- LA 5-262. History and Literature of Landscape Design
- RCD 5-100. Interdisciplinary Seminar I
- RCD 5-101. Interdisciplinary Seminar II
- Soc 5-605. Urbanization and Social Policy
- SSci 3-503. Urban Crisis

WATER

- AgEn 1-050. Water Supply and Irrigation in Developing Countries
- AgEn 3-405. Soil and Water Management
- AgEn 3-410. Hydrology, Water Control
- AgEn 3-800. Rural Sanitation and Water Supply
- AgEn 5-540. Erosion Control, Watershed Engineering
- AgEn 5-550. Drainage and Irrigation Engineering
- CE 5-420. Introduction to Water Resources Management
- CE 5-500. Analysis and Design of Water Supply Systems
- CE 5-501. Analysis and Design of Waste Water Systems
- CE 5-505. Management of the Aquatic Environment
- Ecol 5-812. Aquatic Ecology
- FBio 1-101. Introduction to Air and Water Quality
- FRD 5-237. Forest Meteorology and Hydrology
- Geo 5-611. Ground Water Geology
- Geo 5-612. Analytical Geohydrology
- Geo 8-618. Ground Water Geology
- PubH 5-150. Topics in Environmental Health
- PubH 5-170. Topics in Environmental Biology
- PubH 5-177. Environmental Biology
- PubH 5-179. Public Health Biology—Field Investigations
- PubH 5-241. Environmental Health Aspects of Water Supply
- PubH 5-244. Environmental Aspects of Liquid Waste Disposal
- PubH 8-248. Water Quality Investigation and Research Techniques
- PubH 8-249. Water Quality Research
- Soil 3-218. Seminar: Soil Drainage and Irrigation

WETLAND

Ecol 5-018. Wetland Ecology

WILDLIFE

Ent 5-400. Experimental Ecology

FW 3-050/3-051. Principles of Fisheries and Wildlife Management

FW 3-167. Techniques of Forest Wildlife Management

FW 5-552. Wildlife Ecology and Management II

VPaP 5-103. Parasites of Wildlife

VPaP 5-104. Disease of Wildlife

IV. DEPARTMENT CONTACTS, DEGREE PROGRAM DESCRIPTIONS, COURSE DESCRIPTIONS

In compiling this section, every attempt was made to make it as complete as possible. The user will find the list organized alphabetically by department. Under each department heading is the name, address, and phone number of a faculty member who is willing to advise students interested in an environmental curriculum. In addition, existing environmental programs or program options are listed as are the environmentally-related courses of the department. Each course description contains the following information: course number, title, and description; credits, student qualifications; and instructor's name, address, and phone number.

Department of Aerospace Engineering and Mechanics (AEM)

Institute of Technology

107 Aeronautical Engineering

CONTACT: A. A. Blatherwick, 101 Aeronautical Engineering, 373-5010

PROGRAMS:

As one of several technical options in Aerospace Engineering and Mechanics, students may select the Environmental and Biological Systems option:

Third Year

Spring: Ecol 3-101 Ecology

Fourth Year

Fall: ME 5-612 Environmental Engineering

AEM 5-687 Introduction to Acoustic Propagation

Winter: ME 5-603 Thermal Environmental Engineering

ME 5-613 Particle Technology

Spring: ME 5-614 Particle Technology

5-687. INTRODUCTION TO ACOUSTIC PROPAGATION. (4 cr; prereq 5-201 or #)

Derivation of acoustic equations and elementary wave solutions. Radiation, transmission, and absorption of sound.

Department of Agricultural and Applied Economics (AgEc)

College of Agriculture

222 Haecker Hall

CONTACT: J. Waelti, 306 Haecker Hall, 373-1604

3-610. COMMUNITY RESOURCE DEVELOPMENT. (4 cr; prereq 1-030 or #) [U. Blank, 134 Temporary South of Coffey Hall, 373-1093] winter

Basic concepts of resource use including physical and economic classifications; physical and economic feasibility; benefits and costs; external effects; cost sharing;

Department of Agricultural Engineering

selected resource use problems. Economic areas and units for planning and development; generating alternative program elements and developing consequences; problems in choosing elements for an optimum resource development program.

- 5-790. WORLD FOOD SUPPLY PROBLEMS.** (4 cr; prereq major in agriculture, veterinary medicine, home economics, social science, or $\$$, agricultural economics grad by $\$$ only) [L. Martin, 326A Haecker Hall, 373-0955] spring

A multidisciplinary approach will examine the world's growing population. Principles will be sought from the social and economic sciences, the plant sciences, and the animal sciences for the application to food problems. (Same as PIPA 5-220, Soc 5-675, VM 5-790, and HE 5-381).

- 8-264. RESOURCE ECONOMICS.** (3 cr; prereq Econ 5-162 or $\$$) [L. Martin, 326A Haecker Hall, 373-0955] fall

Economic analysis relevant to resource use and management; concepts of joint production and joint costs; external effects of resource decisions; applications of public finance, welfare economics, capital analysis, and other decision-making approaches; investment and management problems in water resources, outdoor recreation, forestry and fisheries; economic problems of air pollution and environmental quality.

Department of Agricultural Engineering (AgEn)

College of Agriculture and Institute of Technology

213 Agricultural Engineering

CONTACT: A. M. Flikke, 203 Agricultural Engineering, 373-1316

PROGRAMS:

The Department of Agricultural Engineering considers much of its program to be of direct environmental concern. For a more complete description see the Institute of Technology bulletin or the College of Agriculture bulletin.

- 1-101. ISSUES IN THE ENVIRONMENT.** (3 cr) spring

Aspects of environmental design which provide maximum compatibility of man with his environment, source of water pollution in the environment, and managed use of forest resources to maintain environmental quality.

- 1-050. WATER SUPPLY AND IRRIGATION IN DEVELOPING COUNTRIES.** (4 cr; prereq Soph or \wedge ; 2 lect hrs and 2 lab hrs per wk) [E. R. Allred, 205 Agricultural Engineering, 373-1342] fall

Development and utilization of available water resources for food production in developing countries including construction of sanitary water wells, pumping methods, irrigation requirements and methods, drainage, salinity control, water quality and waste disposal. Intended primarily for non-engineers.

- 3-050. SOIL-PLANT RELATIONS IN AGRICULTURAL ENGINEERING.** (4 cr; prereq AEM 3-016 or \dagger ; 3 lect and 3 lab hrs per wk) [A. M. Flikke, 200 Agricultural Engineering, 373-1316] winter

Interrelation of the soil-plant system and engineering and management requirements. Plant structure. Growth-processes. Soil-plant environment. Energy and water balance. Limiting factors. Mechanical and hydraulic properties of soil profile, moisture relations; strength parameters for structural and mechanical design.

- 3-405. SOIL AND WATER MANAGEMENT.** (4 cr, $\$$ 3-410, 5-400; prereq Math 1-111, Phys 1-031; 3 lect and 3 lab hrs per wk) [C. L. Larson, 207 Agricultural Engineering, 373-1331] fall

Basic principles of erosion control drainage, irrigation and hydrology. Introduction to surveying.

- 3-410. HYDROLOGY, WATER CONTROL.** (4 cr; prereq Math 1-111, Soils 1-122; 3 lect hrs per wk and 1-3 ar) [C. L. Larson, 207 Agricultural Engineering, 373-1331] winter

The hydrologic cycle—precipitation, infiltration and runoff. Uniform flow in open channels, flow measurement, Estimating peak runoff. Terraces and grass water ways for erosion and sediment control. Water resources and problems. Water control on a watershed basis. Choice of laboratory, discussion group or individual project.

Program and Course Descriptions

- 3-800. RURAL SANITATION AND WATER SUPPLY.** (4 cr; prereq Phys 1-031; Chem 1-005; 3 lect hrs per wk) [P. R. Goodrich, 222 Agricultural Engineering, 373-1656] fall
Wells, pumps, water supply and treatment. Water supply and waste disposal systems for homes, farmsteads, resorts and recreational use.
- 5-130. FOOD ENGINEERING I.** (4 cr; prereq growth and survival of micro-organisms, food spoilage and poisoning, food chemistry, thermodynamics of mixtures, 5-060 or ¶ or §; 4 lect hrs per wk) [D. R. Thompson, 201 Agricultural Engineering, 373-1348] fall
Fundamental requirements for handling food products. Separation processes in the food industry. Dehydration and storage of food.
- 5-140. FOOD ENGINEERING II.** (4 cr; prereq FSci 3-120, chemistry of basic food components, and their reactions, introduction to electromagnetics or ¶; 3 lect and 3 lab hrs per wk) [R. Thompson, 201 Agricultural Engineering, 373-1348] winter
Engineering principles of thermal processing of food, pasteurization, heat exchange, sterilization, baking, and microwave heating. Sanitation and microbiological aspects of food engineering.
- 5-540. EROSION CONTROL, WATERSHED ENGINEERING.** (4 cr; prereq 3-050, 3-060, CE 5-401; 3 lect and 3 lab hrs per wk) [C. L. Larson, 207 Agricultural Engineering, 373-1331.] fall
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.
- 5-550. DRAINAGE AND IRRIGATION ENGINEERING.** (4 cr; prereq 3-050, 3-060, CE 5-401; 3 lect and 3 lab hrs per wk) [E. R. Allred, 205 Agricultural Engineering, 373-1342] winter
Flow of water through agricultural soils. Irrigation and drainage requirements, salinity control, evapotranspiration, water supply development and control. Conveyance of drainage systems. Institutional, environmental and economic aspects of soil moisture control.
- 5-740. ENVIRONMENTAL CONTROL FOR AGRICULTURAL PRODUCTION.** (4 cr; prereq 3-050, 3-060, ME 5-603; 3 lect and 3 lab hrs per wk) [K. A. Jordan, 220 Agricultural Engineering, 373-1327] spring
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. Preparation includes biological requirement of Agricultural Engineering Curriculum.
- 5-810. AGRICULTURAL WASTE MANAGEMENT.** (4 cr; prereq Phys 1-031, Chem 1-005, Biol 1-001; 3 lect hrs per wk) [J. A. Moore, 222 Agricultural Engineering, 373-1343] spring
Characteristics of various animal manures, plant materials, and processing wastes. Sanitary collection, storage, treatment, and utilization or disposal of liquid and solid agricultural waste.
- 5-910. AGRICULTURAL WASTE MANAGEMENT ENGINEERING I.** (4 cr; prereq upper division; 3-050, 3-060; 3 lect and 3 lab hrs per wk) [J. A. Moore, 222 Agricultural Engineering, 373-1343] winter
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. Utilization of liquid and solid wastes. Non-urban water supply and quality.
- 5-920. AGRICULTURAL WASTE MANAGEMENT ENGINEERING II.** (4 cr; prereq 5-910; 3 lect and 3 lab hrs per wk) [P. R. Goodrich, 222 Agricultural Engineering, 373-1656] not offered in 1971-72
Design of systems for the collection, storage, treatment, utilization, and disposal of animal wastes.

Department of Animal Science (AnSc)

College of Agriculture
120 Peters Hall

CONTACT: L. E. Hanson, 117 Peters Hall, 373-0983

- 1-401. PRINCIPLES OF ANIMAL NUTRITION.** (5 cr; prereq Soph) [R. J. Meade, 123 Peters Hall, 373-0975; G. M. Speers, 204 Peters Hall, 373-0893] fall, spring
Classification and functions of nutrients; nature of nutrient requirements and their expression; gross differences in anatomy and physiology of digestion of ruminants and nonruminants; digestion, absorption and utilization of nutrients; and sources of nutrients for livestock and poultry. Feeding standards and their uses.
- 1-520. MILK PRODUCTION.** (3 cr, §FSci 1-520; prereq 1-100 or §) [G. E. Miller, 207 Old Anatomy, 373-1453; V. S. Packard, 148 Food Science and Industries, 373-1075] fall
Production and management concepts and their application to dairy farm planning and the production and marketing of high quality milk.
- 5-601. SWINE PRODUCTION.** (4 cr; prereq 1-401 or 3-402 or §, 3-220 recommended) [R. J. Meade, 123 Peters Hall, 373-0975] fall
Status and characteristics of the swine industry; application of the principles of animal breeding, nutrition, physiology and economics to swine production; consideration in the development of a successful swine enterprise.
- 5-603. BEEF CATTLE PRODUCTION.** (4 cr; prereq 1-401 or 3-403 or §, 3-220 recommended) [J. Meiske, 133 Peters Hall, 373-0972] spring
Status and characteristics of the beef cattle industry; application of the principles of animal breeding, nutrition, physiology, and economics to management of beef cattle breeding herds. Ration formulation, management, and marketing of feedlot cattle.
- 5-604. DAIRY FARM MANAGEMENT.** (4 cr; prereq 1-401 or 3-403 or §, 3-220 recommended) [G. E. Miller, 207 Old Anatomy, 373-1453; C. W. Young, 130 Haecker Hall, 373-1110]
Status and characteristics of the dairy industry; application of the principles of animal breeding, nutrition, physiology, and economics to management of dairy cattle and to planning and operation of a dairy farm.
- 5-605. COMMERCIAL POULTRY PRODUCTION.** (4 cr; prereq 1-401 or 3-402 or §) [G. M. Speers, 204 Peters Hall, 373-0893] fall
Current practices and production systems with emphasis on managerial aspects of egg, broiler, and turkey production. Technical and practical phases of production and marketing considered in relation to their underlying principles. Visits to appropriate commercial production units.

Department of Anthropology (Anth)

College of Liberal Arts
210 Ford Hall

CONTACT: F. C. Miller, 200 Ford Hall, 373-4625

- 5-115. ECONOMIC ANTHROPOLOGY.** (5 cr; prereq 1-002 or 5-101; waived for majors in economics and business administration) [S. Gudeman, 242 Ford Hall, 373-7765] probably not offered in 1971-72
Analysis and comparison of varied systems of production and distribution; special reference to non-industrial societies. Relationship between economic and social, political, religious, psychological and environmental factors.
- 5-116. CULTURAL ECOLOGY.** (5 cr; prereq 1-001 or 1-002, 6 cr of area courses) [D. Puleston, 254 Ford Hall, 373-4964] not offered in 1971-72
Survey of the literature on cultural ecology with emphasis on biological approach to ecosystems and population studies. Major monographs dealing with problems in cultural ecology will be covered in readings and lectures.
- 5-151. CULTURAL CHANGE AND DEVELOPMENT.** (5 cr; prereq 1-002) [R. Kiste, 258 Ford Hall, 373-4696] fall, spring
Processes of cultural change: invention, diffusion, and acculturation. Effects of colonialism, urbanization, and modernization. Analysis of developing societies.

Program and Course Descriptions

- 5-152. ANTHROPOLOGY OF SOCIAL MOVEMENTS.** (5 cr; prereq 1-002 or 5-101 or #) [L. Gerlach, 250 Ford Hall, 373-4695] not offered in 1971-72
Cross-cultural comparative study of nature, process and function of social, political, and religious movements of change. Examination of different theoretical approaches including Christianity, Islam, Asia, Africa, U.S.A.

