Course Descriptions

Listings in this section are grouped according to discipline or rubric, and rubrics are listed alphabetically. In addition to an actual description of the course, each listing includes course credit, mode of instruction and prerequisite, if any. While the quarters each course is offered are also shown (A—autumn, W—winter; S—spring, Su—summer), you should consult the Schedule of Classes, published prior to pre-registration each quarter, for the most up-to-date information on course availability.

Course Description Information

Course offerings are subject to the availability of staff and adequate enrollment. Consult the schedule of classes to determine the courses actually offered each quarter.

Numbering System

001-099—courses below college level. No college credit given. Credits may not be counted toward a degree.
100-199—Freshman—Lower Division
200-299—Sophomore—Lower Division
300-399—Junior—Upper Division
400-499—Senior—Upper Division
500-599—Graduate Courses (except senior, 5th-year courses in the School of Architecture)
600-699—Graduate Courses

Core Courses

Core courses are designated by a letter following the course number (e.g. Engl 1221C). The following letters are used to specify the core groups:

C—Communications
F—Fine Arts and Humanities
M—Mathematics
N—Natural Sciences
S—Social Sciences
T—Technology

Classification of Courses

In the second line of each course description, following the number of credits for the course, there appears a course classification designation which indicates the mode of instruction for that course. In some cases two classifications are listed along with the number of credits in each classification.

Following is an explanation of course classifications.

Lect.—Lecture: Presentation of course material by the instructor, utilizing the lecture method.
Lab—Laboratory: Instructing and supervising students in laboratory investigations.
St.—Studio: Instructing and supervising students in studio investigations.
Rec.-Dis.—Recitation-Discussion: Presentation of course materials designed to involve students in recitation and/or discussion.
Sem.—Seminar: Students share, with the instructor, responsibility for preparation and presentation of course material.
Ind. St.—Independent Study: Directed study and/or research on an individual basis, under supervision of instructor.
Tut.—Tutorial: Individualized instruction. Students work one-to-one with the instructor.

Prgm. Ins.—Programmed Instruction: Presentation of course materials by programmed methods.

Graduate Credit

Courses which may be taken for graduate credit are designated by a 500 or 600 number.

Uniform Course Numbers

Uniform numbers are used in all departments for undergraduate and graduate credit:

200, 300, 400 and 500—Seminar
270, 470 and 570—Individual Problems (individual projects)
280, 480 and 580—Special Topics (group project)
475—Undergraduate Projects
276, 476 and 576—Internship
575—Graduate Research Paper (professional paper or professional project)
589—Graduate Consultation
590—Master's Thesis
689—Reading and Research
690—Doctoral Thesis

These courses may be repeated for credit. Specific titles of Special Topics courses are listed in the Schedule of Classes, on the Class Rolls and the student's permanent record.

Some courses such as Special Topics, Individual Problems and Internship are offered for varying amounts of credit, e.g. 1-5. A maximum number of credits is also imposed, e.g. Maximum 6 cr. A student may repeat such courses to earn the maximum number of credits by registering for two or more projects with credits for each...
project totaling the maximum allowed. Credits earned beyond the maximum cannot be applied toward graduation.

Special Topics and Individual Problems Courses

The maximum number of credits allowed toward graduation in 280 plus 480 courses in each rubric is 16, and the maximum number of 470 credits in each rubric is six. Some departments have established lower limits than these, and the student is responsible for checking the specific course listings to see that he or she does not exceed the allowable number of credits. The maximum number of 570 credits applicable to a graduate degree depends upon the degree. No 470 credits are applicable to a graduate degree.

Courses Offered on Demand

A course designated as "On demand" with a specific quarter (i.e., A, W or S, etc.) preceding this phrase means that the course will be offered that quarter if there is sufficient demand.

Undergraduate courses designated as given "On demand" may be offered any quarter in which there is a sufficient number of students who wish to register for the course. Usually undergraduate courses are offered at the request of 10 or more students.

Graduate courses listed "On demand" will be offered when a sufficient number of students have requested the course and faculty availability and budgets permit.

Courses Offered Alternate Years

Certain courses for which there is a small demand are offered every other year. The designation for such a course is: Quarter (Alternate years, will be offered . . . . dates . . . .).

Undergraduate Course Prerequisites

Courses beyond the freshman year usually have "prerequisites." This means that certain lower-level courses must be taken before the student may register for the advanced course.

The prerequisite for undergraduate courses may be "consent of instructor." The student must secure the permission of the instructor of the course before registering for it. "Consent of instructor" is usually required for courses in which there is limited laboratory space and/or equipment or in which specific skills are required.

Graduate Course Prerequisites

Courses at the 500 and 600 levels may be taken only by qualified students. Unless otherwise stated under course prerequisites, graduate level courses are open only to:

1. Students with graduate standing (post baccalaureate students admitted to the College of Graduate Studies, enrolled in non-degree status or second bachelor's degree candidates),
2. Seniors with a cumulative grade-point average of 3.25 or higher, and
3. Other seniors who have a petition approved by the head of the department offering the course, the head of the student's major department, and the Dean of the College of Graduate Studies.

Some courses are limited to students with graduate standing or certain levels of graduate standing. These specific conditions are indicated within the course prerequisite or description statements.

Students below senior standing are not eligible to take graduate-level courses.

Agriculture

994-3681

Agr 100 Agricultural Orientation
A. 1 cr. Lect.
An orientation and guidance course. Acquaints students with educational and research programs in agriculture, agricultural occupations and current affairs in agriculture. Not recommended for upper-class students majoring in agriculture.

Agricultural Economics

Department of Agricultural Economics and Economics
994-3701

Head of Department: Dr. M. J. Watts.


Associate Professors: M.D. Copeland, M.J. Watts, D.J. Young.

Assistant Professors: H.M. Babb (Ext.), M.D. Frank, D.A. Griffith (Ext.), J.T. LaFrance.

AgEc 103 Economics of American Agriculture
W. 4 cr. Lect.
The impact of supply and demand on agriculture, prices, decision making by farmers and ranchers, international trade, agricultural policy, and the importance of inflation and recessions to agriculture. Examples are drawn from Montana agriculture. AgEc 103 can be used instead of Econ 105 where Econ 105 is required as a prerequisite for other Econ courses. Open to all students.

AgEc 280 Special Topics
On demand. 1-5 cr. Maximum 8 cr. Maximum of AgEc 280 plus AgEc 480, 10 cr.

Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

AgEc 300 Seminar: Contemporary Economic Problems
A.W.S. 1 or 2 cr. Sem. Maximum 8 cr.

Current agricultural problems and current writings of people in the profession. Topics vary each quarter; students should check with the department before registering.

AgEc 321 Economics of Agricultural Marketing
A.S. 4 cr. Lect.
PREREQUISITE: Econ 204.

Problems in marketing agricultural products and the economic principles that assist in analysis of these problems. Marketing systems, market functions, agencies and problems of Montana products in particular.

AgEc 337 Agricultural Law
W. 4 cr. Lect.
PREREQUISITE: AgEc 341 and junior standing.

Application of general principles of law to ownership and operation of farming business and its relationship with other agri-business firms, government agencies and people. Emphasis on methods of acquisition and disposal of farm property; alternative forms of organizing farm business; family estate planning; tax management; water law; and general principles of commercial law related to contracts, agency and torts.

AgEc 341 Farm and Ranch Management
A.W.S. 4 cr. Lect.
PREREQUISITE: AgEc 341 and junior standing.

Problems in marketing agricultural products and the economic principles that assist in analysis of these problems. Marketing systems, market functions, agencies and people. Emphasis on methods of acquisition and disposal of farm property; alternative forms of organizing farm business; family estate planning; tax management; water law; and general principles of commercial law related to contracts, agency and torts.

AgEc 345 Agricultural Finance and Credit Analysis
A. 4 cr. Lect.
PREREQUISITE: AgEc 341.

Alternatives available to farmers for acquiring and maintaining control over resources used in agricultural production. Emphasis is on the management of cash, credit, debt, taxes and interest in relation to agricultural price levels and general economic conditions.

AgEc 351 Economics of Agricultural Policy
W. 4 cr. Lect.
PREREQUISITE: Econ 204.

Economic problems of American agriculture and an examination of government policy as a means of solving such problems.

AgEc 423 Agricultural Market Structure
W. 2 cr. Lect. (First 5 weeks of quarter.) PREREQUISITE: AgEc 321.

An introduction to the concepts of market structure, conduct and performance. Emphasis will be placed on market power, role of price, vertical integration, cooperative organization, and collective bargaining in agriculture. This material provides a necessary background to solving commodity-specific marketing problems.
AgEc 424 Applied Grain Marketing
W. 2 cr. Lect. (Second 5 weeks of quarter.)
PREREQUISITE: AgEc 423.
Structure and organization of the world grain industry. Application of economic theory to grain marketing problems. Development of alternative producer marketing strategies including use of future contracts.

AgEc 425 Applied Livestock Marketing
W. 2 cr. Lect. (Second 5 weeks of quarter.)
PREREQUISITE: AgEc 423.
Analysis and evaluation of existing livestock and meat marketing problems specific to beef and pork in the Montana and U.S. markets. Areas of concern include the livestock and meat trade, cattle price cycles, meat imports, producer use of economic outlook forecasts, and evaluating producer marketing alternatives such as the futures market.

AgEc 441 Agricultural Production Economics
A. 4 cr. Lect.
PREREQUISITES: Econ 304 and Math 170.
Static economic analysis of agricultural response functions, enterprise choice, cost functions, resource valuation, and size and scale economies. Introduction to decision theory and linear programming.

AgEc 442 Farm Planning and Management
S. 4 cr. Lect.
PREREQUISITES: AgEc 341 and Math 155.
Application of linear programming to optimization problems encountered in planning and managing farms, ranches and related agricultural businesses. Emphasis will be on models to determine optimal combinations of crop and livestock enterprises and least-cost ration formulation. Other applications of linear programming will also be covered.

AgEc 445 Financial Management and Analysis in Agriculture
W. 4 cr. Lect.
PREREQUISITES: AgEc 345 and a course in statistics.
Capital theory and the role of financial markets in agriculture. Modeling of farms and ranches for investment analysis. Emphasis is on intermediate and long-term investments under risks related to agricultural prices and economic conditions.

AgEc 467 Quantitative Methods in Economics
A. 4 cr. Lect.
PREREQUISITES: Econ 304, Math 155 or 221.
Optimization models in economics under the assumption of certainty. Linear programming and its extensions analyzed as economic models. Emphasis on formulating economic problems in terms of quantitative models. Input-output models are briefly discussed.

AgEc 470 Individual Problems
On demand. 1-4 cr. Ind. St. Maximum 6 cr.
PREREQUISITES: Consent of instructor and department head.
Directed research and study on an individual basis. Student is responsible for filing two copies of memo of agreement with supervising faculty member by end of first full week of quarter. Memo will be treated as a contract and must be acceptable to both student and supervising faculty member.

AgEc 476 Internship
PREREQUISITES: Junior standing and consent of instructor.
On-the-job training and experience in a specific area of the student's interest. The student will be working, under the supervision of a faculty member, in either a suitable agribusiness-related firm or an agriculture-related government agency. In all cases, a final report will be required.

AgEc 480 Special Topics
On demand. 1-4 cr. Lect. Maximum 16 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Graduate Courses in Agricultural Economics
There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

AgEc 512 Production Economics
A. 4 cr. Lect.
PREREQUISITE: Econ 304.
Fundamentals of production economics. Theory of the firm applied to problems of product supply, factor demand and resource allocation. Both constant and flexible product and factor price cases considered. Theoretical properties and empirical viability of common production function models are explored.

AgEc 513 Agricultural Business Finance
W. 4 cr. Lect.
PREREQUISITE: AgEc 345 or Fin 306.
Application of principles of finance to commercial agriculture. Emphasis on financial analysis of agricultural firms, valuation procedures for agricultural investments, risk and liquidity management, costs of capital and financial leverage. The intent is to give students an understanding of the tools and research methods used in agricultural business finance.

AgEc 514 Agricultural Price Analysis
S. 4 cr. Lect.
PREREQUISITES: Econ 304 and 561.
Analytic and working knowledge of agricultural market prices in the dimensions of time, space and form. Analysis of various commodity models will be included and supported by statistical modeling of prices under conventional econometrics, time series analysis and price forecasting method evaluation.

AgEc 570 Individual Problems
PREREQUISITES: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies.
Directed research and study on an individual basis. Student is responsible for filing two copies of memo of agreement with supervising faculty member by end of first full week of quarter. Memo will be treated as a contract and must be acceptable to both student and supervising faculty member.

AgEc 580 Special Topics
On demand. 1-4 cr. Maximum 15 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

AgEc 589 Graduate Consultation
A,W,S,Su. 3 cr. Tut.
PREREQUISITES: Master's standing and approval of the Dean of Graduate Studies.
This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) for a master's degree but who need additional faculty help or time.

AgEc 590 Master's Thesis
A,W,S,Su. 3-12 cr. Ind. St. May be repeated.
PREREQUISITE: Master's standing.

AgEc 690 Doctoral Thesis
A,W,S,Su. 3-12 cr. Ind. St. May be repeated.
PREREQUISITE: Doctoral standing.
AgEd 327 Agricultural Mechanics II for Teachers
S. 4 cr. Lect. 1; Lab. 3.
PREREQUISITE: AgEd 326.
- Development of knowledge and skills in areas of farm conveniences and buildings including concrete, masonry, plumbing, sanitation, and concepts in agricultural materials handling. Safety and lab management is stressed.

AgEd 400 Seminar
A,S. 1-2 cr. Sem. Maximum 4 cr. More than one registration per quarter is permitted.
PREREQUISITE: AgEd 250.
- Review and discussion of current literature on the teaching of vocational agriculture education. Each student will prepare and give one or more presentations.

AgEd 406 (IA 406) Program Development for Agricultural and Industrial Arts Teachers
W,S. 4 cr. Lect.
PREREQUISITES: EdEd 410, 411, 413.
- Determining appropriate industrial arts and vocational agriculture curriculum based on an analysis of student and community needs. Organizing subject matter materials and laboratory resources to promote effective teaching and learning. The organization and administration of school laboratories is also included.

AgEd 408 Planning, Organizing and Teaching Adult Programs in Agricultural and Industrial Settings
W,Su on demand. 1-3 cr. Lect. Maximum 6 cr.
PREREQUISITE: Senior standing.
- Identifying the educational needs of adults residing in rural communities. Rural organizations, leadership training in methods of organizing and conducting adult programs and classes in rural communities.

AgEd 414 Advanced Agricultural Mechanics I for Teachers
W. 4 cr. Lect. 2; Lab. 2.
PREREQUISITE: AE 231 Soil and Water Engineering I.
- Directed study on an individual basis. Student must initiate, the first week of quarter, a written proposal on nature of work with staff member with whom he or she plans to work.

AgEd 418 Advanced Agricultural Mechanics II for Teachers
On demand. 1-3 cr. Lect.
Advanced methods and practices involved in planning and constructing agricultural shop projects. Emphasis is on the construction of farm and ranch labor-saving devices.

AgEd 470 Individual Problems
PREREQUISITE: Graduate standing.
- Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

AgEd 476 Internship
A,W,S,Su. 6-12 cr. Ind. St.
PREREQUISITE: Graduate standing, consent of department head and dean of college.
- An opportunity for students to gain knowledge and skills through experience in a selected field. Each program is cooperatively planned and supervised by a local business or institution and the department. Student arranges program with staff in advance of registration.

AgEd 580 Special Topics
On demand. 1-4 cr. Maximum 12 cr.
PREREQUISITE: AE 320.
- Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Graduate Courses in Agricultural Education

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

AgEd 500 Seminar
On demand. 1 cr. Sem. Maximum 6 cr.
PREREQUISITE: Graduate standing.
- Group discussions of topics of special interest.

AgEd 570 Individual Problems
PREREQUISITE: Graduate standing consent of instructor; approval of department head and Dean of Graduate Studies.
- Directed study on an individual basis. Student must initiate, the first week of quarter, a written proposal on nature of work with staff member with whom he or she plans to work.

AgEd 578 Graduate Consultation
PREREQUISITE: Graduate standing and approval of the Dean of Graduate Studies.
- This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) for a master's degree but who need additional faculty help or time.

AgEd 590 Master's Thesis
A,W,S. 3-12 cr. Ind. St. May be repeated.
PREREQUISITE: Master's standing.

Agricultural Engineering

994-2275

Head of Department: Dr. W.E. Larsen.
Associate Professors: R.M. Linn (Ext.)
Assistant Professors: R.K. Milledge.

AE 102 Agricultural Engineering Science
S. 2 cr. Lect.
PREREQUISITE: Math 140.
- Problem solving and basic concepts in power and machinery, soil and water, livestock production, electrification, processing, structures, and confined livestock production.

AE 231 Soil and Water Engineering I
W. 4 cr. Lect.
PREREQUISITE: Math 181 and P&S 201.
- Data collection and analysis for precipitation, infiltration, evaporation and runoff. Design of vegetated waterways, terraces and culverts. Wind and water erosion prediction and control. Farm pond design.

AE 280 Special Topics
On demand. 1-5 cr. Maximum 8 cr. Maximum of AE 280 plus AE 480, 16 cr.
- Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

AE 309 Design of Agricultural Structures I
A alternate years, will be offered A 1986. 4 cr. Lect.
PREREQUISITE: EM 253.

eAE 530 Fundamentals of Montana Water Law
W. 3 cr. Lect.
PREREQUISITE: Junior standing.
- Basic principles of Montana water law as applied to semiarid regions. Development of water law, constitutional laws, case laws, statutes, surface and ground water rights, and adjudication procedures.

AE 352 Soil and Water Engineering II
W. 4 cr. Lect. 5; Lab. 1.
PREREQUISITES: AE 201 and EM 335.
- Design of mechanical components and subsystems for agricultural applications. Design of foundations and retaining walls.

AE 410 Agricultural Power Transmission
W alternate years, will be offered W 1987. 4 cr. Lect.
PREREQUISITE: EM 335 and concurrent enrollment in AE 320.
- Design, construction, and analysis of surface irrigation systems.

AE 340 Agricultural Power Transmission
W alternate years, will be offered W 1987. 4 cr. Lect.
PREREQUISITE: EM 335 and concurrent enrollment in AE 320.
- Design, construction, and analysis of hydraulic systems. Gear trains, transmissions, belt drive and other power transmission devices for agricultural applications.

AE 400 Senior Seminar
S. 1 cr. Sem.
PREREQUISITE: Senior standing.
- Professionalism and professional organizations. Current problems and developments in agricultural engineering. Each student prepares and presents a paper in his or her field of interest.

AE 411 Environmental Design for Agricultural Structures
W alternate years, will be offered W 1987. 4 cr. Lect.
PREREQUISITE: Phys 228.
- Design of environmental aspects of agricultural structures, including livestock waste management, heating and ventilating of confined livestock shelters, and environmental control for crop storage structures.

AE 416 Electric Power Control Systems
A alternate years, will be offered A 1987. 4 cr. Lect.
PREREQUISITE: Phys 229.
- Electrical power and control system applications, including crop processing and handling, environmental control and sprinkler irrigation systems.

AE 418 Unit Operations in Agricultural Processing
S alternate years, will be offered S 1988. 4 cr. Lect.
PREREQUISITE: EM 336.
- Design of unit operations for agriculture including fluid flow, size reduction, materials separation and handling, drying and refrigeration. Heat transfer concepts for food products.
AE 420 Energy Conversion for Mobile Power
W alternate years, will be offered W 1988. 4 cr. Lect. 3; Lab. 1.
PREREQUISITES: EM 252 and ME 334.
Sources and systems for supplying energy to agricultural operations; internal combustion engines, fuels, power and traction units.

AE 425 Irrigation System Design
S alternate years, will be offered S 1988. 4 cr. Lect.
PREREQUISITE: AE 352.
Design of sprinkler irrigation systems and component parts. Analysis of other pressure irrigation systems. Economic feasibility.

AE 433 Soil and Water Engineering III
S alternate years, will be offered S 1987. 4 cr. Lect. 3; Lab. 1.
PREREQUISITES: AE 332 and EM 335.
Design principles and methods for agricultural engineers. Oral and written reports on design projects required.

AE 440 Advanced Agricultural Engineering Design
S alternate years, will be offered S 1988. 4 cr. Lect. 1; Lab. 2; Ind. St. 1.
PREREQUISITES: AE 340 and EM 335.
Design principles and methods for agricultural engineers. Oral and written reports on design projects required.

AE 470 Individual Problems
A,W,S,Su. 1.5 cr. Ind. St. Maximum 6 cr.
PREREQUISITE: Senior standing or consent of instructor and department head.
Directed research and study on an individual basis.

AE 480 Special Topics
On demand. 1.5 cr. Lect. Maximum 12 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Graduate Courses in Agricultural Engineering

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

AE 570 Individual Problems
A,W,S,Su. 1.5 cr. Ind. St. Maximum 9 cr.
PREREQUISITES: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies.
Directed research and study on an individual basis.

AE 580 Special Topics
On demand. 1.5 cr. Maximum 15 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

AE 589 Graduate Consultation
A,W,S,Su. 3 cr. Tut.
PREREQUISITES: Master's standing and approval of the Dean of Graduate Studies.
This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) for a master's degree but who need additional faculty help or time.

AE 590 Master's Thesis
A,W,S,Su. 3-12 cr. Ind. St. May be repeated.
PREREQUISITE: Master's standing.

Agricultural Engineering Technology

Department of Agricultural Engineering 994-2275
See Agricultural Engineering for faculty lists.

AET 202 Principles and Processes in Welding I
A,W,S. 5 cr. Lect. 2; Lab. 3.
Oxyacetylene and shielded metal arc welding with applications to industrial joints and welding positions. Includes fusion and welding, braze welding, torch cutting, classification and identification of industrial alloys, welding metallurgy and heat treatments of steel.

AET 204 Agricultural Surveying
S. 2 cr. Lect. 1; Lab. 1.
Basic surveying for non-engineers. Land measurement, differential levelling, plane table mapping, measurements, layout of fields, contours and ditches, mapping, public land survey system.

AET 232 Drawing and Design A. 4 cr. Lab.
Basic lettering, sketching, mechanical drawing, descriptive geometry and blueprint development. Design project based on agricultural problems.

AET 280 Special Topics
On demand. 1-5 cr. Maximum 8 cr. Maximum of AET 280 plus AET 480, 16 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

AET 304 Principles and Processes in Welding II
W. 5 cr. Lect. 2; Lab. 3.
Advanced arc and oxyacetylene processes for farm and industry; hardfacing and silver brazing; TIG and MIG welding heat treatments, weld inspection, automatic torch cutting, steel alloys, aluminum and stainless steel.