School of Architecture and Landscape Architecture (Arch) (LA)

Institute of Technology
110 Architecture

CONTACT: R. Martin, 110 Architecture, 373-2198

PROGRAMS:

The regular architecture and landscape architecture programs are of direct environmental interest. The four degree programs offered by the School of Architecture and Landscape Architecture are:

- Bachelor of Environmental Design
- Bachelor of Landscape Architecture
- Bachelor of Architecture
- Master of Architecture

For further information consult Prof. Martin or the Institute of Technology bulletin.

See also courses in Horticultural Science.

- Arch, LA 1-001. ENVIRONMENTAL DESIGN: MAN AND ENVIRONMENT.** (4 cr) [D. R. Holloway, 110 Architecture, 373-2198] fall
Exploration of interaction of man and his environment using the disciplines of natural and social sciences and the arts as resource background for readings, lecture, discussion, and workshop sessions.
- Arch, LA 1-002. ENVIRONMENTAL DESIGN: TOOLS AND PROCESSES.** (4 cr; prereq 1-001) [D. R. Holloway, 110 Architecture, 373-2198] winter
Examination of nature and effects of various tools and processes of environmental change ranging from buildings and landscapes to economic policies, climate and myths. Readings, lectures, discussion and workshop sessions.
- Arch, LA 1-003. ENVIRONMENTAL DESIGN: IMPLEMENTATION AND EVALUATION.** (4 cr; prereq 1-002) [D. R. Holloway, 110 Architecture, 373-2198] spring
Design projects, discussions and readings exploring personal abilities to implement and evaluate environmental change.
- Arch, LA 1-022. HISTORY OF ENVIRONMENTAL DEVELOPMENT: LANDSCAPE ARCHITECTURE.** (4 cr; prereq 1-021; 4 lect hrs per wk) [R. B. Martin, 110 Architecture, 373-2198] winter
Discussions focused on investigating those forces and individuals that shaped the form of landscape in 19th and early 20th century America.
- Arch, LA 1-023. HISTORY OF ENVIRONMENTAL DEVELOPMENT: PLANNING.** (4 cr; prereq 1-022; 4 lect hrs per wk) [H. N. Iskander, 110 Architecture, 373-2198] spring
Survey course dealing with rise and history of cities as centers of civilization. Collaboration among various disciplines for creating better urban environment and improving the quality of human life in cities.
- Arch 3-064/3-065. ENVIRONMENTAL MANAGEMENT AND CONTROL.** (5 cr per qtr; prereq 3-062; 4 lect hrs per wk) [R. E. Diedrich, 110 Architecture, 373-2198] fall/winter
Environmental-mechanical considerations including comfort technology, space habitability, climate, psychometrics, control and management systems; waste management including plumbing systems and waste disposal techniques. Electrical systems, energy, power distribution and machinery; lighting systems, physiology of seeing, light sources and control; spatial acoustics, noise barriers, absorption.

General Biology Program

Arch 3-081/3-082/3-083. ARCHITECTURAL DESIGN. (6,6,6+ cr; prereq 2nd yr for IT students, Jr for CLA students and Δ ; 18 lab hrs per wk; entrance fall qtr only) fall/winter/spring

Basic exercises in composition of line, form, proportion, color, and texture. Elements of architectural design. Architectural drawing. Model Making.

Arch 3-091/3-092/3-093. ARCHITECTURAL DESIGN. (6,6,6+ cr; prereq 3-083; 18 lab hrs per wk) fall/winter/spring

Arch 5-137. PLANNING URBAN FUNCTION AND STRUCTURE. (4 cr; prereq $\$$)

Exploration of economic, technological and social factors which underlie the location, distribution, and internal structure of urban settlements. Quantitative and qualitative analysis of social, economic and physical problems or consequences of contemporary urbanization.

Arch 5-138. PLANNING THEORY AND METHODOLOGY. (4 cr; prereq 5-137 or $\$$)

Logic of a planning process as a method of decision-making. Formulation and goals and evaluation of alternative course of action, standards, and requirements for specific planning objectives (housing, transportation and community facilities). Legal, administrative, and fiscal devices for plan implementation. The place of planning function in government and the role of citizens and private groups.

LA 3-081/3-082/3-083. LANDSCAPE ARCHITECTURAL DESIGN. (6 cr per qtr; prereq LA student; 1 lect and 15 lab hrs per wk; Hort 3-093 may be substituted for LA 3-083)

Lectures and projects which begin to expand awareness of the design potential of environment; develop processes and graphic techniques for problem solving; begin a search toward developing methods of presenting ideas verbally and visually.

LA 3-091/3-092/3-093. LANDSCAPE ARCHITECTURAL DESIGN. (6 cr per qtr; prereq LA 3-083; 2 lect and 12 lab hrs per wk; Hort 5-112 may be substituted for LA 3-092)

Lectures and projects in exploration of the design potential of natural land materials, exploration of landscape survey and analysis techniques, assessment of the elements of environment as they condition design potential, exploration of methodologies for solving design problems, exploration of methods of expressing landscape form both graphically and through models; design of small scale site systems with simple variables.

LA 5-115/5-116. THEORY OF LANDSCAPE FORM AND STRUCTURE. (2 cr per qtr; prereq 3-091 or $\$$; 4 discussion hrs per wk) winter

Studies in landscape perception; lectures, discussions, and exercises in: application of abstract design principles to the assessment of land developments; review of psychological and social implications of land developments; exploration of the design potential of landscape materials; investigation of contemporary problems in land development including all scales and types of land uses.

LA 5-262. HISTORY AND LITERATURE OF LANDSCAPE ARCHITECTURE. (4 cr; 4 lect hrs per wk) [R. B. Martin, 110 Architecture, 373-2198] spring

A search for design principles as expressed in landscapes created by man from ancient times to the contemporary period. Specific focus on analysis of the visual form of environments as outgrowths of geographical, cultural, and technological determinants.

General Biology Program (Biol)

College of Biological Sciences

104 Zoology

CONTACT: W. L. Koukkari, 201 Botany, 373-2209

PROGRAM:

For information on degree options, see the college bulletin.

1-011. BIOLOGY. AN INTRODUCTION TO BIOLOGY. (5 cr)

Its importance and relationship to the life of man. Objectives: 1) to help students understand the importance of biology and its relationship to the life of man and to the various areas of his thought; 2) to provide students with an understanding of biology and the way biologists formulate and solve problems.

Program and Course Descriptions

- 3-012. PLANT BIOLOGY.** (5 cr; prereq Chem 1-005 or Chem 1-025) [D. McLaughlin, 504 Botany, 373-5473] winter, spring
Comparative study of growth, development, and function of plants; emphasis on adaptations which have evolved in various groups of plants providing suitable means of support, transport of materials, mutations, and reproductions; evolution and diversity of plant life.
- 3-021. BIOCHEMISTRY.** (4 cr; prereq 1-002 or Δ , Chem 3-302) [S. Dagley, 165a Gortner Laboratory of Biochemistry, 373-1260] fall, spring
Introduction to biochemistry and biophysics of cells; emphasis on enzyme catalysis, cellular energetics, biosynthesis of cellular constituents, and cellular regulatory mechanisms.
- 3-041. ECOLOGY.** (4 cr; prereq 1 qtr calculus and Biol 3-031, or $\$$) [K. W. Corbin, 340 Museum of Natural History, 373-5643; J. G. McColl, 339 Museum of Natural History, 376-7238; J. R. Tester, 394 Museum of Natural History, 373-5646] fall, spring
Interactions of plant and animal populations and their environments: The organization, functioning, and development of ecological systems; population growth and regulation. Modern man's impact on the biosphere.
- 3-051. BIOLOGY AND THE FUTURE OF MAN.** (4 cr; P-N only) [E. Gorham, 8 Botany, 373-5619; D. C. Pratt, 105 Botany, 373-3928] fall
A non-technical discussion of biological factors affecting the quality of life, e.g., pollution, chemical and biological warfare, population growth, food supply, resource sufficiency, value of wilderness, genetics and eugenetics public health, aging, behavior control, and biological aspects of ethics, morals, and societal organization.
- 5-951. THE BIOLOGIST AS SCIENTIST, EDUCATOR, AND CITIZEN.** (3 cr; prereq 15 cr in bio sci) [A. Hooper, 344 Gortner Laboratory of Biochemistry, 373-1282] winter
The role of the scientist in decision-making and persuasion; teaching methods in biology; the organizational structure of the academic and governmental world; the impact of science on society, practical and philosophical.

Department of Botany (Bot)

College of Biological Sciences
123 Snyder Hall

CONTACT: E. J. Cushing, 8 Botany, 373-2232
D. B. Lawrence, 8 Botany, 373-2223
E. Gorham, 8 Botany, 373-5619

PROGRAM:

For information on degree options, see the college bulletin.

- 1-012. PLANTS USEFUL TO MAN.** (4 cr; for majors or non-majors) [D. B. Lawrence, 8 Botany, 373-2223; H. Jonas, 8 Botany, 373-5919] fall, winter
Survey of roles which plants have played in man's biological and cultural development. Lectures and demonstration of material.
- 3-071. PLANTS AND HUMAN AFFAIRS.** (4 cr) [H. Jonas, 8 Botany, 373-5919] fall
A consideration of the reciprocal and deterministic interaction between plants and man as illustrated by events and developments in agriculture, industry, trade, domestic, and foreign affairs, medicine, in religious customs, and in the arts.

School of Business Administration (BA)

225 Business Administration

CONTACT: R. J. Holloway, 1235a Business Administration, 373-4407

See also the Departments of Industrial Relations, Management and Transportation, and Marketing and Business Law.

Department of Chemical Engineering and Materials Science

- 3-001. SOCIAL CONCERNS OF BUSINESS.** (3 cr; P-N only; non-business students with #)
[R. J. Holloway, 1235a Business Administration, 373-4407] fall, winter
A course dealing with current social problems with which business is related, e.g., pollution, consumerism, poverty. Emphasis on discussion, selected readings, and individual projects.
- 3-000. INDEPENDENT STUDY.** (Cr ar; prereq #) [R. J. Holloway, 1235a Business Administration, 373-4407]

Business Law

Business Law courses are listed in the DEPARTMENT OF MARKETING AND BUSINESS LAW

Department of Chemical Engineering and Materials Science (ChEn)

School of Chemistry, Institute of Technology
151 Chemical Engineering

CONTACT: H. Tsuchiya, 251 Chemical Engineering, 373-2306

PROGRAMS:

The Department of Chemical Engineering and Materials Science offers, for an environmental option, the Eco-Chemical Engineering Program. In addition to the required courses for the third and fourth years, the following courses are recommended:

Third Year

- Fall: Chem 5-502 Physical Chemistry
- Winter: MicB 5-105 Biology of Microorganisms
- Spring: Biol 3-021 Biochemistry
Biol 3-025 Laboratory in Biochemistry

Fourth Year

- Fall: ChEn 5-751 Biological Engineering Analysis
CE 5-505 Management of the Aquatic Environment
- Winter: ChEn 5-752 Biological Engineering Analysis
- Spring: ChEn 5-753 Biological Engineering Analysis

- 5-101. PRINCIPLES OF CHEMICAL ENGINEERING.** (4 cr; 3 lect and 2 rec hrs per wk)
Material and energy balances applied to chemical engineering systems.
- 5-102. PRINCIPLES OF CHEMICAL ENGINEERING.** (4 cr; 3 lect and 2 rec hrs per wk)
Fluid dynamics and its applications to chemical engineering unit operations.
- 5-103. PRINCIPLES OF CHEMICAL ENGINEERING.** (4 cr; 3 lect and 2 rec hrs per wk)
Heat and mass transfer and its applications to chemical engineering unit operations.
- 5-301. CHEMICAL REACTOR ANALYSIS.** (4 cr; 3 lect and 2 rec hrs per wk; prereq 5-202)
Principles of reactor design for homogeneous reactions. Analysis of reactors from a kinetic and thermodynamic point of view.
- 5-751/5-752/5-753. BIOLOGICAL ENGINEERING ANALYSIS.** (3 cr per qtr; prereq #) [K. Keller, 401 Mines and Metallurgy, 373-5276; H. Tsuchiya, 251 Chemical Engineering, 373-2306] fall, winter, spring
Modeling and analysis of biosystems. Thermodynamics, transport and transfer, bio-chemical reactions, growth and death processes are discussed from both deterministic and probabilistic viewpoints.
- 5-904. SPECIAL TOPICS IN POLLUTION CONTROL.**
Special topics to be taught winter and/or spring quarters. For further information contact [W. Ranz, 151 Chemical Engineering, 373-2296]

Programs and Course Descriptions

Department of Civil and Mineral Engineering (CE)

Institute of Technology
122 Mines and Metallurgy

CONTACT: W. Maier, 296 Experimental Engineering, 373-2517

PROGRAM:

The Department of Civil and Mineral Engineering environmental program option is titled Environmental Engineering, and the following courses are recommended for completion of this option:

- 3-500. Introduction to Environmental Engineering
- 5-500. Analysis and Design of Water Supply Systems
- 5-501. Analysis and Design of Waste Water Systems
- 5-505. Management of the Aquatic Environment
- 5-510. Solid Waste Management

3-200. INTRODUCTION TO TRANSPORTATION ENGINEERING. (4 cr; prereq #) |W. Maier, 296 Experimental Engineering, 373-2517| fall, spring

Techniques and processes used in solving transportation problems of urban areas. Collection and characteristics of base year data, formulation of mathematical models to simulate existing travel patterns, forecasting procedures and evaluation of different transportation systems.

3-500. INTRODUCTION TO ENVIRONMENTAL ENGINEERING. (4 cr; prereq 3-400 or #)

Needs of urbanized society and their impact on the environment; physical, chemical, and biological characterization of the environment; environmental quality standards; techniques for pollution abatement.

5-420. INTRODUCTION TO WATER RESOURCES MANAGEMENT. (4 cr)

The present state of the water resources; water resource planning; activation of planning.

5-500. ANALYSIS AND DESIGN OF WATER SUPPLY SYSTEMS. (4 cr; prereq 3-500 or #; 3 lect and 2 lab hrs per wk) winter, spring

Planning and engineering design considerations in developing water supply systems for urban centers. This includes considerations of supply, quality, storage, treatment, distribution, and cost analysis.

5-501. ANALYSIS AND DESIGN OF WASTE WATER SYSTEMS. (4 cr; prereq 3-500 or #; 3 lect and 2 lab hrs per wk)

Planning and engineering design considerations in developing waste and water systems for urban communities. This includes characterization of the volume and quality of the waste streams, treatment, and ultimate disposal of domestic, industrial waste waters, and storm run-off. Environmental effects, cost, and political aspects of ultimate disposal are considered.

5-505. MANAGEMENT OF THE AQUATIC ENVIRONMENT. (4 cr; prereq #; 3 lect and 2 lab hrs per wk)

Man's impact on the aquatic environment is discussed. Water quality objectives are described and math models are used to assess the quantitative effects of pollution sources. Alternatives for pollution abatement are considered in terms of the model. Interrelationship between solid and liquid waste disposal, air quality, and water quality are considered.

5-510. SOLID WASTE MANAGEMENT. (4 cr; prereq #; 3 lect and 2 lab hrs per wk)

Solid waste disposal for urban areas is discussed in terms of volume, composition, and chemical characteristics. Methods and equipment for collection and treatment are described. Various disposal methods are considered in terms of their effects on the environment and the unit cost.

Department of Ecology and Behavioral Biology

Department of Communication Disorders (CDIS)

Graduate School
110 Shevlin Hall

CONTACT: W. D. Ward, 236 Diehl Hall, 373-4565

- 5-704. NOISE AND HEARING.** (3 cr; prereq #) [W. D. Ward, 236 Diehl Hall, 373-4565] spring
Temporary and permanent effects of steady, intermittent, and impulse noises on hearing. Noise measurement, reduction, and control; ear defenders and their limitations. Hearing conservation programs; pre-employment testing and monitoring audiometry.

Department of Ecology and Behavioral Biology (Ecol)

College of Biological Sciences
349 Museum of Natural History

CONTACT: A. J. Brook, 349 Museum of Natural History, 373-5177

PROGRAM:

For information on degree options, see the college bulletin.

- 1-003. THE FINAL CRISIS.** (3 cr; television course offered through General Extension Division of the University of Minnesota) [A. J. Brook, 349 Museum of Natural History, 373-5177]
The ecological crisis, its crucial implications for man's future existence, and the current critical necessity for the development of an ecological awareness.
- 1-004. ECOLOGY AND MAN.** (4 cr; 1-003; prereq Biol 1-011) [A. J. Brook, 349 Museum of Natural History, 373-5177]
A presentation of the basic concepts of ecology with special reference to man's increasing impact and exploitation of the environment and stressing the biosphere's limits with respect to energy, resources, and space.
- 3-001. INTRODUCTION TO ECOLOGY.** (4 cr; open to jrs and above, but not to biology majors) [A. J. Brook, 349 Museum of Natural History, 373-5177] winter
Interrelationships between environmental influences and plants and animals, including man; population growth and regulation; nature, organization, and development of ecological systems. Role of man in biosphere.
- 3-004. FUNDAMENTALS OF ECOLOGY.** (4 cr; prereq Biol 1-002 or 1-011; not open to biology majors) [J. R. Tester, 394 Museum of Natural History, 373-5969] winter
Relationships between organisms and their environment; ecosystem structure and function emphasizing energy flow, biogeochemical cycling and succession; population dynamics; introduction to regional biotic communities.
- 3-101. ECOLOGY FOR ENGINEERS AND PHYSICAL SCIENTISTS.** (4 cr, §1-003, 1-004, 3-001; prereq Math 1-230; not open to biology majors) [R. O. Megard, 200e Pillsbury, 373-7983] fall, winter, spring
A course for engineers and physical science students to present a scientifically sound understanding of the basis for the existence and continued existence of life on the earth.
- 5-014. ECOLOGY OF PLANT COMMUNITIES.** (5 cr; prereq 3-004 or Biol 3-041) [E. J. Cushing, 214a Botany, 373-2232]
Description, classification, and mapping of plant communities and theory of their structure, interrelationships, development, and stability. Field trips to local vegetation types; analysis of quantitative data.
- 5-015. STRUCTURE AND FUNCTION OF ECOSYSTEMS.** (5 cr; prereq 3-045 or #) [J. McColl, 339 Museum of Natural History, 376-7238] winter
Energy exchange and cycles of water and nutrients, in relation to biological productivity and development and regulation of ecosystems.

Programs and Course Descriptions

- 5-016. ECOLOGICAL PLANT GEOGRAPHY.** (3 or 5 cr; prereq Biol 3-041 or 3-004 or §; offered 1971-72 and alternate years) [D. B. Lawrence, 212 Botany, 373-2223; E. J. Cushing, 214a Botany, 373-2232] spring
Ecological principles of plant distribution and landscape analysis, vegetation regions of North America, interpretation of regional vegetation patterns.
- 5-017. ECOLOGICAL LIFE HISTORIES OF PLANTS.** (5 cr; prereq Biol 3-045, Bot 3-132, and §; offered 1972-73 and alternate yrs) [J. McColl, 339 Museum of Natural History, 376-7238] spring
Influence of environmental factors on each developmental stage of life cycle under natural conditions. Individual species assigned for study at Cedar Creek Natural History Area. Weekly half-day field trips.
- 5-018. WETLAND ECOLOGY.** (5 cr; prereq 15 cr in biological subjects, introductory chemistry or §; Biol 3-041 recommended) SSI
Nature, origin, and development of lake, marsh, swamp, and bog ecosystems; environmental control and productivity.
- 5-019. QUATERNARY PALEOECOLOGY.** (5 cr; prereq Ecol 3-001 or Biol 3-041 or §) offered summer 1972 and alt yrs at Itasca
Problems and techniques in the reconstruction of past communities and ecosystems from fossil evidence in deposits of Quaternary age. Field and laboratory methods in the collection and description of stratigraphic sequences and the identification and quantitative analysis of fossil assemblages.
- 5-022. ANIMAL BEHAVIOR.** (4 cr; prereq §) [F. McKinney, 308 Museum of Natural History, 373-5979] winter
Introduction to ethology, the causation, development, evolution, and adaptive significance of behavior.
- 5-023. BEHAVIORAL ADAPTATIONS.** (5 cr) [F. McKinney, 308 Museum of Natural History, 373-5979] winter
Lectures and discussions on current problems in areas of overlap between ethology, ecology, and evolution with special emphasis on social systems, spacing mechanisms and communication.
- 5-024. ENVIRONMENTAL MEASUREMENT AND ANALYSIS I.** (4 cr; prereq 1 yr physics, 1 yr calculus) [R. Maxwell, 390 Museum of Natural History, 373-1676] fall
The use of the continuity principle in relating meteorological parameters to biologic systems and the modeling of environmental interactions with organisms.
- 5-025. ENVIRONMENTAL MEASUREMENT AND ANALYSIS II.** (4 cr; prereq Ecol 5-024) [R. Maxwell, 390 Museum of Natural History, 373-1676] winter
The elements of a measuring system and the determination of meteorological parameters to study the physical relationships between an organism and its environment.
- 5-026. ENVIRONMENTAL MEASUREMENT AND ANALYSIS III.** (2-5 cr; prereq 5-025 or §; also offered at Lake Itasca Biology Session) [R. Maxwell, 390 Museum of Natural History, 373-1676] spring, SSI
The principles and techniques presented in 5-024 and 5-025 are applied to habitats found in the Itasca region.
- 5-027. HUMAN POPULATION, ENVIRONMENT AND RESOURCES.** (4 cr) [J. Serrin, 109b Vincent Hall, 373-4685] winter
Discussion of local, national and world demographic problems. Impact of population on environment, resources and resource allocation; ecological implications. Birth and death control programs. Demographic models; optimal rate predictions.
- 5-028. ADVANCE ECOSYSTEM ANALYSIS.** (5 cr; prereq Ecol 5-015) [J. G. McColl, 339 Museum of Natural History, 376-7238]
Individual projects including literature review, field data collection and/or laboratory analyses and synthesis of results. Projects will relate to cycling of water or chemical elements, or to energy flow in ecosystems at the Cedar Creek Natural Area. Weekly half-day field trips.
- 5-029. POPULATION ECOLOGY.** (4 cr; prereq 3-004 or Biol 3-041, 1 course in statistics) [J. R. Tester, 394 Museum of Natural History, 373-5646; D. B. Sniff, 103 Museum of Natural History, 373-4909] winter
Factors involved in the regulation, growth, and general dynamics of populations will be considered. The major areas to be considered include 1) data which are needed to describe population, 2) population growth, 3) consideration of population models, and 4) intensive discussion of regulatory mechanisms.

Department of Economics

- 5-812. AQUATIC ECOLOGY.** (5 cr; prereq 15 cr, incl Biol 1-002 or 3-011 or Zool 1-013) [J. C. Underhill, S4 Zoology, 373-3648] SSI. [A. Brook, 339 Museum of Natural History, 373-5177] SSI
Conditions for life in water and distribution of aquatic animals.
- 5-813. ADVANCED LIMNOLOGY.** (5 cr; prereq Ecol 5-812; Itasca) [R. O. Megard, 200e Pillsbury, 373-9783] summer
Current topics in limnological research with emphasis on the analysis of aquatic productivity. Lecture, laboratory, and field work.
- 5-814. COMMUNITY STRUCTURE AND FUNCTION.** (5 cr; prereq Biol 3-041 or §) SSI
Communities represented in Itasca Park and vicinity and their dynamic relationships. Also the relationships of local communities to the flora and fauna of Minnesota as a whole. Use of modern methods of community analysis and measurement of environmental factors.
- 5-815. FIELD ETHOLOGY.** (5 cr; prereq Biol 3-011; Zool 5-077 or 5-834 recommended; Itasca) summer
Studies of behavioral evolution, motivation, and ontogeny stressing the relationship between environment and behavior by using field research techniques.
- 5-816. ECOLOGY OF FRESHWATER ALGAE.** (5 cr; prereq Bot 5-231 or 5-811 or §; Itasca) [A. J. Brook, 349 Museum of Natural History, 373-5177] summer
Aspects of algal ecology in lakes and ponds; phytoplankton, benthos, and periphyton; also in streams, bogs, soils and other terrestrial habitats. Laboratory instruction in relevant research techniques.
- 5-817. VERTEBRATE ECOLOGY.** (5 cr; prereq 3-041 or equiv; offered in Lake Itasca Biology sessions) [J. Tester, 304 Museum of Natural History, 373-5646] SSI, SSI
Field work on populations and their relationship to local environments; habitat analysis and ecological research methods. Individual and team research projects, field trips, and lectures.
- 5-818. QUANTITATIVE ECOLOGY.** (5 cr; limited to 15 students; prereq 9 cr in ecology; Itasca) summer
Lectures, discussions, and field studies on populations, communities, and ecosystems. Emphasis on methods of sampling and measuring ecological parameters and on data analysis and interpretation.
- 5-819. SOILS AND THE ECOSYSTEM.** (5 cr, §Soil 5-532; prereq 3-004 or Biol 3-041 or §; Itasca) [R. Farnham, 303 Soils, 373-1447] summer
Formation and distribution of soils in relationship to vegetation, climate, and other soil-forming factors. Interrelationships of soils in the ecosystems.
- 8-002. QUANTITATIVE ASPECTS OF ECOLOGICAL SYSTEMS.** (4 cr; prereq 5-015, 3 cr ecology, 5 cr statistics) [D. B. Siniff, 103 Museum of Natural History, 373-4909; J. G. McColl, 339 Museum of Natural History, 376-7238] spring; offered 1971-72 and alt yrs
Ecological concepts which normally require quantitative measurements and synthesis of measurements to interpret organisms-environment interactions. Measurements such as density estimates and distribution and abundance patterns among species; division of community resources among species and species diversity. Quantitative characteristics of random variables used in defining these concepts. Concepts used in quantifying the structure and function of natural ecosystems as a whole.

Department of Economics (Econ)

College of Liberal Arts

1035 Business Administration

CONTACT: N. J. Simler, 1035 Business Administration, 373-3690

- 1-041. CONSUMER ECONOMICS.** (4 cr) [S. Maynes, 1151 Business Administration, 373-3607] fall
Application of economic principles to major decisions of consumers. How to use income most effectively. Use of credit. Saving; insurance principles; decisions to purchase a house. Source of consumer information; product testing agencies; government efforts to protect consumers.

Program and Course Descriptions

- 3-041. CURRENT ISSUES WORKSHOP.** (3 or 4 cr ar)
Each quarter one or more topics of current interest will be analyzed using the tools and viewpoint of economic theory. Course will emphasize discussion rather than lectures, and active student participation.
- 3-131. WELFARE ECONOMICS.** (4 cr; prereq 3-101 or equiv) fall, winter, spring
Introduction to welfare economics. Economic efficiency and the conditions necessary to sustain it. Conflicts between the efficiency and income distribution goals. How market structure and public policies increase or decrease efficiency.
- 3-351. ECONOMICS OF SCIENCE AND TECHNOLOGY.** (4 cr; prereq 3-102 or equiv) [C. Nelson, 1115 Business Administration, 373-3585] spring
Relation of economic progress and growth of science and technology. Includes: effect of invention, discovery, and education on economic growth; effect of demand, market structure, and size of firm on rate of invention and adoption of new products and processes; private and social returns from research and education; associated problems of public policy.
- 5-131. SYSTEMS AND PROGRAM ANALYSIS.** (4 cr; prereq 3-101, 3-751 or equiv) [E. Coen, 1035b Business Administration, 373-3690]
Application of economic analysis to projects, systems, and sub-systems. Criteria for optimization, scope of analysis, measurement of benefits and costs, time, discounting, and sensitivity analysis under uncertainty. Role and usefulness of analysis in decision making. Case studies from private and public sectors.

Department of Entomology, Fisheries, and Wildlife (Ent) (FW)

College of Agriculture
219 Entomology, Fisheries and Wildlife

CONTACT: H. C. Chiang, 219 Entomology, Fisheries and Wildlife, 373-1713

L. D. Frenzel, 219 Entomology, Fisheries and Wildlife, 373-1715

T. F. Waters, 219 Entomology, Fisheries and Wildlife, 373-1706

PROGRAM:

A major in Fisheries and Wildlife is designed to provide the student with essential basic training in the biological and physical sciences and related disciplines which provide the broad background necessary for work in the professional fields. For further information see the college bulletin or one of the above advisers.

ENTOMOLOGY (ENT)

- 1-005. ECONOMIC ENTOMOLOGY.** (4 cr; prereq Biol 1-002 or #) fall
Brief introduction to the 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.
- 5-020. FIELD ENTOMOLOGY.** (5 cr; prereq Biol 1-002 or equiv; Itasca) summer
The insect fauna in various natural habitats of the park and surrounding area. Includes field trips, collection and classification of insects, as well as studies of general morphology, life histories, and habitats of local species under ecological conditions governing the distribution of insect fauna of the region.
- 5-130. AQUATIC ENTOMOLOGY.** (5 cr; prereq 3-175, 5-020 or equiv or #; Itasca) summer
Identification and biology of aquatic and littoral insects in all stages.

Department of Entomology, Fisheries, and Wildlife

- 5-250. PRINCIPLES OF ECONOMIC ENTOMOLOGY.** (4 cr; prereq 15 cr zoology and entomology incl 1-005 or #) offered 1972-73 and alt yrs
Methods and principles of insect control. Lectures and laboratory demonstration.
- 5-400. EXPERIMENTAL ECOLOGY.** (3 cr; prereq 9 cr biology or equiv and 3 cr animal or plant ecology, #, 18-300) [Hau-Chang Chiang, 212 Entomology, Fisheries, and Wildlife, 373-1713] winter
Experimental approach to study of environmental factors affecting animal populations.
- 5-904. SPECIAL PROBLEMS IN ENTOMOLOGY.** (Cr ar; prereq #; Itasca) SSI, SSII
Advanced work and ample opportunity for individual research, especially in various faunistic studies.