AET 314 Basic Engine Principles for Agriculture
A. 4 cr. Lect. 1; Lab. 1.
PREREQUISITE: Math 140.
Fundamental principles of gasoline engines as used in agricultural applications. Engine operation, adjustment, maintenance and repair for maximum operating efficiency. Lab experience emphasizes overhaul of multicylinder agricultural engines.

AET 319 Farm Machinery Management and Evaluation
S. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: Math 140
Evaluation and adjustment procedures for improved equipment performance. Principles for effective management of field equipment. Alternative comparisons. Calibration procedures are done in lab with a variety of farm machinery.

AET 324 Industrial Welding
A,S. 4 cr. Lect. 2; Lab. 2.
PREREQUISITE: MeET 321.
Study of the processes of metal bonding based on modern methods of metal welding and cutting. Lab exercises, applications and demonstrations based on processes available with current equipment.

AET 325 Irrigation Practices
W. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: Math 140.
General principles and methods of irrigation. Water requirements of crops. Use of irrigation water control structures and water measuring devices.

AET 329 Watershed Technology
W. 4 cr. Lect.
PREREQUISITES: Math 140 and junior standing.
Basic agricultural hydrology. Discussion of variables related to runoff, water erosion and wind erosion. Controls for wind and water erosion; water storage and water conservation.

AET 330 Sprinkler Irrigation
A. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: Junior standing and Math 140.
Selection, operation and maintenance of sprinkler irrigation systems. Pumps, power unit horsepower and component parts. Economics.

AET 334 Applied Electrification
W. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: Math 140.
Electrical fundamentals. Wiring requirements for the home, shop and service buildings. Single and three-phase motors and control systems.

AET 401 Farm Buildings
S. 4 cr. Lect.
PREREQUISITE: Math 140.
Environmental control of farm buildings including heat and moisture production of animals, insulation, heating and cooling. Animal waste management systems. Planning and construction of farm buildings.

AET 415 Mobile Power for Agriculture
W. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: AET 314.
Performance measurement and evaluation of multi-cylinder gasoline and diesel tractors and engines. Engine adjustment and performance. Power transmission with traction. PTO and hydraulic systems.

AET 470 Individual Problems
A,W,S,Su. 1.5 cr. Ind. St. Maximum 6 cr.
PREREQUISITES: Junior standing and consent of instructor and department head.
Directed research and study on an individual basis.

AET 480 Special Topics
On demand. 1.5 cr. Lect. Maximum 12 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

AET 482 Animal Nutrition A.
W. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: Math 140.
Fundamental principles of animal nutrition as used in agricultural applications. Animal production, nutrition, feeding and feeding of farm animals. Lab experience emphasizes utilization of multicylinder agricultural engines.

Agricultural and Industrial Arts Education

Department of Agricultural and Industrial Education 994-3201
See Agricultural Education and Industrial Arts for faculty lists.

Graduate Courses in Agricultural and Industrial Education

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

A&IE 501 Program Planning in Agricultural and Industrial Arts Education
A,Su. 4 cr. Lect.
PREREQUISITES: Graduate standing. AgEd 406 or IA 406.
A study of the literature on specific facets of planning applicable to agricultural and industrial arts education and for extension education. Application of program planning concepts through projects by each class member.
A&IE 506 Research Methods  
A.Su. 4 cr. Lect.  
PREREQUISITE: Graduate standing.  
Principles and techniques of research appropriate for planning, conducting and reporting vocational educational research.

A&IE 507 Program Evaluation  
W.Su. 4 cr. Lect.  
PREREQUISITES: Graduate standing and A&IE 506.  
Principles and procedures used in developing and conducting locally directed evaluation of vocational agriculture and industrial arts and extension education programs.

A&IE 575 Professional Paper  
A.W.S. 1-8 cr. Ind. St.  
PREREQUISITES: A&IE 501 and 506.  
A professional paper written on an agricultural or industrial education topic mutually agreed upon by the student and his or her graduate committee.

Animal Science  
Department of Animal and Range Sciences  
994-3721

Head of Department: Dr. A.C. Linton  

AnS 101 Animal Science in Agriculture  
A.S. 4 cr. Lect.; Lab. 1.  
Introductory animal science; includes basic principles of animal genetics, nutrition and reproduction and their application to the production of beef and dairy cattle, sheep, swine, horses and poultry. Open to all students.

AnS 130 Equitation, Basic  
A.W.S. 2 cr. Lab.  
Fundamentals of western-style horseback riding; walk, trot, lope, stop and simple turns. Laboratory fee required.

AnS 131 Equitation, Intermediate  
A.W.S. 1 cr. Lab.  
PREREQUISITE: AnS 130.  
For students with a secure seat at the lope. Western equitation techniques including cueing with hands, legs, weight and voice. Laboratory fee required.

AnS 200 Seminar  
A. 1 cr. Sem.  
Discussion of current professional opportunities in animal science.

AnS 201 World Food  
S. 4 cr. Lect.  
PREREQUISITE: Sophomore standing.  
Factors affecting adequacy and availability of world food supply, human population trends, overview of food production systems with emphasis on the role of animal agriculture.

AnS 210 Live Animal and Carcass Evaluation I  
S. 3 cr. Lect.; Lab. 2.  
Techniques and experience in live animal evaluation, use of comparative judging, production data and other evaluative criteria.

AnS 211 Live Animal and Carcass Evaluation II  
A. 2 cr. Lab.  
Techniques and experience in live animal evaluation with increased emphasis on technical production and carcass data.

AnS 216 Meats  
W. 3-4 cr. Lect.; Lab. 1 or 2.  
Science of meat and meat products related to meat industry. Livestock slaughter and carcass fabrication for retail, applying to the meat industry and farm. Students may elect one credit of laboratory which relieves them from participation in animal slaughter.

AnS 222 Feeds and Feeding  
W. 4 cr. Lab. 1 or 2.  
PREREQUISITE: AnS 101.  
Nutrient requirements of livestock; composition and value of feeds and formulation of rations. Taught as a service course, will not satisfy departmental requirements under the animal science major.

AnS 224 Equitation, Specialized  
S. 3 cr. Lab.  
PREREQUISITE: AnS 131.  
Specialized techniques for training young horses.

AnS 225 Recreational Horse Management  
A. 4 cr. Lect.; Lab. 1.  
PREREQUISITE: Sophomore standing.  
Light horse management, behavior, feeding, reproduction and selection. For students with general interest in horses. Taught as a service course; will not satisfy departmental requirements under animal science major or minor.

AnS 228 Equitation, Advanced  
A. 1 cr. Lab.  
PREREQUISITE: AnS 131.  
For experienced students with their own horse. Advanced equitation techniques, including collection, head set, changes of lead, pivots and roll backs.

AnS 230 Horse Management and Packing in the Back Country  
Su. 3 cr. Lect.; Lab. 2.  
Introduction to management and use of horses in the mountains as well as ecological considerations of back country use. Labs include equitation, restraint of grazing horses and packing. A three-day pack trip into the Gallatin National Forest will conclude the course. Laboratory fee required.

AnS 280 Special Topics  
On demand. 1.5-5 cr. Maximum 8 cr. Maximum of AnS 280 Plus AnS 480, 16 cr.  
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

AnS 300 Seminar  
W.S. 1 cr. Sem. Maximum 2 cr.  
PREREQUISITE: Junior standing.  
Discussion of current topics and issues in animal agriculture.

AnS 307 Live Animal and Carcass Evaluation III  
W. 3 cr. Lect. 1.  
PREREQUISITES: AnS 211 and 216.  
Techniques for the evaluation of market livestock and carcasses and their relation to livestock production. Procedures include U.S. grading standards, introduction to pricing and objective carcass measurements.

AnS 308 Competitive Livestock Evaluation  
A.W. 1 cr. Lab. Maximum 2 cr.  
Advanced skills in evaluation of livestock, meat and wool. Also practical experience in conducting 4-H and FFA judging programs.

AnS 309 Principles of Animal Nutrition  
A. 4 cr. Lect.  
PREREQUISITE: Biol 121 and Chem 122.  
Chemical composition, digestion, absorption and metabolism of various nutrients.

AnS 310 Applied Animal Nutrition  
W. 4 cr. Lect.; Lab. 1.  
PREREQUISITES: AnS 309.  
Animal feeding, ration planning and nutritive value of common feed stuffs.

AnS 312 Physiology of Reproduction  
A. 4 cr. Lect.  
PREREQUISITE: VetS 271.  
Reproductive physiology in farm animals and application of current knowledge in improving reproductive performance of domestic animals.

AnS 313 Physiology of Reproduction Lab  
A. 1 cr. Lab.  
PREREQUISITES: AnS 312, (AnS 312 may be taken concurrently).  
Examines reproductive processes presented in AnS 312 including reproductive anatomy, endocrine control, sexual behavior, fertilization and pregnancy.

AnS 314 Animal Genetics  
W. 4 cr. Lect.; Rec.-Dis. 1.  
PREREQUISITE: Biol 121.  
Fundamentals of genetics with examples from animals, man and plants.

AnS 320 Artificial Insemination  
W. 3 cr. Lect.; Lab. 1.  
PREREQUISITE: AnS 312.  
Management of a successful A.I. program with cattle. Laboratory practice in the techniques of artificial insemination. Laboratory fee required.

AnS 324 Principles of Animal Breeding  
S. 4 cr. Lect.; Rec.-Dis. 1.  
PREREQUISITES: AnS 314 or Biol 324, Stat 216.  
Genetic improvement of farm animals through performance testing, methods of selection and application of mating systems such as crossbreeding.

AnS 327 Beef Production  
S. 4 cr. Lect.; Rec.-Dis. 1.  
PREREQUISITE: AnS 222 or 309.  
Overview of the beef industry including production, marketing and distribution.

AnS 328 Beef Production Lab  
S. 1 cr. Lab.  
PREREQUISITE: AnS 327, (AnS 327 may be taken concurrently).  
Husbandry techniques associated with beef cattle.

AnS 400 Seminar  
W.S. 1 cr. Sem.  
PREREQUISITE: Senior standing.  
Review of literature, preparation of a technical paper, and oral presentation of technical material.

AnS 401 Dairy Production and Management  
On demand. 4 cr. Lect.; Lab. 1.  
PREREQUISITES: AnS 310, 312 and 324.  
Dairy management with special emphasis on feeding, breeding, selection and milking procedures.

AnS 411 Physiology of Gestation Lab  
A. 1 cr. Lab.  
PREREQUISITES: AnS 312 and AnS 320.  
Application of physiological knowledge to increase meat and milk production and experience with techniques of pregnancy diagnosis in cattle. Laboratory fee required.
AnS 413 Horse Production and Management I
W. 4 cr. Lect. 3; Lab. 1.
PREREQUISITES: AnS 310, 312 and 324.
History, breeds, psychology and behavior, anatomy and physiology, conformation, biomechanics and horse shoeing.

AnS 414 Horse Production and Management II
S. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: AnS 413.
Nutrition, health, reproduction and genetics.

AnS 415 Endocrine Physiology
W. 4 cr. Lect.
PREREQUISITES: Senior standing and Biol 125.
Study of endocrine glands, their secretions and regulatory function in the physiology of mammals. Emphasis on functional anatomy and concepts of cellular regulatory functions and communication in endocrine physiology.