FISHERIES AND WILDLIFE (FW)

- 3-050. PRINCIPLES OF FISHERIES AND WILDLIFE MANAGEMENT.** (3 cr, §5-451, 5-551; for non fisheries and wildlife majors; prereq Biol 1-002 or equiv; Biol 3-041 or For 3-101 or Ecol 3-001) [L. Frenzel, 323 Entomology, Fisheries, and Wildlife, 373-1715] winter
Introduction to fishery and wildlife population ecology; relations between fish and wildlife and their environments; management of fish and game populations and habitats; management and research methods; administration of fish and wildlife agencies.
- 3-167. TECHNIQUES OF FOREST WILDLIFE MANAGEMENT.** (2 cr; prereq 3-050; Cloquet) fall, spring
Biology and management of important forest wildlife species; methods of evaluating forest wildlife populations and habitats.
- 5-396. SPECIAL PROBLEMS IN VERTEBRATE ECOLOGY.** (Cr ar; prereq #; Itasca) SSI, SSII
Advanced work and ample opportunity for individual research, especially in various faunistic studies.
- 5-451. ECOLOGY OF FISHERY POPULATIONS.** (3 cr; prereq Ecol 3-001 or equiv; Ecol 5-812 or Geo 5-601, Zool 5-121, Math 1-142 or equiv; or #) fall
Relationship of fishery populations to limnological conditions; factors influencing strength of year classes; influence of climatological factors on fish growth; species interactions as related to population structure; influence of natural and fishing mortality rates on structure and yield of exploited populations; fishery yield models.
- 5-452. FISHERY MANAGEMENT.** (3 cr; prereq 5-451 or #) [T. Waters, 120 Entomology, Fisheries and Wildlife, 373-1706] winter
Fundamentals of population control; use of fishing regulations; habitat development; water quality control; use of artificial stocks for population maintenance; relationship between sport and commercial fisheries, including economic aspects; fundamentals of hatchery practice; pond management.
- 5-453. TECHNIQUES OF FISHERY BIOLOGY.** (3 cr; prereq 5-452 or #) spring
Basic methods used in fishery research and management; lake and stream survey methods, mapping, chemical and biological sampling methods of fish collection, use of nets and traps, fish toxicants, electro-fishing; tagging and marking; methods of creel census.
- 5-454. FISHERY ECOLOGY IN POLLUTED WATERS.** (3 cr; prereq 5-451, Chem 1-004, 1-005, 1-006, Chem 3-100, 3-101, #)
Description of degrading water quality factors and influence on fish production. Fishery bioassay setting of standards and determination of criteria for aquatic organisms; administrative problems of pollution abatement. Biological indicators of degraded water quality.
- 5-552. WILDLIFE ECOLOGY AND MANAGEMENT II.** (4 cr) [J. Peek, 320 Entomology, Fisheries and Wildlife, 373-1723] winter
Principles and concepts pertaining to relationships between wildlife populations and their habitat requirements and relationships of important game species; relationships to land use and land management practices; habitat evaluation and management.
- 8-450. FISHERIES RESOURCES OF THE UNITED STATES.** (3 cr when offered; prereq 8-449 or #) [L. Smith, 132 Entomology, Fisheries and Wildlife, 373-1708] offered alt yrs or when demand warrants
Product; methods and description of commercial fisheries; state, federal, and international administration and regulation; significant laws and current legislation. Organization of fishery programs.

Program and Course Descriptions

Department of Environmental Health

School of Public Health (PubH)

Health Sciences

1112 Mayo

CONTACT: R. D. Singer, Room 1110 Mayo, 373-8084

PROGRAM:

The programs in Environmental Health have been offered in the School of Public Health since 1935. They are designed to cover the many health aspects of environmental control and to develop broad-based knowledge to prepare graduate students for responsible planning and direction of environmental programs. Programs of graduate study leading to M.P.H. (Master of Public Health), M.S. and Ph.D. degrees are available. The course of instruction leading to a Master's degree requires a minimum of 11 months of study beginning with the second term of Summer Session (about July 15th) preceding the regular academic year. Course work is available in such areas as air pollution, institutional environmental health, radiological health, occupational health, water hygiene, liquid and solid wastes, food hygiene, environmental biology and microbiology, injury control, administration or general sanitation. Students may either specialize in a particular topic area or make a broad selection from all the courses available.

For more information consult the *Graduate School Bulletin*, the *School of Public Health Bulletin* or R. D. Singer.

- 3-151. INTRODUCTION TO ENVIRONMENTAL HEALTH.** (3 cr; prereq 3 cr in PubH) [D. Vesley, 541 Space Science Center, 373-7958] spring
Principles of urban and rural sanitation relating to water, food, wastes, housing, accidents, radiation, air, insects, rodents.
- 5-150. TOPICS IN ENVIRONMENTAL HEALTH.** (Cr ar; prereq #) fall, winter, spring, SSI, SSII
Selected readings and discussions of problems in environmental health.
- 5-151. ENVIRONMENTAL HEALTH.** (3 cr; prereq #) [R. G. Bond, 1114 Mayo, 373-8081] fall
Methods for promoting man's health and comfort by controlling the environment.
- 5-170. TOPICS IN ENVIRONMENTAL BIOLOGY.** (Cr ar; prereq #) fall, winter, spring
Selected readings in environmental biology with discussion of control techniques.
- 5-171. ENVIRONMENTAL MICROBIOLOGY.** (3 cr; prereq 5-002, 5-151, MicB 3-103 or #)
[V. W. Greene, 1108 Mayo, 373-8085] fall, spring
Survival, dissemination, transportation, and significance of microorganisms in the environment; application of principles to environmental health problems.
- 5-177. ENVIRONMENTAL BIOLOGY.** (3 cr; prereq #) [O. Ruschmeyer, 1112 Mayo, 373-8077; T. Olson, 1115 Mayo, 373-8083] fall
Introduction to plant and animal forms important in environmental health and biological aspects of water supply waste treatment, stream pollution, and special phenomena related to human disease transmission.
- 5-178. VECTORS AND PARASITES IN HUMAN DISEASES.** (3 cr; prereq #) [O. Ruschmeyer, 1112 Mayo, 373-8077; T. Olson, 1115 Mayo, 373-8083] winter
Basic biological concepts of parasitic diseases, vectors and application of vector control methods in environmental health programs.
- 5-179. PUBLIC HEALTH BIOLOGY—FIELD INVESTIGATIONS.** (3 cr; prereq #) [O. Ruschmeyer, 1112 Mayo, 373-8077; T. Olson, 1115 Mayo, 373-8083] spring
- 5-180. TOPICS IN AIR POLLUTION.** (Cr ar; prereq #) fall, winter, spring
Selected readings in air pollution with discussion based on these readings.
- 5-181. INTRODUCTION TO THE AIR POLLUTION PROBLEM.** (3 cr; prereq #) [H. Paulus, 1140 Mayo, 373-8082] fall, winter
History, sources, controls, effects, surveys, legal aspects; administration of programs.

Department of Environmental Health

- 5-182. AIR POLLUTION CONTROLS AND SURVEYS.** (3 cr; prereq 5-181, #) [H. Paulus, 1150 Mayo, 373-8082] spring
Public health engineering approach to air pollution controls and surveys.
- 5-183. PROBLEMS OF AIR POLLUTION CONTROL.** (Cr ar; prereq 5-181, #) [H. Paulus, 1140 Mayo, 373-8082] fall, winter, spring, SSI
Special supervised studies involving laboratory and field investigation procedures; pertinent literature review.
- 5-184. AIR ANALYSIS.** (3 cr; prereq 5-181, 5-183, or 5-211, #) [H. Paulus, 1140 Mayo, 373-8082] spring
Laboratory and field exercises including air flow measurement, calibration of instruments, analysis of gases, stack sampling, dust counting and sizing, and industrial plant visits.
- 5-190. TOPICS IN INJURY CONTROL.** (Cr ar; prereq #) [G. Michaelson, Health Service, 373-3088; G. L. Scheffler, W148 Health Service, 373-3273]
Directed Readings and reports on selected problem areas in injury control.
- 5-191. PRINCIPLES AND METHODS OF INJURY CONTROL.** (Cr ar; prereq #) [G. Michaelson, Health Service, 373-3088; G. L. Scheffler, W148 Health Service, 373-3273]
Accidents as a community public health problem; current concepts of etiology and methodology of control.
- 5-200. TOPICS IN RADIOLOGICAL HEALTH.** (Cr ar; prereq #) fall, winter, spring
Selected readings in radiological health with discussion based on these readings.
- 5-201. MEASUREMENT AND APPLICATION OF IONIZING RADIATION.** (3 cr lect and lab, 2 cr lect only; prereq #) [D. Barber, W169 Health Service, 373-3387] fall
Introduction to principles of measurement and use of radiative sources; emphasis on health hazards.
- 5-202. ENVIRONMENTAL RADIOACTIVITY.** (3 cr; prereq #) [C. Straub, 1108 Mayo, 373-8086; D. Barber, W169 Health Service, 373-3387] winter
Sources, measurement, evaluation, and control of environmental radioactivity; hazards to general population.
- 5-203. LOW LEVEL RADIOACTIVITY AND RADIATION MEASUREMENTS.** (3 cr; prereq #) [D. Barber, W169 Health Service, 373-3387] spring
Advanced isotope techniques designed for assay of low levels of radioactivity in environmental samples.
- 5-210. TOPICS IN OCCUPATIONAL HEALTH.** (Cr ar; prereq #) fall, winter, spring
Selected readings in occupational health with discussions based on these readings.
- 5-211. INDUSTRIAL HYGIENE ENGINEERING.** (3 cr; prereq #) [K. J. Caplan, Health Service, 373-9925] fall
Field and laboratory methods used by industrial hygiene engineers in study and control of occupational health hazards.
- 5-212. VENTILATION CONTROL OF ENVIRONMENTAL HAZARDS.** (3 cr; prereq 5-211, #) [K. J. Caplan, Health Service, 373-9925]
Theory and application of exhaust ventilation in control of airborne environmental hazards; principles of exhaust hoods, air moving devices, gas cleaning devices; demonstration of measurement techniques; relationship of hazard and process to ventilation design criteria.
- 5-213. PUBLIC HEALTH ASPECTS OF TOXIC PRODUCTS.** (2 cr; prereq #) [K. Caplan, Health Service, 373-9925] winter
Problems of protecting industrial workers and private consumers from useful but potentially harmful products; product testing programs and administration; labeling problems.
- 5-214. AGRICULTURAL OCCUPATIONAL HEALTH.** (3 cr; prereq 5-211 or #) [K. Caplan, Health Service, 373-9925]
Occupational health problems of agricultural workers, practical and available preventive measures, educational and administrative needs.
- 5-220. TOPICS IN FOOD SANITATION.** (Cr ar; prereq #) fall, winter, spring
Review of literature and practice to identify association of food sanitation problems to public health.
- 5-222. FOOD SANITATION.** (3 cr; prereq 5-002, #) [T. Olson, 1115 Mayo, 373-8083] spring
Review of current literature on sanitary problems in production, processing, and distribution of meat, milk, shellfish, and other foods; methods of supervision.

Program and Course Descriptions

- 5-241. ENVIRONMENTAL HEALTH ASPECTS OF WATER SUPPLY.** (3 cr; prereq #) [C. P. Straub, 1108 Mayo, 373-8086] winter
Role of water in health of man; physical, chemical, and biological characteristics; evaluation of source, treatment, and distribution systems.
- 5-244. ENVIRONMENTAL ASPECTS OF LIQUID WASTE DISPOSAL.** (3 cr; prereq #) [C. P. Straub, 1108 Mayo, 373-8086] spring
Role of liquid wastes in health of man; physical, chemical, and biological characteristics; evaluation of source, treatment, and disposal facilities.
- 8-201. RADIATION DOSIMETRY.** (3 cr; prereq #) [D. Barber, W169 Health Service, 373-3387] spring
Radiant energy absorption in liquids, gases, and solids; absorption in biological systems.
- 8-202. RADIATION DOSIMETRY LABORATORY.** (1 cr; prereq 8-201) [D. Barber, W169 Health Service, 373-3387] spring
Laboratory exercises involving principles discussed in 8-201.
- 8-211. HEALTH SURVEY OF MANUFACTURING PROCESSES.** (2 cr; prereq 5-211) [K. Caplan, Health Service, 373-9925]
Survey of occupational disease problems and preventive measures in major industries and in operations common to many industries; field trips.
- 8-248. WATER QUALITY INVESTIGATION AND RESEARCH TECHNIQUES.** (6 cr; prereq #) [T. Olson, 1115 Mayo, 373-8083] SSI, SSII
Field techniques and special research methods for establishing pollution base-lines; recognition and appraisal of advance eutrophication.
- 8-249. WATER QUALITY RESEARCH.** (6 cr; prereq #) [T. Olson, 1115 Mayo, 373-8083; O. Ruschmeyer, 1112 Mayo, 373-8077; others]

Department of Evening and Special Classes

General Extension Division
201 Westbrook Hall

CONTACT: (Miss) B. R. Sinniger, 54 Nicholson Hall, 373-0115

There is always the possibility that special classes (either credit or non-credit) and certain conferences and institutes on the subject of ecology may be developed and/or activated during the coming year, but are not, as yet, included in the present listings. To learn of such possibilities, please contact Miss Sinniger, 373-0115.

Ecol 1-003. THE FINAL CRISIS. (3 cr; TV) [A. J. Brook, 349 Museum of Natural History, 373-5177]

The ecological crisis, its crucial implications for man's future existence, and the current critical necessity for the development of an ecological awareness.

Biol 3-051. BIOLOGY AND THE FUTURE OF MAN. (4 deg cr) spring semester

A nontechnical discussion of biological factors affecting the quality of life, e.g., population growth, genetics and eugenetics, aging, biochemistry of behavior, biological aspects of social systems, chemical and biological warfare, food supply, environmental change, space biology, biological aspects of ethics and morals.

Ecol 1-004. ECOLOGY AND MAN. (4 deg cr) winter quarter

The basic concepts of ecology with special reference to man's increasing impact and exploitation of the environment, stressing the biosphere's limits with respect to energy, resources, and space. After an initial organization meeting on the first night of class, students will, in subsequent meetings, view video-taped lectures, followed by small group discussions and/or demonstration sessions. Discussion of selected readings from the two required texts (Kormondy's *Concepts in Ecology* and his *Readings in Ecology*) will form the basis of some of the small group sessions.

Department of Evening and Special Classes

Ecol 3-001. INTRODUCTION TO ECOLOGY. (4 deg cr) winter quarter

The basic concepts of ecology with special reference to man's increasing impact and exploitation of the environment stressing the biosphere's limits with respect to energy, resources, and space. After an initial organizational meeting on the first night of class, students will, in subsequent meetings, view video-taped lectures, followed by small group discussion and/or demonstration sessions. Discussion of selected readings from the two required texts (Kormondy's *Concepts in Ecology* and his *Readings in Ecology*) will form the basis of some of the small group sessions. A mid-quarter examination and book reviews on two paperbacks dealing with problems of man and his environment will be required. The final examination will be essay, based on the synthesis of the basic concepts of ecology.

FSci 1-010. MAN'S FOOD. (3 deg cr) spring quarter

Deals with the currently popular subject of human nutritional need; food composition, world food supply, consumption patterns, acceptance, quality programs and regulations, food preservation, commercial processes, packaging, marketing, national and international food programs.

GC 1-112. MAN AND HIS ENVIRONMENT. (3 deg cr) winter quarter

This course deals with the biological principles of the inter-relationships which exist between man and his environment, or the study of ecology as applied to the problems of man's past, present, and future existence. The basic principles of ecology are applied to such topics as the structure and function of the eco-system; the pollution of air, water, and soil; the population explosion; the evolution of man, his migrations, and the development of human settlements or bio-social environments; marine radiation, and space biology; and the creation of livable environments for man, present and future.

Geo 1-007. ENVIRONMENTAL GEOLOGY. (4 deg cr; prereq Geo 1-001) fall quarter

Geological applications in resource management, land use planning, technology, and conservation. Geological evolution of the biosphere and the impact of man's activities on land, sea, and air resources. Geological hazards. The Twin Cities metropolitan area as a geological environment. Lectures, laboratories, and field trips.

Geo 1-008. GEOLOGY AND MAN. (4 deg cr) [R. L. Bartels, 123 Pillsbury Hall, 373-3378] fall semester

An introductory course concerned with man in his physical environment; geological hazards (e.g., earth quakes); the nature and use of natural resources; geological aspects of pollution, recreation, and land use; the effect of the composition of rocks and soils on nutrition and disease. An introduction to the broad nature of earth science. Lecture, labs, and field trips.

Geog 3-361. ENVIRONMENTAL EVALUATION AND ADAPTATION. (3 deg cr) fall quarter

Designed to explore attitudes toward environment from the viewpoint of humanistic geography and the history of ideas. Among the questions to be considered are: What attitudes do we hold toward the physical environment, the world of nature, and of man-made things? How do we perceive and evaluate them? What have been, and what are, our environmental ideals? How do styles of life, evolved in adaptation to the physical setting, influence our attitudes to environment? What are some of the consequences of our environmental attitudes, ideas, and ideals? What visible marks do they leave on the landscape? The course will examine human attitudes and values in general and those of certain non-literate peoples in particular.

PubH 5-151. ENVIRONMENTAL HEALTH. (3 cr; prereq #) [R. G. Bond, 1114 Mayo, 373-8081] fall

Methods for promoting man's health and comfort by controlling the environment.

PubH 5-171. ENVIRONMENTAL MICROBIOLOGY. (3 deg cr; prereq PubH 5-002, 5-121, MicB 3-103) [V. W. Greene, 1108 Mayo, 373-8085] spring quarter

Survival, dissemination, transportation and significance of micro-organisms in the environment; application of principles to environmental health problems.

PubH 5-181. INTRODUCTION TO AIR POLLUTION PROBLEMS. (3 deg cr; prereq equiv experience, #) [H. J. Paulus, 1140 Mayo, 373-8082]

History, sources, controls, effects, surveys, legal aspects, and administration of air pollution programs.

PubH 5-182. AIR POLLUTION CONTROLS AND SURVEYS. (3 deg cr; prereq 5-181) [H. J. Paulus, 1140 Mayo, 373-8082; K. J. Caplan, Health Service, 373-9925] spring semester

Public health engineering approach to air pollution controls and surveys.

Program and Course Descriptions

- PubH 5-211. INDUSTRIAL HYGIENE ENGINEERING.** (3 deg cr; prereq equiv experience, §) [K. J. Caplan, Health Service, 373-9925] winter quarter
Field and laboratory methods used by industrial hygiene engineers in study and control of occupational health hazards.
- PubH 5-241. ENVIRONMENTAL HEALTH ASPECTS OF WATER SUPPLY.** (3 deg cr; prereq equiv experience, §) [C. P. Straub, 1108 Mayo, 373-8086] spring quarter
Role of water in health of man; physical, chemical, and biological characteristics; evaluation of source, treatment, and distribution systems.
- PubH 5-244. ENVIRONMENTAL ASPECTS OF LIQUID WASTE DISPOSAL.** (3 deg cr; prereq equivalent experience, §) [C. P. Straub, 1108 Mayo, 373-8086] winter quarter
Role of liquid wastes in health of man; physical, chemical, and biological characteristics; evaluation of source, treatment, and disposal facilities.
- SSci 3-402. ECOLOGY, TECHNOLOGY, AND SOCIETY.** (4 deg cr) [J. E. Anderson, 235 Mechanical Engineering, 373-5548] fall and spring quarters
An examination of the impact of technology on society as seen by engineers, scientists and social scientists. The social problems associated with economic growth such as environmental consequences, the arms race, food and fertilizers, and population growth will be explored. Alternative strategies for meeting the problems will be examined. Speakers are drawn from the University faculty, the staffs of state and local agencies, business and industry, and others knowledgeable in the problem at hand. The course is designed to suit the needs of a wide audience—including all colleges of the University, as well as the community at large.

Fisheries and Wildlife

Courses are listed in the DEPARTMENT OF ENTOMOLOGY, FISHERIES, AND WILDLIFE.

Department of Food Science and Industries (FSci)

College of Agriculture
225 Food Science and Industries

CONTACT: S. T. Coulter, 228 Food Science and Industries, 373-1071
Howard Morris, 227 Food Science and Industries, 373-1071

- 1-010. MAN'S FOOD.** (3 cr) [H. Morris, 227 Food Science and Industry, 373-1071] winter
Man's nutritional needs; food composition, world food supply, consumption patterns, acceptance, quality programs and regulations, food preservation, commercial processes, packaging, marketing, national and international food programs.
- 5-120. FOOD MICROBIOLOGY.** (3 or 5 cr; 3 cr for lect, 2 cr for lab, lect taken separately with §; prereq MicB 5-153) [F. F. Busta, 238 Food Science and Industries, 373-1071]
Relationship of environment to occurrence, growth, and survival of microorganisms in foods; evaluation of microbiological quality of dairy and food products; characteristics and activities of bacteria, yeasts, and molds related to food spoilage; utilization of microorganisms in manufacture of dairy and food products; recognition and control of food-borne pathogens and food poisoning.
- 5-122. SANITATION AND PROCESS MICROBIOLOGY.** (4 cr, 3 cr for lect taken separately with §; prereq 5-153 or §) [F. F. Busta, 238 Food Science and Industries, 373-1071]
Factors that influence the control and destruction of microorganisms; chemical, physical, and microbiological principles in cleaning and sanitizing dairy and food processing equipment; inactivation of microorganisms and thermal process evaluation; microbiological fermentations and preservation methods; development of sanitation programs; microbiological standards for dairy and food products.

College of Forestry

110 Green Hall

CONTACT: K. E. Winsness, 12 Green Hall, 373-0842

PROGRAM:

A major in Forestry is designed to provide the student with essential basic training in the biological and physical sciences and related disciplines which provide the broad background necessary for work in the professional fields. For further information see the college bulletin or one of the advisers.

The courses listed below are from the following departments:

Forest Biology (FBio)

Forest Resources Development (FRD)

They have been listed together for convenience.

FBio 1-101. INTRODUCTION TO AIR AND WATER QUALITY. (4 cr; prereq Biol 1-011, Chem 1-005 or #) [A. Mace, 101A Green Hall, 373-0840] winter

This course is intended to present an overall view and an appreciation of air and water quality problems. Basic processes which govern the accretion, depletion, and cycles of specific types and sources of pollution will be considered. Methods of pollution abatement and assessment of the influence of political, social, and economic pressures on the maintenance of a "quality environment" will be described.

FRD 1-201. CONSERVATION OF NATURAL RESOURCES. (3 cr; open to nonforestry majors) [F. Kaufert, 110g Green Hall, 373-0826; W. Miles, 102 Green Hall, 373-0720] winter

Renewable natural resources of the United States and the world; their utilization, interrelationship and management treated from an economic standpoint and related to their importance to society and our responsibility for their conservation. Lectures and reports.

FBio 3-101. FOREST ECOLOGY. (3 cr; Itasca) summer

Ecological principles. Silvical characteristics of tree and shrub species. Forest communities and environmental factors.

FBio 5-100. SILVICULTURE. (3 cr; prereq 1-100, 3-101, Soil 1-122 or #) [H. Scholten, 349 Green Hall, 373-0844] winter

Introduction to the silvicultural systems, intermediate cuttings, and related practices. Forest regeneration problems and techniques.

FRD 5-210. MULTIPLE USE. (5 cr; prereq 3-203, AgEc 1-030; Cloquet) fall, spring

Elements and interrelationships of forest administration, management, utilization, engineering, hydrology, and recreation. Lectures, field trips, and problems.

FRD 5-212. FOREST ECONOMICS. (4 cr; prereq AgEc 1-020 or #) [H. Gregersen, 110c Green Hall, 373-1754] winter

An examination of the United States and world forest resource supply and consumption relationships; forest products industries and wood products user characteristics; aggregate and firm capital use theory for long period production processes; market systems for principal forest products; macro problems of the forest economy; and decision-making in micro forest economic situations. Lectures and problems.

FRD 5-230. FOREST FIRE. (2 cr; prereq 1-100, or #) [F. Irving, 105 Green Hall, 373-0833] winter

Fire behavior, effects, control, and use.

FRD 5-232. MANAGEMENT OF RECREATIONAL LANDS. (3 cr) [L. Merriam, 101B Green Hall, 373-0847] spring

Recreational use of the forest and associated land and water. Policy problems arising from recreational demands.

FRD 5-234. FOREST PROTECTION. (2 cr; prereq 5-230 or #; Cloquet) [F. Irving, 105 Green Hall, 373-0833] fall, spring

Field exercises in the behavior, effects, control, and use of fire. Identification and ecology of forest disease and insect problems.

Program and Course Descriptions

- FRD 5-237. FOREST METEOROLOGY AND HYDROLOGY.** (4 cr; prereq Itasca, Soil 1-122, Geo 1-011, or #) [A. Mace, 101A Green Hall, 373-0840] spring
Analysis of effects of climate on the forest ecosystem and components of the hydrologic cycle. Principles of managing the forest system including effects of climate and vegetation of soil moisture, timing of runoff and water quantity and quality.
- FRD 5-250. FOREST POLICY.** (3 cr; prereq Sr or #) [R. Skok, 301B Green Hall, 373-0836] winter
Public and private forest policies in the United States. Forest policies of other nations. Analysis of current policy issues. Lectures and reports.

General College (GC)

106 Nicholson Hall

CONTACT: A. Johnson, 121 Folwell Hall, 373-3715

PROGRAM:

See description below of GC 1-921/1-922/1-923/1-924.

- 1-111. SCIENCE IN CONTEXT: WEATHER AND CLIMATE.** (5 cr; 4 lect, 2 lab hrs per wk) [A. Johnson, 121 Folwell Hall, 373-3715] fall, winter, spring
A study of our day-to-day and long-range weather patterns is made in terms of interactions among the atmosphere, the oceans, the land surfaces, and the motions of the earth. The uneven distribution of the sun's energy over the earth's land and water surfaces produces atmospheric circulation systems that result in fair weather, storms, seasonal changes, air pollution, and water resource problems. Basic principles of science are applied to problems of analyzing changing weather patterns, preparing forecasts, and predicting regional climates.
- 1-112. SCIENCE IN CONTEXT: MAN AND HIS ENVIRONMENT.** (5 cr) [V. Liston, 126 Folwell Hall, 373-3722] fall, winter, spring
This course deals with the biological principles of the interrelationships which exist between man and his environment, or the study of ecology as applied to the problems of man's past, present and future existence. The basic principles of ecology are applied to such topics as the structure and function of the ecosystem; the pollution of air, water, and soil; the population explosion; the evolution of man, his migrations, and the development of human settlements or biosocial environments; marine, radiation, and space biology; and the creation of livable environments for man, present and future.
- 1-113. SCIENCE IN CONTEXT: UTILIZATION OF NATURAL RESOURCES.** (5 cr) [T. Helget, 122 Folwell Hall, 373-4027; N. Jefferson, 111 Folwell Hall, 373-4486] fall, winter, spring
Mankind is vitally concerned with gaining knowledge about the earth as a place in which to live and as a base for procuring the necessities of life. Nature provides a basic wealth of materials that can be utilized by man, but these resources must be used intelligently. These natural resources (land, soil, water, plants, animals, forest, minerals, and wildlife), their location, characteristics, and use by man are considered an essential part of the education of an American citizen. So intimately is the welfare of the human race associated with natural resources that every citizen should be informed concerning their utilization.
- 1-131. BIOLOGICAL SCIENCE: PRINCIPLES.** (5 cr) [N. Jefferson, 111 Folwell Hall, 373-4486; L. Matusak, 115 Folwell Hall, 373-5642] fall, winter, spring
A study of the variety and relationships of living organisms illustrates the general principles of biology as they apply to man, animals, and plants.
- 1-921. ENVIRONMENTAL PROBLEMS: NATURAL SCIENCE**
- 1-922. ENVIRONMENTAL PROBLEMS: SOCIAL SCIENCE**
- 1-923. ENVIRONMENTAL PROBLEMS: INDIVIDUAL WRITING**
- 1-924. ENVIRONMENTAL PROBLEMS: HUMANITIES**

A series of courses has been developed in the General College which is a problem-centered, team-taught, interdisciplinary study of environmental problems. This package would be one academic quarter in length and would

Department of Geography

be taught via field studies, seminars, field trips, and formal contact between students and staff. *Primary emphasis* will be placed on individual and small group off-campus investigation and reporting. Approximately 40 students will register for a solid block of 16 credits. The credits will be split between the natural sciences, social sciences, communications, and humanities.

Environmental problems such as pollution, over-population, starvation crises in urban ecology, and exploitation of natural resources will be studied by identifying problems and formulating possible solutions. The social, scientific, and humanitarian factors of the various problems will be interrelated through cooperative planning by several staff members with the diversity of backgrounds and interests required for this approach. (16 cr) [A. B. Johnson, 121 Folwell Hall, 373-3715] winter

Department of Genetics and Cell Biology (GCB)

College of Biological Sciences
227 Snyder Hall

- 1-101. HEREDITY AND HUMAN SOCIETY.** (4 cr, §3-002, 3-022, or Biol 3-032) winter, spring
The principles of heredity and their social and cultural implications. Emphasis is on man, his diversity and the influence of social institutions on his evolution. Topics discussed include the genetic basis of sex, race and intelligence, and the problems raised by genetic engineering. For students in programs not directly related to the biological sciences.
- 3-002. HUMAN GENETICS, SOCIAL AFFAIRS.** (3 cr) [E. Anderson, 6 Zoology, 373-3639; S. Reed, 10 Zoology, 373-3798] spring
An introduction to human genetics with special emphasis on the study of individuals, families, populations, and races with respect to differences in intelligence, behavior, disease, and other matters of social concern. For students in programs not directly related to the biological sciences.