AnS 422 Wool and Wool Industry
A alternate years, will be offered A 1987. 4 cr. Lect. 2; Lab. 2.
Fundamental characteristics of wool, evaluation, production, improvement and uses. The economic importance and operation of the wool industry.

AnS 424 Computerized Beef Selection
W. 2 cr. Rec-Dis.
PREREQUISITE: AnS 324.
Development of a selection program for beef cattle and use of the selection program during 10 years of selection on a beef herd simulated by computer.

AnS 425 Swine Production and Management
A. 4 cr. Lect. 3; Lab. 1.
PREREQUISITES: AnS 310, 312 and 324.
Modern swine management and production including feeding, selection, reproduction, housing and marketing.

AnS 426 Sheep Production and Management
W. 4 cr. Lect. 3; Lab. 1.
PREREQUISITES: AnS 310, 312 and 324.
Sheep production management problems with emphasis on reproduction, feeding, breeding and selection.

AnS 427 Beef Cattle Management
A. 4 cr. Lect. 3; Lab. 1.
PREREQUISITES: AnS 310, 312, 324 and 327.
Application of nutrition, reproduction and breeding to management decision making of the range beef enterprise.

AnS 470 Individual Problems
A,W,S,Su. 1-3 cr. Ind. St. Maximum 6 cr.
PREREQUISITES: Consent of instructor and department head.
Directed research and study on an individual basis.

AnS 476 Internship
A,W,S,Su. 1-6 cr. Ind. St.
PREREQUISITE: Junior standing.
In-depth training, understanding and experience in a specific area of the student's interest. The student will be working under the supervision of the department and a suitable livestock or animal related industry.

Graduate Courses In Animal Science

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

AnS 500 Seminar
PREREQUISITE: Graduate standing.
Review and discussion of literature relating to animal science.

AnS 515 Advanced Animal Breeding
S on demand. 4 cr. Lect. 3; Lab. 1.
PREREQUISITES: Stat 350, 352 and AnS 324.
Quantitative genetics applied to the improvement of animals. Biometrical relationships among relatives, methods of estimating genetic parameters and selection techniques.

AnS 539 Advanced Physiology of Reproduction
W. 4 cr. Rec-Dis.
PREREQUISITE: AnS 312.
Readings and lectures with special emphasis on recent techniques in endocrinology.

AnS 530 Advanced Animal Nutrition
A. 4 cr. Lect. 2; Lab. 2.
PREREQUISITES: AnS 310, Chem 211.
An introduction to sources and techniques used in conducting research in nutrition as well as new and pertinent findings in nutrition.

AnS 531 Ruminant Nutrition
S on demand. 3 cr. Lect.
PREREQUISITES: AnS 310, Chem 442.
Anatomy and physiology of the rumen. Digestion, absorption and metabolism with emphasis on the relation of rumen microbial digestion to the nutrition of ruminants. Rumen dysfunction and metabolic disorders.

AnS 532 Non-Ruminant Nutrition
W alternate years, will be offered W 1988. 3 cr. Lect.
PREREQUISITES: AnS 310, Chem 442.
Principles in monogastric nutrition and research applications.

AnS 570 Individual Problems
A,W,S,Su. 1-5 cr. Ind. St. Maximum 9 cr.
PREREQUISITES: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies.
Directed research and study on an individual basis.

AnS 575 Professional Paper
PREREQUISITE: Graduate standing.
A professional paper written on an animal science or related topic mutually agreed upon by the student and his or her graduate committee.

AnS 580 Special Topics
On demand. 2.5 cr. Maximum 15 cr.
PREREQUISITE: Graduate standing.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

AnS 589 Graduate Consultation
A,W,S,Su. 5 cr. Tut.
PREREQUISITES: Master's standing and approval of the Dean of Graduate Studies.
This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) for a master's degree but who need additional faculty help or time.

AnS 590 Master's Thesis
A,W,S,Su. 3-12 cr. May be repeated.
PREREQUISITE: Master's standing.

Anthropology

Department of Sociology
994-4201

Director: J. B. Davis.
Professor: J. B. Davis.
Associate Professor: T. E. Roll.
Assistant Professor: L. Carucci.

Anth 1015 Introduction to Anthropology
A,W,S. 4 cr. Lect.
Survey of the subfields of anthropology: archaeology, physical anthropology, linguistics and cultural anthropology.

Anth 201 Introduction to Archaeology
A,W,S. 4 cr. Lect.
The nature of culture, culture growth and history; a survey of the range of cultural phenomena including material culture, social organization, religion, language and other aspects.

Anth 210 Indians of Montana
A,Su. 4 cr. Lect.
Prehistory and cultural ecology of Indian tribes in Montana.

Anth 280 Special Topics
On demand. 1-5 cr. Maximum 8 cr. Maximum of Anth 280 plus Anth 480, 16 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Anth 303 Introduction to Physical Anthropology
S alternate years, will be offered S 1987. 4 cr. Lect.
PREREQUISITES: Anth 101 and Biol 121.
Human evolution, genetics, variation, osteology and basic techniques of physical anthropology.

Anth 310 Indians of North America
W. 4 cr. Lect.
Prehistory, ethnography and cultural ecology of Indians in North America; analysis and comparison of representative cultures by culture area.

Anth 320 Archaeology of North America
W. 4 cr. Lect.
Prehistoric cultural developments in North America; area adaptations and cultural dynamics.

Anth 326 Language and Culture
On demand. 3 cr. Lect.
PREREQUISITE: Anth 101 or 204.
Language as a subsystem of culture, interplay between culture context, perception, thought and symbolism.

Anth 330 Primitive Religion
A. 3 cr. Lect.
The origins, elements, forms and symbolism of religion; the role of religion in society and cultural definitions of mystical phenomena.
Anth 340 Archaeology Field School
Su. 12 cr. Lect. 8; Lab. 4. (Offered when funding available).
PREREQUISITE: Anth 101.
A full summer of archaeological field work at a location away from the University; experience in excavation and laboratory workup of data, and training in mapping and photographic techniques.

Anth 400 Seminar
A.W.S. 2 cr. Lect. Maximum 8 cr.
PREREQUISITES: Anth 101 and a total of 23 credits in anthropology.
Selected topics of special interest in anthropology.

Anth 405 Medical Anthropology
A alternate years, will be offered A 1988. 4 cr. Lect.
PREREQUISITE: Anth 101.
Anthropological data, principles and theory applied to aspects of health maintenance in a transcultural context. Native practices and the analysis of health problems associated with periods of accelerated culture change.

Anth 410 Old World Prehistory I
A alternate years, will be offered A 1987. 3 cr. Lect.
PREREQUISITES: Anth 101 and 201.
Europe, Africa and Asia from the beginnings of human culture history through the Paleolithic.

Anth 411 Old World Prehistory II
W alternate years, will be offered W 1988. 3 cr. Lect.
PREREQUISITES: Anth 101 and 201.
Europe, Africa and Asia from the Mesolithic through the Neolithic to the advent of the Iron Age.

Anth 413 Descriptive Linguistics
On demand. 3 cr. Lect.
PREREQUISITES: Anth 101 and 204.
The anthropological use of linguistic data; an introduction to phonology, morphology and syntax.

Anth 415 Prehistory of a Selected Area
On demand. 3 cr. Lect. Maximum 6 cr.
PREREQUISITES: Anth 101 and 201.
Archaeological analysis of areas of special interest.

Anth 420 Advanced Archaeology
S. 4 cr. Lect.; Lab. 1.
PREREQUISITES: Anth 101, 201 and junior or senior standing.
Current methods in archaeology. Students participate as supervisors during directed excavations.

Anth 421 Ethnology of a Selected Area
On demand. 3 cr. Lect. Maximum 6 cr.
PREREQUISITE: Anth 204.
The prehistory and cultural ecology of a culture area.

Anth 422 History of Anthropological Theory
S alternate years, will be offered S 1988. 3 cr. Lect.
PREREQUISITE: Anth 204.
The development of anthropological science within its social context; analysis of representative classics.

Anth 425 Social Organization of Primitive People
A alternate years, will be offered A 1986. 3 cr. Lect.
PREREQUISITE: Anth 204.
Kinship systems in primitive society and their significance in the organization of social life. Theories of kinship, marriage regulations, kinship role patterns.

Anth 432 Cultural Dynamics
W alternate years, will be offered W 1988. 3 cr. Lect.
PREREQUISITES: Anth 101 and 204.
Culture change through the processes of innovation, diffusion and acculturation.

Anth 435 Replicative Studies and Interpretation
On demand. 2 cr. Lab.
PREREQUISITES: Junior standing, Anth 101, and Anth 410 or 411.
Hands-on approach to analysis of prehistoric manufacturing techniques. Typically focuses on a single technology (stone, bone, ceramics, etc.). Students attempt to replicate prehistoric implements. Course is offered on a pass/fail basis.

Anth 470 Individual Problems
A.W.S. 1-6 cr. Ind. St. Maximum 6 cr.
PREREQUISITE: Junior standing or consent of the instructor and department head.
Directed research and study on an individual basis.

Anth 480 Special Topics
On demand. 1-6 cr. Maximum 16 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Graduate Courses in Anthropology

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

Anth 570 Individual Problems
A.W.S. 1-4 cr. Ind. St. Maximum 9 cr.
PREREQUISITE: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies.
Directed research and study on an individual basis.

Anth 580 Special Topics
On demand. 1-6 cr. Maximum 15 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Architecture

994-4255
Director of School: R.C. Utzinger
Professors: G.S. McClure, Jr., H.C. Rosé
Emeritus, E.S. Smyrl, R.C. Utzinger.

Arch 113 Building Construction I
W. 3 cr. Lect.
Materials and principles of building construction.

Arch 114 Building Construction II
S. 3 cr. Lect.
PREREQUISITE: Arch 113.
Continuation of Arch 113 with an overview of how components of a building fit together and the rationale behind their construction.

Arch 120 Introduction to Architecture
A. 2 cr. Lect.
Architecture and the allied design professions. Emphasis is placed on developing an understanding and appreciation of the built environment through reading, lectures, and visual study.

Arch 122 Introduction to American Architectural History
W. 2 cr. Lect.
Form and styles of American architecture from the colonial era to the present.

Arch 123 Introduction to Planning
S. 2 cr. Lect.
History of cities and the nature and scope of planning and environmental design.

Arch 154 Architectural Design I
A. 4 cr. Disc. 1; Lab. 3.
Basic visual design principles with emphasis on two-dimensional composition.

Arch 155 Architectural Design II
W. 4 cr. Disc. 1; Lab. 3.
PREREQUISITE: Arch 154.
A continuation of basic visual design principles with emphasis on three-dimensional composition and the introduction to essential tools for graphic communication.

Arch 156 Architectural Design III
S. 4 cr. Disc. 1; Lab. 3.
PREREQUISITE: Arch 155.
Development of three-dimensional composition and design technique. Topics include freehand drawing, perspective, shades and shadows, human figures and landscapes.

Arch 211 Current Topics in Architecture
A.W.S. 6 cr. Lect. Maximum 6 cr.
Research and reading in current architectural practice and theory related to the Visiting Lecturer Series.

Arch 231 Climate and Architecture
A. 3 cr. Lect.
PREREQUISITE: Math 165.
Man's architectural and site response to climate at a regional, community and small building scale. Includes passive solar energy and heat flow fundamentals.

Arch 232 Water Supply and Sanitation Systems/Acoustics
S. 3 cr. Lect.
PREREQUISITE: Math 165.
Analysis and design of acoustic systems and components for buildings. Analysis and design of water, plumbing, and fire safety systems at both the small and large building scale.