Department of Geography (Geog)

College of Liberal Arts
414 Social Sciences

CONTACT: R. Skaggs, 546 Social Sciences, 373-5435

PROGRAM:

The Department of Geography has set up a program for geography majors who wish to orient their programs toward physical environment studies. For further information, consult Professor Skaggs or another member of the geography faculty.

- 1-401. PHYSICAL GEOGRAPHY.** (5 cr) fall, winter, spring
Major features of distribution patterns of climate, relief, vegetation and soils; regional differences in problems of physical development.
- 1-425. INTRODUCTION TO METEOROLOGY.** (4 cr; same as Soil 1-262) [D. Baker, 101A Plant Science, 373-1356; R. Skaggs, 546 Social Sciences, 373-5435] fall
Precalculus introduction to nature of the atmosphere and its behavior. Topics include 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.
- 3-101. GEOGRAPHY OF THE UNITED STATES AND CANADA.** (4 cr; prereq 5 cr in geography or #) [J. R. Borchert, 311 Walter Library, 373-7833] fall
Examination of manner in which abilities of different peoples have interacted with natural environment in producing regional differentiation of United States and Canada.

Program and Course Descriptions

- 3-111. GEOGRAPHY OF MINNESOTA.** (3 cr) not offered in 1971-72
Survey of physical resources, population, and commercial production. Field trips in eastern Minnesota.
- 3-351. NORTH AMERICAN RESOURCE MANAGEMENT.** (4 cr; prereq 1-401 or #) [W. Barrett, 414 Social Sciences, 373-2661; R. Skaggs, 546 Social Sciences, 373-5435] not offered 1971-72; alt yrs
Comparative current and historical analysis of factors affecting regional landscapes in Canada, United States, and Mexico; emphasis on interaction of physical setting and institutions; effect of industrialization, urbanization, and population growth on environment.
- 3-355. ENVIRONMENTAL ALTERATIONS.** (4 cr) [R. Skaggs, 546 Social Sciences, 373-5435] fall, winter, spring
Analysis of the kinds of disturbances man may introduce into ecosystems and groups of ecosystems and the spatial distribution and organization of the effects.
- 3-361. ENVIRONMENTAL EVALUATION AND ADAPTATION.** (4 cr; prereq 1-301 or #) [Y. Tuan, 548 Social Sciences, 373-5413] fall
The making of "worlds" out of "environments"; survey of how different peoples evaluate and adapt to their natural surroundings, with emphasis on past and non-literate cultures.
- 3-421. CLIMATOLOGY.** (4 cr; prereq 1-401 or #) [R. Skaggs, 546 Social Sciences, 373-5435; W. Barrett, 414 Social Sciences, 373-2661] fall
World distribution of climatic elements; methods of arranging climatic data; climatic classifications and world distributions of climatic types; general circulation; climatic change and climatic fluctuations.
- 5-422. MICRO-CLIMATOLOGY.** (4-6 cr; prereq 5-421 or #) not offered 1971-72
Detailed study of heat and moisture balance of the earth; reception and disposal of precipitation and energy in local environment.
- 5-433. DYNAMIC AND SYNOPTIC CLIMATOLOGY.** (4 cr; prereq 5-421 or #) [R. Skaggs, 546 Social Sciences, 373-5435] winter
Application of dynamic and synoptic meteorological theory to broadside climate genesis; introduction to explanatory climatological models.
- 5-811. ENVIRONMENTALISM, ENVIRONMENT, AND THE QUALITY OF LIFE.** (4 cr; prereq 3-361 or #) [Y. Tuan, 548 Social Sciences, 373-5413]
A survey of ideas on environmentalism with special emphasis on those that lead to the organization of the physical environment into human settings (rural and urban) in the belief that they affect life's ideals.
- 8-410. PHYSICAL ENVIRONMENT PROBLEMS IN METROPOLITAN AREAS.** (3 cr; prereq #) winter, spring
Metropolitan areas may experience intensified problems associated with man's use of the physical environment. In this seminar the relevant literature is examined followed by research projects in the local area. This seminar is intended to expose geographers, planners, and other social scientists to the ways in which the local physical environment is modified by man in metropolitan areas and the substantial problems which can be generated.

Department of Geology and Geophysics (Geo)

School of Earth Sciences, Institute of Technology
108 Pillsbury Hall

CONTACT: H. O. Pfannkuch, 2d Pillsbury Hall, 373-5678

- 1-001. PHYSICAL GEOLOGY.** (5 cr; prereq high school physics and chemistry recommended; 3 lect hrs, one 2 hr lab, 1 rec hr per wk) [G. Rapp, 104 Pillsbury, 373-4047]
A first course in geology for science majors and an introduction to the scientific method and the nature of the earth for others. Survey of the main features of the physical world and of the processes that have formed them. Six to eight homework problems in special fields of geology and geophysics.

Department of Horticultural Science

- 1-002. HISTORICAL GEOLOGY.** (4 cr; prereq 1-001 or 1-111; 3 lect hrs, one 2 hr lab per wk) [R. Sloan, 103 Pillsbury Hall, 373-4567]
Evolution of the earth from its origin to the present, with special attention to the succession of physical and biological events of the past 600 million years.
- 5-601. LIMNOLOGY.** (4 cr; prereq Chem 1-005, ♯) fall
Description and analysis of the events occurring in lakes, reservoirs, and ponds, beginning with their origins and progressing through a study of their physics, chemistry, and biology. Emphasis is placed on the interrelationships of these parameters, and on the effects of civilization on lakes. Laboratory, field trips.
- 5-611. GROUND WATER GEOLOGY.** (3 cr; prereq 1-001 or 1-111, Math 1-230, 1 qtr phys, chem, or ♯) [H. Pfannkuch, 2d Pillsbury Hall, 373-5678]
Origin, occurrence, and movements of ground water. Characteristics of major aquifers and aquitards. Exploratory investigations. Hydrogeologic units and boundaries. Principles and theoretical aspects of recharge. Quality of ground water supplies.
- 5-612. ANALYTICAL GEOHYDROLOGY.** (3 cr; prereq 5-611, Math 1-240 or 5-601, CE 3-400 or ♯) [H. Pfannkuch, 2d Pillsbury Hall, 373-5678]
Microphysics of flow through porous media; geological factors in aquifer performance; equations for ground water flow; computer and analog models of aquifers; ground water basin analysis.

College of Home Economics

200 McNeal Hall

CONTACT: L. Morse, 231 McNeal Hall, 373-1542

R. Owens, 217 McNeal Hall, 373-1549

- 5-381. WORLD FOOD SUPPLY PROBLEMS.** (4 cr; prereq major in agriculture, veterinary medicine, home economics, social science majors or ♯, agricultural economics grad by ♯ only; same as PIPa 5-220, AgEc 5-790, Soc 5-675, VM 5-790) [L. Martin, 326 Haecker Hall, 373-0955] winter
A multidisciplinary approach will examine the social, economic, and technical problems of feeding the world's growing population. Principles will be sought from the social and economic sciences, the plant sciences, and the animal sciences for their application to food problems.

Department of Horticultural Science (Hort)

College of Agriculture

111 Horticulture

CONTACT: A. A. Duncan, 111 Horticulture, 373-1026

PROGRAM:

The Department of Horticultural Science and the School of Architecture and Landscape Architecture jointly sponsor programs in Landscape Architecture. They are briefly described in this bulletin under Architecture and Landscape Architecture.

- 1-024. THEORY OF LANDSCAPE DESIGN.** (4 cr) [G. Hard, 424 New Horticulture Building, 373-1011] winter
Analysis of design elements and forms involving line, direction, shape, proportion, and color, with emphasis on their function in design; a study of perception and man's relationship to his environment, and the social and psychological basis for design. Lectures and laboratory.
- 5-010. PRINCIPLES OF OUTDOOR RECREATION DESIGN AND PLANNING.** (4 cr) [J. Kuska, 422 New Horticulture Bldg., 373-1663; T. Knopp, 101c Green Hall, 373-0831] fall
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, summer and winter recreational facilities.

Program and Course Descriptions

5-013. ADVANCED LANDSCAPE DESIGN. (5 cr; prereq 3-092)

Advanced landscape design and site planning related to complex problems. Emphasis will be placed on analytic methods and procedures as well as detailed design and presentation of solutions.

5-105, 5-106. RECREATIONAL PLANNING AND DESIGN I AND II. (6 cr per qtr; prereq 5-010)
[J. Kuska, 422 New Horticulture Bldg., 373-1663] winter

Analysis, development and presentation of landscape design solutions for diverse recreational land use.

Humanities Program (Hum)

College of Liberal Arts
286 Ford Hall

CONTACT: R. J. Ames, 286 Ford Hall, 373-3516
P. Giese, 376 Ford Hall

1-009. SCIENCE AND HUMANITIES. (5 cr) [P. Giese, 376 Ford Hall] fall, spring

Examines interrelations of "is" questions (What is the nature of the cosmos and its laws? How do we find out?) and "should" questions (What should man strive for? What should "ideal" societies be like?) and explores the involvement of human values in the processes of science and the products of technology. How does knowledge and belief influence our relationships to each other and to our environment?

3-040. SCIENCE AND HUMANITIES. (5 cr; prereq Jr, Sr, or ♯) [M. Penn, 251 Ford Hall, 373-5227] spring, SSI

Examines warfare between two cultures, scientific and humanistic, through consideration of decisive documents from Ficino and Vives to recent work of Polanyi, Koestler, Brownoski, and A. Huxley.

Department of Industrial Relations (IR)

School of Business Administration
537 Business Administration

CONTACT: G. W. England, 547 Business Administration, 373-3827

3-101. HUMAN RELATIONS IN INDUSTRY. (3 cr) [P. Zirgale, 508 Business Administration, 373-5737] fall, winter, spring

Philosophy, policy, and methods. The problems of human relations arising in large scale organization of people and approaches to their solution. Role playing, sensitivity training, conference and discussion methods, case study.

School of Journalism and Mass Communication (Jour)

College of Liberal Arts
111 Murphy Hall

CONTACT: P. Tichenor, 15 Murphy Hall, 373-3369

3-021. MASS COMMUNICATION AND THE NEWS. (4 cr; not open to journalism majors) spring
How news gets to and affects the public in print, on the air, by film. Evaluation of news gathering and presentation methods. Contemporary influences on media.

5-133. SCIENCE COMMUNICATION. (4 cr; prereq 3-121 or 3-176 for majors, ♯ for non-majors.)
[P. Tichenor, 15 Murphy Hall, 373-3369] winter

Role of journalistic communication in science; scientist-journalist relationships; communicating results of scientific investigations to public, specialized audiences, industry.

- 5-143. INTERPRETATION OF SCIENCE AND TECHNOLOGY.** (4 cr; prereq 5-133, 5-501 and Phil 5-601) [P. Tichenor, 15 Murphy Hall, 373-3369] spring
Analysis of scientific research and technological development for mass and specialized media; critical study of science content in media; audience impact.
- 5-144. URBAN JOURNALISM.** (4 cr; prereq 3-121, 5-131, or Grad, professional experience, or §) [G. A. Burd, 432 Murphy Hall, 373-0343] spring
Urban problems and mass media role and performance; specialized reporting and commentary on urban functions; urban media policy and news gathering techniques; critical analysis of media content; reporting projects in urban subjects and appropriate readings.
- 5-501. COMMUNICATION AND PUBLIC OPINION.** (4 cr; prereq 15 cr in social sciences) fall, winter, spring
Theories of communication process and of persuasion and attitude change. Functions of interpersonal and mediated communication in diffusion of information and in opinion formation.
- 5-721. MASS MEDIA IN A DYNAMIC SOCIETY.** (4 cr; prereq 1-201 or 3-121 for journalism majors, § for others) winter, spring
Economic, political, and social determinants of character and content of mass communications. Patterns of operations, effect on content, and relative social utility. Theory of mass society.

Landscape Architecture

See SCHOOL OF ARCHITECTURE AND LANDSCAPE ARCHITECTURE

Law School (Law)

125 Fraser Hall

CONTACT: D. Bryden, 125 Fraser Hall, 373-5815

- 5-201. LAND USE PLANNING.** (3 cr) [P. Martin, 373-5883] winter
Concerned with the public control of land use and development, primarily in metropolitan areas. Problems considered are of increasing importance to lawyers whose practice involves them in the affairs of local governments or in real estate transactions.
- 5-215. ENVIRONMENTAL REGULATION.** (3 cr) [D. Bryden, 125 Fraser Hall, 373-5815] winter, spring
Study of the legal aspects of major environmental problems, with basic introductory materials from other disciplines such as economics, engineering, and biological sciences. Topics will include air and water pollution, management of lakes, parks, open space, and scenic easements, drainage of wetlands, governmental organization for environmental protection, multiple use of federal lands, etc.
- 5-606. ADMINISTRATIVE LAW.** (4 cr) [G. Robinson, 133 Fraser Hall; C. Auerbach, 269 Fraser Hall, 373-2736] fall, spring
Function of administrative agencies in our society; legislative, judicial, and executive control of administrative agencies; interrelations of legislative, judicial, executive and administrative agencies in development of public policy. Most practitioners are likely to spend more of their time dealing with administrative agencies than litigating in court. The modern practice of law therefore requires a knowledge of the administrative process.
- 5-807. SEMINAR: NATURAL RESOURCES—CONSERVATION AND MANAGEMENT.** (4 cr) [D. Bryden, 125 Fraser Hall, 373-5815]
Intensive work on selected problems concerning environmental protection and resources.

Program and Course Descriptions

Department of Management and Transportation

School of Business Administration

868 Business Administration

CONTACT: A. K. Wickesberg, 804 Business Administration, 373-3846

MANAGEMENT (Mgmt)

3-004. BUSINESS POLICY: STRATEGY FORMULATION AND IMPLEMENTATION. (3 cr; prereq Sr and completion of business core or *final core course) [R. K. Gaumnitz, Business Administration, 373-3600] fall, winter, spring

Undergraduate level integrating course designed to develop skill in the general management function of determining corporate or divisional goals and in designing programs of action for achieving these goals. Class time is devoted almost exclusively to case analysis and discussion. Students are asked to apply data supplied in the case, as well as concepts and theories presented in this and other courses, to the solution of goal selection and strategy implementation problems. The viewpoint of the general line manager (department, division, or executive level) will be taken.

3-005. GOVERNMENT AND BUSINESS. (3 cr) not offered 1971-72

8-010. CORPORATE STRATEGY: DESIGN, IMPLEMENTATION. (3 cr, §3-004; content of this course makes it necessary to restrict admission to those with rather extensive preparation in business administration.) [R. K. Gaumnitz, Business Administration, 373-3600] winter, spring

TRANSPORTATION (Tran)

3-054. FUNDAMENTALS OF TRANSPORTATION. (3 cr; prereq Econ 1-002 or equiv) [F. Beier, 761 Business Administration, 373-5141] fall, winter, spring

Organization and economic aspects of the transportation system of the United States including rail, highway, air, pipeline, and water transportation. The nature of the transportation function in business. Regulatory problems associated with transportation. Current transportation development and problems.