Arch 241 Basic Architectural Structures I
W. 4 cr. Lect.
PREREQUISITE: Math 165, 170 and Phys 205.
Building structures and the development of mechanics of rigid bodies including centroids and moments of inertia of structural forms.

Arch 242 Basic Architectural Structures II
S. 4 cr. Lect.
PREREQUISITE: Arch 241.
The development of mechanics of deformable bodies including basic states of stress, characteristics of structural materials and theory of elastic beams of one material.

Arch 254 Architectural Design IV
A. 5 cr. Disc. 1; Lab. 3.
PREREQUISITE: Arch 156.
Small-scale architectural design projects that emphasize principles of order, circulation, site and...
Arch 327 Architectural History I
A. 3 cr. Lect.
History of Western architecture beginning with the development of the earliest civilizations as they grappled with new building materials, structural principles, environmental issues and political developments. Content will be a chronological progression through the works of the early Christian era.

Arch 328 Architectural History II
W. 3 cr. Lect.
History of Western architecture beginning with medieval architecture and ending with the architecture of the 18th century.

Arch 329 Architectural History III
S. 3 cr. Lect.
History of Western architecture focusing upon the development of a modern consciousness from the 19th century to the present.

Arch 333 Lighting and Electrical Systems
A. 4 cr. Lect.
PREREQUISITE: Phys 206. Analysis and design of electrical and lighting systems used in architecture.

Arch 334 Heating, Ventilating and Air Conditioning Principles and Systems
W. 3 cr. Lect.
PREREQUISITES: Arch 231 and Phys 206. Analysis and design of the heating, ventilating and air conditioning systems normally used in architecture. Includes psychrometric analysis, heat flow and analysis of environmental requirements.

Arch 343 Architectural Structures I
A. 4 cr. Lect.
PREREQUISITE: Arch 242 or EM 215. Loads on structures, and analysis and design of beams in steel, wood and concrete.

Arch 344 Architectural Structures II
W. 4 cr. Lect.
PREREQUISITE: Arch 343. Analysis of statically indeterminate beams and frames and axially loaded columns and beam-columns in wood and steel.

Arch 345 Architectural Structures III
S. 4 cr. Lect.
PREREQUISITE: Arch 344. Reinforced concrete columns, connections in wood and steel, lateral load consideration, theory of modern building systems and structural system planning.

Arch 354 Architectural Design
AW,WS,Su on demand. 5 cr. Lect. 1; Disc. 1; Lab. 3. MAXIMUM 15 cr.
PREREQUISITE: Arch 256.
Continuation of second year design using architectural design projects of medium scale and complexity. Emphasis on social and behavioral issues affecting design, special user group problems (handicapped, elderly, etc.), regionally responsive architecture, structural concepts, energy conscious design, and historical and cultural perspectives.

Arch 363 Advanced Architectural Graphics
W. 3 cr. Lab.
PREREQUISITE: Arch 262.
Advanced architectural presentation through an exploration of various media and techniques.

Arch 411 Field Trip
Su on demand. 8 cr.
Study in a foreign country or countries or the United States under the direction of an architecture faculty member to obtain an understanding of the modern and historical architecture as well as the architects and cultural forces that created it. Since each field trip will be unique, students and faculty members must develop a detailed syllabus outlining the topics, areas to be studied and course requirements which must be approved by the architecture faculty. The study will culminate in a formal report to the students and faculty in the School of Architecture autumn quarter following the trip.

Arch 412 Inspection Field Trip
AW,WS,W 1 cr. Ind. St. (May be repeated the following quarter the student is enrolled on campus only.) PREREQUISITE: Fourth-year standing.
An individual or group initiated, approved trip to an area or areas of architectural interest for the purposes of studying that area's architecture in-depth. The first quarter is used to develop the itinerary, which is subject to approval, and to obtain some background on the architecture to be studied. The second quarter is to be used to prepare a report and presentation covering all aspects of the trip. The trip is to be taken during a vacation period when regularly scheduled course work will not be missed or while the student is on the internship program.

Arch 415 Construction Drawings and Specifications
A. 4 cr. Lect. 1; Lab. 3.
PREREQUISITES: Arch 114 and fourth-year standing. The theory and practice of drawings and specifications as contract documents for building projects using procedures similar to those found in a professional architect's office.

Arch 416 Professional Practice
W. 3 cr. Lect. 2; Rec-Diss. 1.
PREREQUISITE: Fourth-year standing.
Architect's relationship to society, clients, the profession, consultants and contractors in design and construction. Topics include: ethics, legal and contractual relationships; management; construction contract administration; professional registration; owner-architect-contractor relationships.

Arch 417 Architectural Practice Internship
PREREQUISITES: Arch 415 and 416 and admission to the internship option. Students arrange for employment in an architectural office for a continuous period of five and one-half months to study architectural practice through participation and submission of reports. First quarter enrollment is for four credits, second quarter for ten.

Arch 422 Introduction to American Architecture from a Preservation Perspective
A. 3 cr. Lect.
American architecture from a preservation perspective: 1850-1930. Major monuments by key architects, folk and vernacular forms by anonymous builders, and engineering accomplishments will be dealt with equally. Generally, Bozeman area architectural forms become the focus of the final exam and term projects in an attempt to heighten the meaning of the course content. Preservation principles and techniques are integrated into the historical content. This course is prerequisite for Arch 425 taught in the spring.

Arch 423 Topics in Modern Architecture—Richardson, Sullivan and Wright
W alternate years, will be offered W 1987. 3 cr. Lect.
A detailed discussion of H.H. Richardson and his work influenced Sullivan and Wright. The training, design philosophy and work of each will be explored.

Arch 424 Topics in Modern Architecture—deStijl, Bauhaus, LeCorbusier
W alternate years, will be offered W 1988. 3 cr. Seminar.
This course builds upon the principles of early-modernism taught the previous year and develops the impact that Richardson, Sullivan and Wright had on the generation of architects found in the deStijl group in Holland, the Bauhaus in Germany, and on individuals such as Behrens, Gropius, Mies, LeCorbusier and American practitioners.

Arch 425 Preservation Seminar: Vernacular Architecture as Cultural Informant in the West.
S alternate years, will be offered S 1987. 3 cr. Seminar.
PREREQUISITE: Arch 422.
This hands-on field course complements and applies the content of Arch 422, and trains a student to actively participate in the field of preservation. A local survey is generally the result of the class effort, though special individual projects are also allowed. The course relies upon active student participation and course material application.

Arch 426 Architectural Theory and Criticism: The Struggle Between Craft, Technique and Industrial Design, 1900-1930s
S alternate years, will be offered S 1988. 3 cr. Rec-Diss.
This course builds upon the principles of early-modernism and the foundations of modernism taught in the seminar offerings, and focuses upon the theme of "arts and crafts and the machine"—a pervading issue from William Morris to Gropius. Works ranging from traditional architecture at the turn of the century to the international style will be explored with regard to this theme.

Arch 436 Advanced Issues in Energy-Conscious Design
WS on demand. 3 cr. Lect. 2; Lab 1.
PREREQUISITE: Arch 334.
Advanced and state-of-the-art issues in energy conservation for small and medium-sized buildings. Topics may include advanced passive solar design, day lighting, new building insulation approaches, computer-based energy calculations and material.

Arch 446 Advanced Architectural Structures
A. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: Arch 345.
Advanced structural topics, structural system planning, and the structural analysis and design of a small building as a class project.
Arch 454 Design Studio
A,W,Su on demand. 6 cr. Lect. 1; Rec.-Dis. 1; Lab. 4. Maximum 24 cr.
PREREQUISITE: 15 credits of Arch 354.
Advanced design using medium to large scale projects and emphasizing multi-building relationships and massing, site planning, integration of structural and technical systems in building, contemporary design theory, and programming.

Arch 458 Community Design Center
A,W,S. 6 cr. Lect. 1; Rec.-Dis. 1; Lab. 4. Maximum 12 cr.
PREREQUISITES: Two quarters Arch 354 and consent of instructor. Student must meet the prerequisite requirements for Arch 554 to substitute the course for Arch 554.
The Design Center assists public and non-profit groups by providing planning, programming and design ideas. Emphasis and scope of projects are determined by community needs. This course will substitute for Arch 354, 454 and 554.

Arch 470 Individual Problems
A,W,Su, 1-5 cr. Ind. St. Maximum 6 cr.
PREREQUISITE: Consent of instructor.
Student initiated, faculty directed study and research on an individual basis in subject areas not offered by the School of Architecture.

Arch 480 Special Topics
On demand. 1-5 cr. Maximum of Arch 280 and 480, 12 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Arch 492 Planning Studio
W. 4 cr. (non-majors). Lect. 2
PREREQUISITE: Arch 354.
Urban and rural problems and issues, processes and regulations.

Arch 554 Design Studio
A,W,Su on demand. 6 cr. Lect. 1; Rec.-Dis. 1; Lab. 4. Maximum 12 credits.
PREREQUISITES: 12 credits of Arch 454 and all tabulated courses in the architecture curriculum through the third year.
Advanced architectural and urban design issues and projects that develop an understanding of public planning goals and constraints, urban infrastructure, formal urban fabric, socio-cultural issues, project costs and financing, and small town planning and design.

Arch 555 Architectural Thesis I
A,W,S. 6 cr. Ind. St.
PREREQUISITE: 12 credits of Arch 554.
An architectural design project chosen by the student and subject to the approval of the student's adviser and the thesis coordinator. Advanced study, research and data collection leading to environmental analysis, programming and the development of conceptual design alternatives presented in graphic and written form. Passing grade must be C or better.

Arch 556 Architectural Thesis II
A,W,S. 8 cr. Ind. St. May be repeated, maximum 16 cr.
PREREQUISITE: Arch 555.
A continuation of the architectural topic selected for Arch 555 and the development of the written, graphic and three-dimensional materials required to illustrate the design process and the solution of the project.

Graduate Courses in Architecture
There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

Arch 570 Individual Problems
A,W,Su, 1-5 cr. Ind. St. Maximum 9 cr.
PREREQUISITES: Fifth year in Arch or graduate standing, consent of instructor, approval of school director and Dean of Graduate Studies.
Student initiated, faculty directed study and research on an individual basis in subject areas not offered by the School of Architecture.

Arch 580 Special Topics
On demand. 1-5 cr. Maximum 12 cr.
PREREQUISITE: Fifth year in Arch or graduate standing.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Art 994-4501
Director of School: J. Poor (acting).
Associate Professors: N.R. Pope, H. Schlotzhouer.
Instructor: S. Miles.
The School of Art reserves the right to retain student's work for exhibition and instructional purposes.

Art 101 Art Appreciation
A,W,Su. 3 cr. Lect.
For the non-art major. To increase the understanding and appreciation of the visual arts.

Art 102 Introduction to Visual Studies
On demand. 3 cr.
The art major's introduction to current professional attitudes and practices in the visual arts.

Art 110 Studio I
A,W,Su. 5 cr. Studio 3; Rec.-Dis. 2.
Primarily for art majors. Fundamental visual processes in the creation and perception of art. Group and individual problems of increasing complexity involving form in many media. Basic two-dimensional visual concepts.

Art 111 Studio II
A,W,Su. 5 cr. Studio 3; Rec.-Dis. 2.
Primarily for art majors. Fundamental visual processes in the creation and perception of art. Group and individual problems of increasing complexity involving form in many media. Basic color concepts.