5-134. TRANSPORTATION AND BUSINESS LOGISTICS. (4 cr) not offered 1971-72

5-196. TRANSPORTATION REGULATION AND NATIONAL POLICY III. (3 cr; prereq 3-054 or 8-154...5-194 recommended) [E. Nightingale, 770 Business Administration, 373-3581]

Analysis of current major issues, pertinent studies and reports in national policy and regulatory areas, including recent and proposed legislation and Congressional hearings thereon. ICC and CAB cost studies. Practice and procedure before the Interstate Commerce Commission. Evaluation of the impact of regulation and national policies on the economy. Role of Federal government as largest user of transportation services and as an operator of transportation facilities (MAC and MSTs). Individual research.

Department of Marketing and Business Law

School of Business Administration

1235 Business Administration

CONTACT: R. J. Holloway, 1235a Business Administration, 373-4407

MARKETING (Mktg)

8-820. SEMINAR: SOCIAL AND ECONOMIC ASPECTS OF MARKETING. (3 cr; prereq 8-000, #) [R. Holloway, 1235a Business Administration, 373-4407] fall

Department of Mechanical Engineering (ME)

Institute of Technology

125 Mechanical Engineering

CONTACT: P. L. Blackshear, Jr., 313 Mechanical Engineering, 373-3014

PROGRAM:

The Mechanical Engineering Department has an environmental option program to acquaint the student with the major environmental factors such as temperature, humidity, sound, air and water pollution and the engineering principles for analysis and control of each. Although emphasis is on principles, application to temperature control, humidification, dehumidification, refrigeration, gas cleaning, contamination control, industrial ventilation, sound control and water quality control are discussed. This program will provide a basic preparation for entry into such application areas as the heating, ventilating and air condition industry, air pollution measurement and control activities at the local, state and federal level and the manufacturing of pollution control equipment.

- ME 5-612 Environmental Engineering
- ME 5-603 Thermal Environmental Engineering
- ME 5-605 Refrigeration
- ME 5-613 Principles of Particle Technology
- ME 5-614 Principles of Particle Technology
- ME 5-607 Industrial Ventilation and Contamination Control
- CE 3-500 Introduction to Environmental Engineering
- CE 5-420 Introduction to Water Resources Management
- CE 5-510 Solids Waste Management
- PubH 5-151 Environmental Health
- PubH 5-211 Industrial Hygiene Engineering
- PubH 5-181 Introduction to Air Pollution

5-603. THERMAL ENVIRONMENTAL ENGINEERING. (4 cr; 4 lect per wk)

Thermodynamic properties of moist air; h-w diagram for moist air; solar radiation; heat and water vapor transmission in structures; effects of thermal environments upon people, processes, and materials; thermal loads, thermal environmental control systems. Background in Thermodynamics (ME 3-303) and Heat Transfer (ME 5-342) or equivalent is essential.

5-605. REFRIGERATION. (4 cr; 4 lect per wk)

Mechanical vapor compression systems; absorption systems; thermoelectric cooling; gaseous air cycle; steam-jet refrigeration. Liquefaction of air, hydrogen, and helium; production of oxygen and nitrogen by separation of air. Background in Thermodynamics (ME 3-303) essential.

5-607. INDUSTRIAL VENTILATION AND CONTAMINATION. (4 cr; 4 lect per wk)

Contaminants, dispersion mechanisms, transport, fans, hoods, gas cleaners, behavior of jets and sinks, closed and open systems, applications to industrial processing and emission control. Preparation in fluid mechanics (CE 3-400) and Thermodynamics (ME 3-303) or equivalent necessary.

5-612. ENVIRONMENTAL ENGINEERING. (4 cr; 4 lect per wk)

Basic principles of engineering assessment and control of emissions to air and water, noise measurement and control, and control, handling, and disposal of solid wastes. Upper division necessary.

5-613/5-614. PRINCIPLES OF PARTICLE TECHNOLOGY.

Definition, theory, and measurement of particle properties, particle statistics, fluid dynamics, optical, electrical, and thermal behavior of particles. Background Thermodynamics (ME 3-303) desirable (4 cr; 4 lect per wk)/Gas cleaning, particle transport, comminution, classification, surface properties, packed beds, powder behavior and miscellaneous topics (ME 5-613) essential. (4 cr; 4 lect per wk)

Program and Course Descriptions

Department of Microbiology (MicB)

College of Biological Sciences
1060 Mayo

PROGRAM:

For program options, see college bulletin.

- 5-105. BIOLOGY OF MICROORGANISMS.** (4 cr, §3-103; prereq 5 cr in biological sciences, Chem 3-301, 3-302, or §) [D. Klein, 354 Gortner Laboratory of Biochemistry, 373-1586; P. J. Chapman, 170 Gortner Laboratory of Biochemistry, 373-1264] fall, winter
Lectures, demonstrations, and laboratory exercises in taxonomy, anatomy, physiology, biochemistry, and ecology of microbes. Emphasis on fundamental properties of bacteria.

Department of Plant Pathology (PIPa)

College of Agriculture
304 Plant Pathology

- 5-220. WORLD FOOD SUPPLY PROBLEMS.** (4 cr; prereq major in agriculture, veterinary medicine, home economics, social science majors or §, agricultural economics grad by § only; same as AgEc 5-790, Soc 5-675, VM 5-790, and HE 5-381) [L. Martin, 326A Haecker Hall, 373-0955] spring
A multidisciplinary approach will examine the social, economic, and technical problems of feeding the world's growing population. Principles will be sought from the social and economic sciences, the plant sciences, and the animal sciences for their application to food problems.

Plant Physiology (PIPh)

Graduate School

- 5-702. MEASUREMENT OF PLANT-ENVIRONMENT INTERACTIONS.** (1 cr; prereq §) [E. I. Sucoff, 110c Green Hall, 373-0843]
Photosynthesis, Gas Exchange. A laboratory course dealing with measurements using intact plants, including water balance, energy budget, and gas exchange between plants and the environment.
- 5-703. MEASUREMENT OF PLANT-ENVIRONMENT INTERACTIONS.** (2 cr; prereq §) [E. I. Sucoff, 110c Green Hall, 373-0843]
Internal Water Balance. A laboratory course dealing with measurements using intact plants, including water balance, energy budget, and gas exchange between plants and the environment.

Department of Political Science (Pol)

College of Liberal Arts
1414 Social Sciences

- 1-025. WORLD POLITICS.** (4 cr) [E. Pirro, 1472 Social Sciences, 373-4054; R. Riggs, 1480 Social Sciences, 373-5061; C. Walcott, 1408 Social Sciences, 373-4074] fall, winter, spring
Introduction to contemporary international relations; forms of state interaction; problems of conflict and cooperation.
- 1-031. AMERICAN PUBLIC POLICY.** (4 cr) [G. Wynie, 1478 Social Sciences, 373-5223; R. Eystone, 1482 Social Sciences, 373-3233] fall, winter, spring
Analysis of policy to meet major foreign and domestic issues facing American political systems; emphasis on forces molding government policy on civil rights, labor, and business, military and diplomatic strategy, foreign aid.

School of Public Affairs

- 5-308. LEGISLATIVE PROCESS.** (4 cr; prereq 1-002 or #) |E. Shaw, 1408 Social Sciences, 373-5221; E. Eidenberg, 1331 Social Sciences, 373-2628| fall, spring
The American Congress and state legislatures, internal organization, the committee system, party leadership; relationships with executives and administration agencies; legislative policy-making; interest group, party and constituency influences on the legislative process.
- 5-309. JUDICIAL PROCESS.** (4 cr; prereq 1-002 or #) |S. Kristov, 1414a Social Sciences, 373-2651; F. Sorauf, 1327 Social Sciences, 373-0200| winter
Structure of American judiciary; selection of judges; process of litigation; influences on judicial decisions; impact of and compliance with decisions; role of Supreme Court in American political system.
- 5-328. METROPOLITAN GOVERNMENT AND POLITICS.** (4 cr; prereq 1-002 or #) |T. Scott, 1414b Social Sciences, 373-2651|
Analysis of contemporary metropolitanism; development and definition of major metropolitan problems; analysis of governmental-political responses to such problems including development of federal and state programs; discussion of the politics of metropolitan reform efforts.
- 5-321. GOVERNMENT AND ECONOMIC ORDER.** (4 cr; prereq 1-002 or #) |R. Eyestone, 1482 Social Sciences, 373-3233| spring
Analysis of economic policy-making processes; examination of several major substantive policy issues, such as fiscal policy, monetary regulation of economic activities; assessment of impact of governmental activity upon the private economic sector.
- 5-322. AMERICAN SOCIAL POLICY.** (4 cr; prereq 1-002 or #) |M. Gieske, 327 Johnston Hall, 373-5461| fall
This course will examine American government actions which importantly affect the distribution of desired benefits (health care, education, housing, transfer payments) and burdens (taxation, regulation of conduct, social stigma). The focus will be on the relation between government actions and social problems, but analysis will not be restricted to programs whose ostensible concern is health, education, and welfare. Attention will also be given to assisting the prospects for change.
- 5-877. COMPARATIVE FOREIGN POLICY.** (3 cr) |P. Hopmann, 1246 Social Sciences, 373-2691| winter, spring
Comparative analysis of the foreign policies of major states; national and international determinants of foreign policy behavior.

School of Public Affairs (PA)

College of Liberal Arts

314 Social Sciences

CONTACT: J. E. Brandl, 314 Social Sciences, 373-2653

- 8-130. SEMINAR: SCIENCE, TECHNOLOGY, AND PUBLIC POLICY.** (3 cr; prereq #) |V. Arnold, 331 Social Sciences, 373-7572| winter
Analysis and discussion of major public policy issues in the areas of science and technology, including assessment of effectiveness of existing programs; consideration of policy alternatives and analysis of their consequences.
- 8-140. SEMINAR: NATURAL ENVIRONMENT POLICY.** (3 cr; prereq #) |V. Arnold, 331 Social Sciences, 373-7572; J. Borchert, 311 Walter Library, 373-7833| spring
- 8-204. PUBLIC ECONOMY.** (3 cr; prereq #) |W. Heller, 1130 Business Administration, 373-5028| spring

Public Health

See DEPARTMENT OF ENVIRONMENTAL HEALTH

Program and Course Descriptions

Resource and Community Development (RCD)

College of Agriculture

CONTACT: D. White, 280 Coffey Hall, 373-0921

PROGRAM:

The program in Resource and Community Development prepares students for careers in resource development: community development; public land use; rural and urban zoning; conservation; recreation; resource economics and sociology; environmental design; and related discipline areas.

The program is offered at the institute level, relying on interdisciplinary effort, in an endeavor to focus the complementary discipline areas of agriculture and forestry on planning and administrative training. This relates the traditional specialties of applied resource development and management as well as the social and economic specialties to expanding contemporary needs. In addition to a selected specialty, students acquire a broad background in supporting areas.

Below are listed the persons to contact for specific majors:

Landscape Architecture—J. Kuska, 373-1663; R. Mullin, 373-1218

Recreation and Resource Management—L. Merriam, 373-0847

Resource Economics—W. Maki, 373-0947; L. Martin, 373-0955

Soil and Water Resource Management—E. Allred, 373-1342; Rouse Farnham, 373-1447

For further information consult the college bulletin or Donald White.

1-010. ISSUES IN THE ENVIRONMENT. (3 cr) [R. Adams, Jr., 117 Plant Science, 373-1361] fall, winter, spring

Interdisciplinary offerings designed to explore five areas of environmental concern: aspects of environmental design which provide maximum compatibility of man with his 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. This is a televised course involving 20 taped lectures and 10 discussion periods. Cooperative offering available at several Minnesota institutions.

5-100/5-101. INTERDISCIPLINARY SEMINAR. (Cr or for 5-100 4 cr for 5-101 [+5-100, 5-101]; prereq Sr RCD for 5-100...5-100 for 5-101) [D. White, 280 Coffey Hall, 373-0921] winter/spring

5-110. SPECIAL PROBLEMS IN RESOURCE AND COMMUNITY DEVELOPMENT. (1-4 cr, no more than 12 total; prereq RCD sr, #)

Projects, plans, and written reports related to RCD 5-100, 5-101; resource and environmental inventory and analysis.

Social Science Program (SSci)

College of Liberal Arts

232 Social Sciences

CONTACT: H. Berman, 232 Social Sciences, 373-3507

3-101/3-102/3-103. THE MEANING OF HUMANITY; SOCIETY AND TECHNOLOGY; COMMUNITY. (4 cr each qtr) [M. Roshwald, 256 Social Sciences, 373-4611] fall/winter/spring
3-101: The problem of the essence of man and the factors determining his course is explored through a variety of theories such as those of Marx, Freud, Plato. 3-102: The impact of technology on human conditions and the attitude of man to technology are examined, both philosophically and sociologically. 3-103: This course deals with the meaning of man as a social being and with the variety of groups in which human beings participate

Department of Sociology

- 3-402. ECOLOGY, TECHNOLOGY AND SOCIETY.** (4 cr) [J. E. Anderson, 235 Mechanical Engineering, 373-5548] fall, winter, spring
An examination of the impact of technology on society as seen by engineers, scientists and social scientists. The social problems associated with economic growth such as environmental consequences, the arms race, food and fertilization and population growth will be explored. Alternative strategies for meeting the problems will be examined.
- 3-503. URBAN CRISIS.** (5 cr; prereq Δ) [G. Glover, 235 Social Sciences, 373-4613] fall, spring
An examination of the effects of white racism and projections of the image of white supremacy on the socio-economic and political life chances of black people in America followed by examination of the nature of and bases for social unrest in Minneapolis. Will combine classroom work and field experience.
- 3-981. SOCIETIES OF THE FUTURE.** (4 cr) [A. M. Harkins, 139d Burton Hall, 373-3187] fall, winter, spring
Application of disciplinary analysis to the problems of specialization and generalization of human understanding, with emphasis upon the future of formal and informal social systems. Aspects of the anticipated impacts of long-range social trends (such as computer controlled education systems, political, economic, social, and moral structural changes). Interaction of the social sciences, business, and humanities and arts with basic facets of long-range social development. Long-range alternatives pertaining to human societies remain open to examination.
- 5-101/5-102. STEADY STATE EARTH: GOALS AND CONSTRAINTS.** (2-3 cr each qtr) [P. L. Blackshear, Jr., 313 Mechanical Engineering, 373-3014] fall, winter, spring
Examination by an interdisciplinary group of faculty of the goals and constraints necessary for a unified society to evolve. A steady state society is one which approximates zero population growth and zero gross national product increase without exploiting the remaining natural resources.
- 3-991/3-992/3-993. SEMINAR IN ALTERNATIVE FUTURES.** (4 cr each qtr) [A. M. Harkins, 139d Burton Hall, 373-3187] fall, winter, spring
Interdisciplinary examination of probable and possible human futures, including the following areas of concentrations: "pure" social imaging; applied social imagination; social technology. Emphasis upon the development of usable cross- and trans-disciplinary concepts and terminology.

Department of Sociology (Soc)

College of Liberal Arts
1114 Social Sciences

CONTACT: G. W. Bohrnstedt, 1114a Social Sciences, 373-2642

- 5-301. SOCIAL MOVEMENTS IN A CHANGING SOCIETY.** (4 cr; prereq 1-001 or # or 1-005, 1-006) not offered 1971-72
Examination of factors underlying social change in modern mass society. Consideration of recent research on social movements, reform and revolution, culture contact, impact of rapid technological change. The individual and social structure under conditions of rapid social change.
- 5-551. WORLD POPULATION PROBLEMS.** (4 cr; prereq 1-001 or 1-005, 1-006 or #) [R. Kennedy, 1148 Social Sciences, 373-2610] fall, winter
Population policy, both historical and present day, in Europe, Asia, and other selected areas but with special emphasis on the United States. Some discussion is given to field of population and power politics.
- 5-555. POPULATION THEORY.** (4 cr; prereq 5-551 or #) [R. Kennedy, 1148 Social Sciences, 373-2610] spring
Emphasizes cultural and social phases of population change; particular reference to birth rates, death rates, and migration. Implications of population change.
- 5-605. URBANIZATION AND SOCIAL POLICY.** (4 cr; prereq 5-601 or #) [D. Cooperman, 1178 Social Sciences, 373-4653] fall
An examination of contemporary changes in urban processes that are considered problematic and the responses and policies of public groups. Analysis of interrelationships of social, cultural, economic, political factors in development of urban problems. Study of models of urban systems and social policy formation. Methods of social cost analysis and formation of policy alternatives.

Program and Course Descriptions

5-675. WORLD FOOD SUPPLY PROBLEMS. (4 cr; prereq major in agriculture, veterinary medicine, home economics, social science majors or \pm ; agricultural economics grad by $\#$ only; same as PiPa 5-220, AgEc 5-790, VM 5-790, and HE 5-381) [L. Martin, 326A Haecker Hall, 373-0955] spring

A multidisciplinary approach will examine the social, economic, and technical problems of feeding the world's growing population. Principles will be sought from the social and economic sciences, the plant sciences, and the animal sciences for their application to food problems.

Department of Soil Science (Soil)

College of Agriculture
125 Soil Science

CONTACT: Russell S. Adams, Jr., Soil Science, 373-1361

PROGRAM:

See below for courses of environmental interest for majors and minors in Soil Science.

The Department of Soil Science has divided its environmentally-related courses into two categories: those of primary environmental interest which are indicated below with a double asterisk (**), and those of secondary environmental interest which should be taken only by students with a major or minor in Soil Science.

1-122. INTRODUCTORY SOIL SCIENCE.** (4 cr, §1-110; prereq Chem 1-005) [H. Arne-
man, 301 Soil Science, 373-1442] fall, winter, spring

Basic physical, chemical, and microbiological properties of soil. Soil genesis, classification, and principles of soil fertility. Lectures, laboratory.

1-262. INTRODUCTION TO METEOROLOGY. (4 cr; same as Geog 1-425) [D. Baker, 101A
Plant Science, 373-1356; R. Skaggs, 546 Social Sciences, 373-5435] fall

Precalculus introduction to nature of the atmosphere and its behavior. Topics include 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.

3-118. SEMINAR: SOIL POLLUTION AND PUBLIC POLICY.** (1 cr) [R. Adams, Soil Science,
373-1361] offered fall, 1972

Round table discussions on assigned readings of subject matter.

3-218. SEMINAR: SOLID DRAINAGE AND IRRIGATION AND THEIR EFFECT ON THE EN-
VIRONMENT.** (1 cr; P-N only) [G. Blake, 333 Soil Science] winter; offered alt yrs

Round table discussions and assigned readings on subject matter.

3-220. SOIL AND WATER MANAGEMENT AND CONSERVATION. (3 cr; prereq 1-122) [J.
Swan, 25 Soil Science, 373-1060] spring

Principles of soil water; temperature and aeration; their effect on plant growth, and interaction with other soil properties. Effect of soil tillage methods and cropping systems on structure and erosion control, water storage, and water infiltration. Techniques and organization involved in soil and water conservation. Field trips, consultation, and reference work.

3-418. SEMINAR: LEACHING AND RUNOFF OF FERTILIZERS.** (1 cr) [A. Caldwell, 217
Soil Science] offered winter, 1972

Round table discussions on assigned readings on the subject matter.

3-528. SEMINAR: USE AND INTERPRETATION OF SOIL SURVEYS.** (1 cr; P-N only) [H.
Arne-man, 301 Soil Science, 373-1442] fall; offered alt yrs

Round table discussions on assigned readings on the subject matter.

5-114. SPECIAL PROBLEMS IN SOILS.** (1-5 cr per qtr, 10 cr max; prereq 1-122 or 5-122)
fall, winter, spring, SSI, SSI

Research, readings, instruction.

5-220. SOIL AND WATER MANAGEMENT AND CONSERVATION. Same as 3-220.

- 5-240. MICROCLIMATOLOGY.** (3 cr; prereq Math 1-111, 1 yr physics) [D. Baker, 101A Plant Science, 373-1356]
Meteorology and climatology in relation to soil-atmosphere interface; soil microclimate, physical processes taking place within the microclimate, modification of microclimate by agricultural practices. Weather instruments and use of climatic data.
- 5-340.** ORGANIC AND PESTICIDAL RESIDUES.** (5 cr; prereq 1-122, 6 cr biochemistry and/or organic chemistry) [R. S. Adams, Soil Science, 373-1361] fall
Examination of the fate of natural and synthetic organic materials in soil, with emphasis upon the chemical, physical, and biological factors of the soil which influence decomposition or persistence. Discusses soil pollution from crop wastes, manures, sewage, petroleum hydrocarbons, detergents, and pesticides.
- 5-512. SOIL GEOGRAPHY.** (4 cr; prereq 1-122; lect, lab, and field trips) [R. Farnham, 303 Soil Science, 373-1447] spring
Introduction to soil morphology and classification as essential to understanding distribution patterns of soils. Primary emphasis on soil geography of the state, region, United States, and the world. Interpretation of this geography with the use of soil maps and aerial photographs in various types of resource development.
- 5-532.** SOILS AND THE ECOSYSTEM.** (5 cr; limited to 20 students; prereq course in ecology; Itasca) [R. Farnham, 303 Soil Science] spring, SSI
The formation and distribution of soils in relationship to vegetation, climate, and other soil-forming factors. The interrelationships of soils in the ecosystem.
- 5-540.** SOIL RESOURCES AND LAND USE.** (4 cr; prereq 1-122 or ♯) [L. Hanson, 33 Soil Science, 373-1061]
Examines current kinds of soil resource evaluations and contrasts these evaluations with those of the past. Presents land use patterns in terms of discussion of the interaction of technology and soil resources. Lecture and case study projects on land use of specific soil resource areas.
- 5-550. ORGANIC SOILS.** (3 cr; prereq 1-122 or 5-122) [R. Farnham, 303 Soil Science] winter
Formation, classification and properties of organic soils, their use and management. Lectures and laboratory.

Speech Science, Pathology, and Audiology

See DEPARTMENT OF COMMUNICATION DISORDERS

Institute of Technology (IT)

107 Main Engineering

CONTACT: Richard Goldstein, 240 Mechanical Engineering, 373-2042
Dean Abrahamson, 243 Space Science Center, 373-4849 or
373-7756

PROGRAM:

No programs are offered at the Institute level, but several are offered by various departments within the Institute of Technology. See the Departments of Aerospace Engineering and Mechanics, Agricultural Engineering, Chemical Engineering and Materials Science, Civil and Mineral Engineering, and Mechanical Engineering for the program options in those departments.

The Institute of Technology has, however, the means whereby experimental courses that are interdisciplinary in nature can be offered with an IT number. The first such course is listed below.

- 5-411, 5-412, 5-413. NEW CONCEPTS IN URBAN TRANSPORTATION.** (4 cr/qr) [for information contact J. E. Anderson, 235 Mechanical Engineering, 373-5548] fall/winter/spring

This interdisciplinary three-quarter course sequence will be offered during the 1971-72 academic year. Instructors are from the disciplines of Aerospace Engineering and

Program and Course Descriptions

Mechanics, Applied Economics, Architecture, Civil Engineering, Geography, Mechanical Engineering, Political Science, and Sociology. The course is intended for seniors and graduate students in the Institute of Technology and the Social Sciences. The first quarter is an introduction to urban transportation with an emphasis on personal rapid transit as a means for solving the urban transportation problem. The second two quarters are a technology assessment of personal rapid transit.

Transportation

See DEPARTMENT OF MANAGEMENT AND TRANSPORTATION

University College (UC)

106 Nicholson Hall

CONTACT: A. L. Vaughan, 106 Nicholson Hall, 373-4638

PROGRAM:

The University of Minnesota has a long tradition of courses related in a variety of ways to the understanding of urban settlement and problems, courses which are offered in a wide assortment of departments and colleges. There also exists a successful history of tailoring interdisciplinary undergraduate study to the interests of individual students through the University College. The University College has generally organized specific groupings of courses, from all parts of the University, which may be combined to form coherent BA programs in Urban Studies. For further information consult the University College.

3-075. INDEPENDENT STUDY. (3 to 15 cr)

This course can be used for any interdisciplinary independent study; it is not for environmental studies only.

College of Veterinary Medicine

256 Veterinary Science Building

CONTACT: S. Diesch, Veterinary Science Building, 373-1125

Courses from the following departments in the College of Veterinary Medicine are listed below:

Veterinary Microbiology and Public Health (VMic)

Veterinary Medicine (VM)

Veterinary Pathology and Parasitology (VPaP)

They have been grouped together for convenience.

VM 3-502. ANIMAL HYGIENE. (5 cr; not open to veterinary medical students) [D. Sorensen, 111 Clinic, 373-0812]

Principles of animal health and disease with emphasis on prevention, control, and eradication.

VM 5-790. WORLD FOOD SUPPLY PROBLEMS. (4 cr; limited enrollment; prereq major in agriculture, veterinary medicine, nutritional sciences, social sciences, social science field or #; grad students by / only; same as AgEc 5-790, HE 5-381; PIPa 5-220, and Soc 5-675) [H. Stoddard, 301 Veterinary Science, 373-1152] spring

A multidisciplinary approach will examine the social, economic, and technical problems of feeding the world's growing population. Principles will be sought from the social and economic sciences, the plant sciences, the animal sciences, and the nutritional sciences for their application to food problems.

Department of Zoology

- VMic 5-410. PROBLEMS IN VETERINARY BACTERIOLOGY AND PUBLIC HEALTH.** (Cr ar; prereq 5-103, #) [S. Diesch, Veterinary Science Building, 373-1125]
- VMic 5-210. VETERINARY EPIDEMIOLOGY.** (4 cr; prereq 10 cr biology, 12 cr chemistry, or #) [S. Diesch, 346 Veterinary Science Building, 373-1125] spring
Principles of epidemiology, ecology, and veterinary public health. Biostatistics applied to the measurement of health and disease in populations.
- VMic 5-320. COMPARATIVE MEDICINE AND PUBLIC HEALTH.** (2 cr; prereq PubH 5-002 or #) [S. Diesch, 346 Veterinary Science Building, 373-1125] winter
Man's relationship to biologic environment. Interrelationships of animal and human health; occurrence of animal diseases, ecology of zoonoses, food production and hygiene, laboratory animal medicine.
- VPaP 5-104. DISEASE OF WILDLIFE.** (3 cr; prereq #) [J. C. Schlotthauer, 205 Veterinary Science Building, 373-0794]
Economic and biologic relationships of infectious and non-infectious diseases of wildlife.
- VPaP 5-103. PARASITES OF WILDLIFE.** (3 cr; prereq #) [H. Griffith, 205 Veterinary Science Building, 373-0792] spring
Economic and biologic relationships of protozoa, helminths and arthropods to wildlife.

Department of Zoology (Zool)

College of Biological Sciences

108 Zoology

CONTACT: D. E. Gilbertson, 9 Zoology, 373-7987

PROGRAM:

See program options in college bulletin.

- 5-170. PHYSIOLOGICAL ECOLOGY.** (4 cr; prereq 5-104 or Biol 3-041, 5-051, stat rec, #) [W. Schmid, 3 Zoology, 373-3966] spring
- 5-814. NATURAL HISTORY OF INVERTEBRATES.** (5 cr; prereq 15 cr in Zoology; Itasca) [D. E. Gilbertson, 9 Zoology, 373-7987] SS1
Taxonomic and ecological survey of local fauna, detailed and independent ecological study of several taxonomic groups.
- 5-819. NATURAL HISTORY OF THE VERTEBRATES.** (5 cr; prereq 15 cr in zoology; Itasca) [J. Underhill, S4 Zoology, 373-3658] SS1
Taxonomic and biological survey of the local fauna, detailed and independent study of the vertebrate classes, exclusive of the birds.

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Course Abbreviations Used In This Bulletin

AEM, Aerospace Engineering and Mechanics	Hum, Humanities
AgEc, Agricultural and Applied Economics	IR, Industrial Relations
AgEn, Agricultural Engineering	IT, Institute of Technology
AnSc, Animal Science	Jour, Journalism and Mass Communication
Anth, Anthropology	LA, Landscape Architecture (courses listed under Architecture and Landscape Architecture)
Arch, Architecture	Law, Law
BA, Business Administration	ME, Mechanical Engineering
Biol, General Biology Program	Mgmt, Management
BLaw, Business Law (courses listed under Marketing and Business Law)	MicB, Microbiology
Bot, Botany	Mktg, Marketing
CDis, Communication Disorders	PA, Public Affairs
CE, Civil and Mineral Engineering	PIPa, Plant Pathology
ChEn, Chemical Engineering and Materials Science	PIPh, Plant Physiology
Ecol, Ecology and Behavioral Biology	Pol, Political Science
Econ, Economics	PubH, Public Health
Ent, Entomology	RCD, Resource and Community Development
FBio, Forest Biology (courses listed under Forestry)	Soc, Sociology
FRD, Forest Resources Development (courses listed under Forestry)	Soil, Soil Science
FSci, Food Science and Industries	SSci, Social Science
FW, Fisheries and Wildlife (courses listed under Entomology, Fisheries and Wildlife)	Tran, Transportation (courses listed under Management and Transportation)
GC, General College	UC, University College
GCB, Genetics and Cell Biology	VM, Veterinary Medicine
Geo, Geology and Geophysics	VMic, Veterinary Microbiology and Public Health (courses listed under Veterinary Medicine)
Geog, Geography	VPaP, Veterinary Pathology and Parasitology (courses listed under Veterinary Medicine)
HE, Home Economics	Zool, Zoology
Hort, Horticultural Science	