Art 112 Studio III
A,W,Su. 5 cr. Studio 3; Rec.-Dis. 2.
PREREQUISITE: Art 111.
Primarily for art majors. Fundamental visual processes in the creation and perception of art. Group and individual problems of increasing complexity involving form in many media. Basic three-dimensional concepts.

Art 114 Art Fundamentals
A,W,Su. 5 cr. Studio 3; Rec.-Dis. 2.
Intended for the non-art major. Introduction to art fundamentals.

Art 202F Survey of Art History II
W,Su on demand. 3 cr. Lect.
This course examines the visual arts from their beginning through the Roman Empire. It focuses on understanding art as the nonverbal expression of universal cultural concepts.

Art 203F Survey of Art History III
W,Su on demand. 3 cr. Lect.
A survey of Baroque, 19th and 20th century art which focuses on the emergence of the artist as an individual responding to the impact of modern society.

Art 205 Painting
A,W,Su. 5 cr. Studio 3; Rec.-Dis. 2.
PREREQUISITE: Art 112 or 114.
Acrylic and oil, introduction of materials, techniques and concepts.

Art 206 Metalsmithing
A,W,Su. 5 cr. Studio 3; Rec.-Dis. 2.
PREREQUISITES: Art 112 or 114.
A beginning course that examines basic metalsmithing techniques and three-dimensional design skills.
Course is structured around design concepts, metal fabrication methods and practical demonstrations.

Art 207 Sculpture Materials
A,W,Su. 5 cr. Studio 3; Rec.-Dis. 2.
PREREQUISITES: Art 112, IIA 204 (majors), or Art 114 (non-majors).
Introduction to three-dimensional form using various media and techniques.

Art 208 Ceramics
A,W,Su. 5 cr. Studio 3; Rec.-Dis. 2.
PREREQUISITE: Art 112 or 114.
Contemporary ceramics—the history, development and aesthetics of ceramic vessels and sculpture. The technical aspects of clay, glazes and the firing of ceramic objects. Problem solving and the development of ideas.

Art 210 Contemporary Ideas
On demand. 3 cr. Lect.
PREREQUISITE: Art 204.
Presentation and discussion of contemporary art works and concepts.

Art 223 Introduction to Graphic Design I
A,S. 5 cr. Studio 3; Rec.-Dis. 2.
The generic aspects of visual communication; basic design, color, letterforms, typography, symbol design, sequencing and photomechanical processes.

Art 224 Introduction to Graphic Design II
W,5 cr. Studio 3; Rec.-Dis. 2.
The continuing development of graphic form and style, with particular emphasis on letterforms, typographic design, symbolism and layout.

Art 237 Design Tools and Techniques
A,W. 5 cr. Studio 3; Rec.-Dis. 2.
PREREQUISITE: Art 112 or 156.
Mechanical drawing and design presentation techniques. Primarily for design students but also for fine arts students who use working drawings for constructing pieces.

Art 238 Representational Drawing
A,W,Su. 5 cr. Studio 3; Rec.-Dis. 2. Maximum 10 cr.
PREREQUISITE: Art 111 or 114.
Group and individual problems in drawing. Includes development of representational drawing techniques and skills and introduction to abstract drawing concepts.

Art 241 Printmaking—Relief
A,Su. 5 cr. Studio 3; Rec.-Dis. 2. Maximum 20 cr.
PREREQUISITE: Art 238.
Development of visual and technical ideas through printing from a variety of raised surfaces such as woodcut and woodengraving.
Art 242 Printmaking—Serigraphy
W,Su 5 cr. Studio 3; Rec.-Dis. 2. Maximum 20 cr.
PREREQUISITE: Art 238.
Development of visual and technical ideas through the silkscreen process.

Art 250 Watercolor
Su 5 cr. Studio 3; Rec.-Dis. 2.
Painting with transparent watercolors. Introduction of materials, techniques and concepts.

Art 280 Special Topics
On demand. 1-5 cr. Maximum of Art 280 plus 480, 16 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Art 309 Baroque and Rococo Art History
S 3 or 4 cr. Lect.
PREREQUISITE: Art 204. Major research paper required as well as permission of instructor for 4 credits.
A study of the development of painting, sculpture and architecture in Italy and Northern Europe from the end of the 16th century through the mid-18th century.

Art 315 Ceramics
A,W,S,Su 5 cr. Studio 3; Rec.-Dis. 2. Maximum 20 cr.
PREREQUISITE: Art 208. Advanced problems in ceramics.

Art 317 American Art History
Alternate years, will be offered A 1986 3 or 4 cr. Lect.
PREREQUISITE: Art 204. Major research paper required as well as permission of instructor for 4 credits.
American art from the colonial period to the 20th century.

Art 318 19th Century Art History
Alternate years, will be offered A 1986 3 or 4 cr. Lect.
PREREQUISITE: Art 204. Major research paper required as well as permission of instructor for 4 credits.
Neoclassicism, Romanticism, Realism and Impressionism.

Art 319 Italian Renaissance
Alternate years, will be offered A 1987 3 or 4 cr. Lect.
PREREQUISITE: Art 204. Major research paper required as well as permission of instructor for 4 credits.
A study of painting, sculpture and architecture in Italy from the end of the 12th century through the 15th century.

Art 325 Advanced Metalsmithing
A 86, W 87, W 88, Su on demand. 5 cr. Studio 3; Rec.-Dis. 2. Maximum 15 cr.
PREREQUISITE: Art 206. An intermediate course designed around a set of specific problems and demonstrations for advanced jewelry and metalsmithing concepts.

Art 327 Printmaking—Intaglio
A,S,Su on demand. 5 cr. Studio 3; Rec.-Dis. 2. Maximum 15 cr.
PREREQUISITE: Art 238. Technical and aesthetic problems of intaglio printmaking, etching, engraving and photogravure.

Art 330 Advanced Metalforming
A,W,S,Su on demand. 5 cr. Studio 3; Rec.-Dis. 2. Maximum 15 cr.
PREREQUISITE: Art 325. An advanced course designed to instruct students in the principles and practices of metalforming techniques. Emphasis will be placed on the technical development of the three-dimensional object and traditional hollowware processes and on the development of a personal imagery.

Art 333 Advanced Metalforming
S 87, A 87, W, S, Su on demand. 5 cr. Studio 3; Rec.-Dis. 2. Maximum 15 cr.
PREREQUISITE: Art 325. An advanced course designed to instruct students in the principles and practices of metalforming techniques. Emphasis will be placed on the technical development of the three-dimensional object and traditional hollowware processes and on the development of a personal imagery.

Art 335 Advanced Metalforming
S 87, A 87, W, S, Su on demand. 5 cr. Studio 3; Rec.-Dis. 2. Maximum 15 cr.
PREREQUISITE: Art 325. An advanced course designed to instruct students in the principles and practices of metalforming techniques. Emphasis will be placed on the technical development of the three-dimensional object and traditional hollowware processes and on the development of a personal imagery.

Art 337 Intermediate Graphic Design I
A 5 cr. Studio 3; Rec.-Dis. 2. Maximum 20 cr.

Art 338 Intermediate Graphic Design II
W 5 cr. Studio 3; Rec.-Dis. 2. Maximum 20 cr.

Art 340 Ancient Art History
A 86, W, S, Su on demand. 1-5 cr. Ind. St. Maximum 15 cr.
PREREQUISITE: Art 204. Major research paper required as well as permission of instructor for 4 credits.
Prehistory, Meso-America and Egypt.

Art 341 Independent Study—Drawing
A,W,S,Su on demand. 1-5 cr. Ind. St. Maximum 15 cr.
PREREQUISITE: 10 cr. in drawing. Group and individual instruction in advanced drawing. Drawing as a tool for aesthetic investigation.

Art 342 Independent Study—Sculpture
A,W,S,Su on demand. 1-5 cr. Ind. St. Maximum 15 cr.
PREREQUISITE: 10 cr. in sculpture. Independent study in field of sculpture.

Art 343 Independent Study—Metalforming
A,W,S,Su on demand. 1-5 cr. Ind. St. Maximum 15 cr.
PREREQUISITE: 15 cr. in metalsmithing. Independent study in metalsmithing.

Art 345 Independent Study—Ceramics
A,W,S,Su on demand. 1-5 cr. Ind. St. Maximum 15 cr.
PREREQUISITE: 15 cr. in ceramics. Independent study in ceramics.

Art 346 Independent Study—Design
A,W,S,Su on demand. 1-5 cr. Ind. St. Maximum 15 cr.
PREREQUISITE: 15 cr. in design. Independent study in the field of design.

Art 347 Italian Renaissance
W alternate years, will be offered W 1987 3 or 4 cr. Lect.
PREREQUISITE: Art 204. Major research paper required as well as permission of instructor for 4 credits.
From post-Impressionism to World War 1.

Art 349 19th Century Art History
W alternate years, will be offered W 1988 3 or 4 cr. Lect.
PREREQUISITE: Art 204. Major research paper required as well as permission of instructor for 4 credits.
Prehistory, Meso-America and Egypt.

Art 350 Painting
A,W,S,Su on demand. 5 cr. Studio 3; Rec.-Dis. 2. Maximum 15 cr.

Art 351 Intermediate Graphic Design II
W 5 cr. Studio 3; Rec.-Dis. 2. Maximum 20 cr.
PREREQUISITE: Art 238. Technical and aesthetic problems of intaglio printmaking, etching, engraving and photogravure.

Art 353 Sculpture
A,W,S,Su on demand. 5 cr. Studio 3; Rec.-Dis. 2. Maximum 20 cr.

Art 354 Sculpture Bronze Casting
S 5 cr. Studio 3; Rec.-Dis. 2.
PREREQUISITE: Art 207. Technical and aesthetic problems in sculpture using the bronze casting process.

Art 401 Advanced Printmaking
W,S,Su on demand. 5 cr. Studio 3; Rec.-Dis. 2. Maximum 15 cr.
PREREQUISITE: Two quarters of printmaking. Group and individual instruction in the various and mixed print-making media.

Art 402 Studio Production for the Artist—Craftsman
On demand. 5 cr. Studio 3; Rec.-Dis. 2. Maximum 15 cr.
To prepare the production oriented artist-craftsman in business, legal and technical aspects of operating a small studio industry.

Art 403 Independent Study—Drawing
A,W,S,Su on demand. 1-5 cr. Ind. St. Maximum 15 cr.
PREREQUISITE: 10 cr. in drawing. Independent study in the field of drawing.

Art 405 Independent Study—Painting
A,W,S,Su on demand. 1-5 cr. Ind. St. Maximum 15 cr.
PREREQUISITE: 15 cr. in painting. Independent study in painting.

Art 414 Independent Study—Printmaking
A,W,S,Su on demand. 1-5 cr. Ind. St. Maximum 15 cr.
PREREQUISITE: 15 cr. in printmaking. Independent study in printmaking.

Art 415 Independent Study—Ceramics
A,W,S,Su on demand. 1-5 cr. Ind. St. Maximum 15 cr.
PREREQUISITE: 15 cr. in ceramics. Independent study in ceramics.

Art 416 Independent Study—Design
A,W,S,Su on demand. 1-5 cr. Ind. St. Maximum 15 cr.
PREREQUISITE: 15 cr. in design. Independent study in the field of design.

Art 417 Independent Study—Art History
A,W,S,Su on demand. 1-5 cr. Ind. St. Maximum 15 cr.
PREREQUISITE: 15 cr. in art history. Independent study in art history.

Art 418 Beginnings of Modern Art History
W 3 or 4 cr. Lect.
PREREQUISITE: Art 204. Major research paper required as well as permission of instructor for 4 credits.
Early Christian, Byzantine, Romanesque and Gothic.

Art 419 20th Century Art History
S 3 or 4 cr. Lect.
PREREQUISITE: Art 204. Major research paper required as well as permission of instructor for 4 credits.
Early Christian, Byzantine, Romanesque and Gothic.

Art 421 Women Artists
W alternate years, will be offered W 1988 3 cr. Lect.
A history of women artists from the Renaissance to the present and a consideration of the image of women in art.

Art 441 Classical Art History
W 5 or 4 cr. Lect.
PREREQUISITE: Art 202. Major research paper required as well as permission of instructor for 4 credits.
Prehistory, Meso-America and Egypt.

Art 442 Medieval Art History
S alternate years, will be offered S 1988 3 or 4 cr. Lect.
PREREQUISITE: Art 203. Major research paper required as well as permission of instructor for 4 credits.
Prehistory, Meso-America and Egypt.

Art 444 Northern Renaissance Art History
W alternate years, will be offered W 1987 3 or 4 Lect.
PREREQUISITE: Art 203. Major research paper required as well as permission of instructor for 4 credits.
Prehistory, Meso-America and Egypt.
Art 465 Advanced Graphic Design I
A. 5 cr. Studio 3; Rec.-Dis. 2.
PREREQUISITE: Art 367
Comprehensive projects in applied visual communications, including subjective and objective assignments. Emphasis will be on communication theory, the design process, typographic and pictorial design, layout techniques and presentation.

Art 466 Advanced Graphic Design II
W. 5 cr. Studio 3; Rec.-Dis. 2.
PREREQUISITE: Art 465
Comprehensive layout and finished art projects with emphasis on portfolio design, verbal and visual presentation, and professional standards of practice.

Art 467 Advanced Graphic Design III
S. 5 cr. Studio 3; Rec.-Dis. 2.
PREREQUISITE: Art 466
Study in major medium directed by Thesis advisor, approval of School Director and Graduate Dean.

Art 470 Individual Problems
A.W.Su. 1-4 cr. Ind. St. Maximum 6 cr.
PREREQUISITES: Consent of instructor and the director.
Student initiated, faculty directed research and study on an individual basis in subject areas not included in the courses offered by the School of Art.

Art 476 Internship
A.W.Su. 3-15 cr. Ind. St.
PREREQUISITE: Acceptance of internship application by intern coordinator.
Students may earn academic credit by working outside the University.

Art 480 Special Topics
On demand. 1-5 cr. Maximum 16 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Graduate Courses in Art

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

Art 505-529: Courses in which student will work on an individual basis with a faculty member in developing imagery and appropriate techniques in a particular area of art.

Art 524 Metalsmithing
A.W.Su. 1-6 cr. Ind. St. Maximum 30 cr.
PREREQUISITE: Art 413.

Art 526 Drawing
A.W.Su. 1-6 cr. Ind. St. Maximum 30 cr.
PREREQUISITE: Art 338.

Art 527 Printmaking
A.W.Su. 1-6 cr. Ind. St. Maximum 30 cr.
PREREQUISITE: Art 401.

Art 529 Sculpture
A.W.Su. 1-6 cr. Ind. St. Maximum 30 cr.
PREREQUISITE: Art 333.

Art 570 Individual Problems
A.W.Su. 1-5 cr. Ind. St. Maximum 9 cr. (Master of Arts degree), and 5 cr. (Master of Fine Arts degree).
PREREQUISITES: Graduate standing, consent of instructor, approval of School Director and Graduate Dean.

Art 575 Professional Paper
A.W.Su. 1-5 cr. Ind. St. Maximum 5 cr.
PREREQUISITE: Graduate standing.
A professional paper written on an art related topic agreed upon by the student and his or her committee.

Art 580 Special Topics
On demand. 1-5 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Art 589 Graduate Consultation
A.W. 4 cr. Rec.-Dis.
PREREQUISITE: Biol 121.

Biology

Head of Department: Dr. P. Brussard.


Assistant Professors: S. Eversman, C.M. Paden, J.C. Priscu, A.C. Rusoff, R.G. Stout.

Lecturers: R. Hays.

Adjunct Associate Professors: W.R. Gould, A.W. Gould.

Adjunct Assistant Professors: W.R. Gould, R.G. White.

Biol 100 Orientation
A.S. 1 cr. Rec.-Dis.
Orientation and guidance for all freshmen who are planning to seek admittance to a health profession such as a medical school, dental school or optometry school.

Biol 105 Environmental Issues and Society
W. 4 cr. Lect. 1; Rec.-Dis. 1.
The relationship between people and the environment, using the earth as an ecosystem to show the effects of people's activities on natural ecosystems. Topics range from grizzlies to acid rain, emphasis on Montana and the west.

Biol 107 Identification of Seed Plants
S. 4 cr. Lect. 2; Lab. 2.
PREREQUISITE: Biol 124.
Identification of conifers, trees and shrubs, and herbaceous seed plants; determination by use of manuals, vocabulary, classification and nomenclature, preparation and collection of seed plant specimens.

Biol 110 Genetics and Society
A. 4 cr. Lab. 1.
Recent advances in genetics which have made "genetic engineering" feasible. The risks and benefits to society will also be discussed.

Biol 120N General Biology—Organisms
A.W. 4 cr. Lect. 3; Lab. 1.
Structure and function of plants and animals in modern environments.

Biol 121N General Biology—Cells
A.W.Su. 4 cr. Lect. 3; Lab. 1.
Structure, function and reproduction at the cellular level of organization. Simple patterns of inheritance.

Biol 124N Plant Form and Function
W. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: Biol 121.
Emphasis on structure and function of seed-bearing plants as major economically and ecologically significant members of the plant kingdom. Algae, fungi, bryophytes are treated in less detail.

Biol 125 Animal Form and Function
S. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: Biol 121.
Comparative aspects of structure and function of animals in representative phyla. Function of organ systems is related to whole organism complexity, internal control and interaction between organisms and their environments.

Biol 205 Introduction to Dentistry
S. 2 cr. Rec.-Dis.
Survey of dental histology, embryology and anatomy with discussions of specialties in dentistry. The course is designed for students who are considering dentistry as a profession.

Biol 211N Physiology and Anatomy I
A.W.Su alternate years, will be offered Su 1986. 5 cr. Lect. 1; Lab. 2.
PREREQUISITE: Biol 121.
General concepts of living systems: cell biology, digestive, circulatory and excretory systems. Principles emphasized are energy flow, homeostasis and integration.

Biol 212 Physiology and Anatomy II
W.Su alternate years, will be offered Su 1986. 5 cr. Lect. 3; Lab. 2.
PREREQUISITE: Biol 121.

Biol 226 Human Biology
A. 4 cr. Rec.-Dis.
PREREQUISITE: High school biology.
Biological concepts as related to contemporary human problems, population, ecology and adaptation.
Biol 280 Special Topics
On demand. 1-6 cr. Maximum of Biol 280 plus Biol 480, 16 cr.
PREREQUISITES: Consent of instructor and department head.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Biol 303 Plant Physiology
W. 5 cr. Lect. 3; Lab. 2.
PREREQUISITES: Biol 124, and Chem 211 or 122 and 134.
Physiological processes of plants, including sensitive reactions of protoplasm, photosynthesis, enzyme reactions, respiration and growth.

Biol 304 Principles of Wildlife Management
W. 4 cr. Lect.
Principles and application of fish and wildlife management.

Biol 305 Introduction to Biological Literature
W. 1 cr. Rec.-Dis.
PREREQUISITE: Junior standing.
Use of bibliographic sources, reference works and journals in biological research.

Biol 306 Introduction to Fish and Wildlife Literature
W. 1 cr. Rec.-Dis.
PREREQUISITE: Junior standing.
Use of bibliographic sources, reference works and journals in fish and wildlife research.

Biol 313 Principles of Ecology
A,S. 3 cr. Lect.
PREREQUISITES: Junior standing and one year of biological courses.
The nature and energetics of environment-organism interrelations and species and community dynamics of ecosystems.

Biol 314 Principles of Ecology Laboratory
A,S. 1 cr. Lab.
PREREQUISITES: Biol 313 (or concurrent enrollment in Biol 313) and junior standing in a biological curriculum.
Ecological analyses of representative ecosystems.

Biol 321 Taxonomy of Seed Plants
W alternate years, will be offered W 1987. 4 cr. Lect. 1; Lab. 3.
PREREQUISITES: Biol 107 and 124.
Taxonomic survey of families and major groups of seed plants. Determination, classification, nomenclature, vocabulary, structural and ecological features; preparation of reference specimens.

Biol 324 Principles of Genetics
A,S. 4 cr. Lect.
PREREQUISITE: Biol 121.
Introduction to Mendelian, population and molecular genetics of eukaryotes, with emphasis on the chromosomal location, arrangement, expression and distribution of genes.

Biol 331 Vertebrate Embryology
W. 5 cr. Lect. 3; Lab. 2.
PREREQUISITES: Biol 125 and junior standing.
Fundamentals of vertebrate embryology. Emphasis is on early embryology and the development of tissues, organs and systems. Laboratory utilizes frog, chick and pig embryos.

Biol 332 Comparative Vertebrate Anatomy
S. 5 cr. Lect. 3; Lab. 2.
PREREQUISITE: Biol 125.
A comparative study of organ systems of vertebrates. Laboratory utilizes representative vertebrate types.

Biol 333 Animal Histology
A. 4 cr. Lect. 2; Lab. 2.
PREREQUISITE: Biol 332.
Microscopic study of cells, tissues and selected mammalian organs.

Biol 350 Analysis of Biological Systems
W. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: Biol 121.
Use of the computer as an analytical and simulation tool in biology. An introduction to the elements of a quantitative approach to biological questions. Emphasis on logical and systematic application of simple algebra, and routine use of program libraries, rather than on mathematics or advanced computer programming.

Biol 400 Seminar
PREREQUISITE: Senior standing.
Discussion of current problems in biology.

Biol 401 Animal Ecology
W. 3 cr. Lect.
PREREQUISITE: Biol 313.
Abundance and distribution of animals in relation to their evolution, behavior, population biology and relations with other organisms.

Biol 405 Animal Physiology
A. 5 cr. Lect. 4; Lab. 1.
PREREQUISITE: Five credits of organic chemistry.
General physiology with mathematical, physical and chemical explanation of reactions known to take place within animals.

Biol 406 Dissection Anatomy of the Human Extremities and Back
S. 4 cr. Lect. 1; Lab. 3.
PREREQUISITES: Biol 211, 212 and upper division anatomy.
A detailed dissection study of the human musculoskeletal systems with emphasis on the extremities and back. Normal anatomy of the muscles, bones, nerves and vessels is stressed.

Biol 407 Biology Instructing
A,W,S. 3 cr. Lab.
PREREQUISITES: Two courses in biology and consent of instructor.
Practice in preparing laboratory materials, handling a class and grading papers.

Biol 408 Parasitology
S. 4 cr. Lect. 5; Lab. 1.
PREREQUISITE: Biol 121.
Important parasites affecting humans and animals; morphology, geographic distribution and life cycle of the major parasitic groups. Laboratory work includes host examination, preparation and identification of internal parasites.

Biol 409 Cell Biology
W. 4 cr. Lect.
PREREQUISITE: Twelve credits in biology and a course in organic chemistry.
In-depth study of cell structure and function.

Biol 411 Genetics Laboratory
W. 2 cr. Lab.
COREQUISITE: Biol 324.
Mutagenesis of organisms and manipulation of DNA for cloning.

Biol 413 Physiological Genetics
S alternate years, will be offered S 1987. 4 cr. Lect.
PREREQUISITE: Biol 324.
Fine structure of hereditary material, replication and mutation of this material and relationship of this material to the general metabolism of the cell and organism; the genetics of several microorganisms.

Biol 414 Limnology
S. 4 cr. Lect. 3; Lab. 2.
Basic aquatic ecology; physical, chemical and biological interactions in freshwater environments. Introduction to limnological apparatus and methods.

Biol 416 Plant Anatomy
A. 4 cr. Rec.-Dis. 1; Lab. 3.
PREREQUISITE: Biol 124.
Morphological origin, structure and function of tissues and organs; identification and importance in plants.

Biol 417 Ecology of Algae and Macrophytes
S alternate years, will be offered S 1988. 4 cr. Lect. 2; Lab. 2.
PREREQUISITE: Biol 121.
Ecology, physiology, classification and identification of aquatic primary producers.

Biol 418 Professional Plant Collecting
A,W,S. Su. 1-6 cr. Ind. St.
PREREQUISITE: Biol 107.
Practicum in collecting, preserving, determining, cataloging, storing and distributing plant specimens for professional herbaria.

Biol 419 Biogeography
W alternate years, will be offered W 1987. 3 cr. Lect.
PREREQUISITES: Upper division or graduate standing.
Distribution of taxa and biomes in space and time; factors of distribution; geographic interactions; applications.

Biol 422 Agrostology
A. 4 cr. Lect. 1; Lab. 3.
PREREQUISITES: Biol 107 and 124.
Determination, classification and nomenclature of grasses and grasslike plants; vocabulary, morphological and ecological features; preparation of reference specimens.

Biol 423 Ichthyology
W. 4 cr. Lect. 2; Lab. 2.
PREREQUISITE: Biol 332.
Major characteristics, classification, nomenclature, distribution and ecology of North American freshwater fishes. Laboratory devoted largely to identification of representative species.

Biol 424 Mammalogy
A. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: Biol 332.
Evolution, functional biology, distribution and classification of mammals. Labs cover taxonomy and identification of representative forms.

Biol 425 Ornithology
S. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: Biol 332.
The special structures, life history, distribution and classification of birds. Montana species recognition is developed through laboratory use of a representative skin collection and several field trips.

Biol 426 Herpetology
W alternate years, will be offered W 1988. 3 cr. Lect. 2; Lab. 1.
PREREQUISITE: Biol 125.
The taxonomy, life history, functional biology and distribution of amphibians and reptiles. Labs cover taxonomy and identification of representative forms.

Biol 428 Invertebrate Zoology
W. 5 cr. Lect. 4; Lab. 1.
PREREQUISITE: Biol 125.
Classification, morphology, physiology and adaptations of major groups of the "lower animals," invertebrates, which include about 95 percent of all known animal species. Laboratory exercises on identification and structural characteristics of major phyla.
Graduate Courses in Biology

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

**Biol 500 Seminar**
A.W.S. 1 cr. Sem. Maximum 6 cr.
PREREQUISITE: Graduate standing.
Discussion of current research topics in biology.

**Biol 501 Readings in Animal Ecology**
W on demand. 2 cr. Rec-Dis.
PREREQUISITE or COREQUISITE: Biol 401.
Presentation and discussion of ecological concepts gathered from reading papers in professional journals. Content follows Biol 401.

**Biol 510 Advanced Plant Physiology I**
A alternate years, will be offered A 1987. 3 cr. Lect.
PREREQUISITE: Biol 303.
Plant metabolism, including photosynthesis, respiration, and biosynthesis.

**Biol 511 Advanced Plant Physiology II**
W alternate years, will be offered W 1988. 3 cr. Lect.
PREREQUISITE: Biol 510.
Plant development, including hormonal and environmental effects on growth and morphogenesis.

**Biol 520 Quantitative Biology**
A alternate years, will be offered A 1986. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: Math 170, and graduate standing. Applications of mathematical models to biological phenomena, with examples drawn from physiology, ecology and bioengineering. The course is intended to develop facility with optimization techniques, numerical methods, matrix operations, complex variables and simple statistical ideas.

**Biol 524 Physiology and Ecophysiology**
W alternate years, will be offered W 1987. 3 cr. Lect.
PREREQUISITE: Biol 324.
Water relations and mineral nutrition, including ion transport, phloem loading, control of stomatal opening, and stress physiology.

**Biol 534 Physiological Plant Ecology**
W alternate years, will be offered W 1987. 3 cr. Lect.
PREREQUISITE: Biol 313.
The interrelations of critical stages in the life histories of plants with environmental patterns and phenomena.

**Biol 536 Plant Community Ecology**
A alternate years, will be offered A 1986. 3 cr. Lect.
PREREQUISITE: Biol 315.
The structure and dynamics of terrestrial plant communities.

**Biol 538 Freshwater Invertebrates**
W alternate years, will be offered W 1988. 3 cr. Lect. 1; Lab. 2.
PREREQUISITE: Graduate standing.
Origin, distribution, habitat, ecology and morphology of important freshwater invertebrate groups. Laboratory study of representative specimens.

**Biol 540 Environmental Physiology**
S alternate years, will be offered S 1987. 2 cr. Rec-Dis.
PREREQUISITE: Biol 444.
A review and discussion of the scientific literature in selected area of comparative and environmental physiology. Topics discussed will complement those covered in Biol 444.

**Biol 541 Population Dynamics**
W alternate years, will be offered W 1987. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: Biol 520.
Techniques for modeling the growth, regulation and harvesting of populations. Computer lab.

**Biol 542 Aquatic Community Ecology**
S alternate years, will be offered S 1987. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: Biol 520.
The theory of community dynamics, and introduction to multivariate methods for community analysis. Computer lab.

**Biol 544 Physical and Chemical Limnology**
A. 4 cr. Lect. 2; Lab. 2.
Advanced study of the physical and chemical dynamics of lakes and reservoirs emphasizing their importance to the ecosystem.

**Biol 545 Advanced Biological Limnology**
S alternate years, will be offered S 1987. 4 cr. Lect. 2; Lab. 2.
Advanced quantitative study of the biology and ecophysiological relationships in aquatic systems with respect to their role in the ecosystem.

**Biol 553 Biology of Water Pollution**
A alternate years, will be offered A 1987. 3 cr. Lect.
PREREQUISITE: Biol 414.
Water pollution problems, particularly as they affect the fisheries resource; toxicity of organic and inorganic wastes, bioassay principles and water quality criteria.

**Biol 570 Individual Problems**
A.W.S.Su. 1-5 cr. Ind. St. Maximum 9 cr.
PREREQUISITES: Graduate standing, consent of instructor, approval of department head and approval of Dean of Graduate Studies.
Directed research and study on an individual basis.

**Biol 580 Special Topics**
On demand. 1-5 cr. Maximum 15 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

**Biol 589 Graduate Consultation**
A.W.S.Su. 3 cr. Tut.
PREREQUISITES: Master's standing and approval of the Dean of Graduate Studies.
Use only by students who have completed all of their course work (and thesis, if on a thesis plan) for a master's degree but who need additional faculty help or time.
Business—Accounting

Department of Accounting

Head of Department: Dr. DeForest Rail (acting)

Professors: H. H. Holen
Associate Professors: G. Crain, C. Frazee, P. Nix,
D. Rail, J. Schwartz.
Assistant Professors: C. Johnson, M. McFetridge,
B. Taylor.

Acct 221 Principles of Accounting I
A,W,Su. 3 cr. Lect.
PREREQUISITE: Math 140 or higher.
An introduction to the principles of accounting for students of all business curricula. Specific topics include accounting concepts, recording transactions, statement preparation, accounting systems, cash, receivables and inventory accounting.

Acct 222 Principles of Accounting II
A,W,Su. 3 cr. Lect.
PREREQUISITE: Acct 221.
An introduction to the principles of accounting for students of all business curricula. Specific topics include accounting for plant assets, liabilities, partnerships, corporations and statement of changes.

Acct 223 Principles of Accounting III
A,W,Su. 3 cr. Lect.
PREREQUISITE: Acct 222.
An expanded study of financial accounting topics, and an introduction to manufacturing and cost accounting, budgeting and cost-volume-profit analysis.

Acct 227 Intermediate Accounting I
A,W,Su. 3 cr. Lect.
PREREQUISITE: Acct 223.
Accounting principles pertaining to balance sheet and income determination. Problems arising in connection with current assets and current liabilities.

Acct 228 Intermediate Accounting II
A,W,Su. 3 cr. Lect.
PREREQUISITE: Acct 227.
Accounting principles pertaining to balance sheet and income determination. Problems arising in connection with long-term assets, long-term liabilities, owner's equities.

Acct 229 Intermediate Accounting III
A,W,Su. 3 cr. Lect.
PREREQUISITE: Acct 228.
Accounting principles pertaining to balance sheet and income determination. Problems arising in connection with leases, pensions, inter-period tax allocation; inflation, accounting changes, analysis of working capital, and statement analysis.

Acct 280 Special Topics
On demand. 1-5 cr. Maximum 8 cr. Maximum of Acct 280 plus Acct 480, 16 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Acct 320 Cost Accounting I
A,W,Su. 3 cr. Lect.
PREREQUISITE: Acct 229.
Standard cost systems for determination of unit cost of production including process and job order. Technical aspects of costing raw materials, labor, overhead. Introduction to budgetary principles.

Acct 321 Computer Programming for Business
A,W,Su on demand. 4 cr. Lect.
PREREQUISITE: BuEd 220.
Fundamentals of the COBOL language. Functions and capabilities of computers in fields of business.

Acct 323 Cost Accounting II
W,S. 3 cr. Lect.
PREREQUISITE: Acct 320.
Costing for inventory, decentralization and measurement of performance, cost accounting and mathematics, special problems in cost allocation theory.

Acct 324 Advanced Accounting I
A,Su. 3 cr. Lect.
PREREQUISITE: Acct 229.
Accounting for partnerships, insolvency, foreign exchange, segment and interim reporting.

Acct 334 Accounting Information Systems
W. 4 cr. Lect.
PREREQUISITES: Acct 321 and OS 333.

Acct 356 Managerial Accounting
A,W,Su. 3 cr. Lect.
PREREQUISITES: Acct 223, Econ 204, Stat 216.
Accounting for non-accounting majors emphasizing accounting information as an end to management decision making.

Acct 340 Governmental Accounting Systems I
A,Su. 3 cr. Lect.
PREREQUISITE: Acct 229.
Design and development of accounting systems for various governmental organizations.

Acct 341 Governmental Accounting Systems II
W. 3 cr. Lect.
PREREQUISITE: Acct 340.
Design and development of accounting systems for various governmental and other not-for-profit organizations.

Acct 344 Legal Topics for Accountants I
A. 3 cr. Lect.
PREREQUISITE: Mgnt 225.
A survey course to cover several legal topics specifically covered on the law portion of the CPA exam: commercial paper, secured transactions, bankruptcy, property, wills, estates and trust.

Acct 345 Legal Topics for Accountants II
W. 3 cr. Lect.
PREREQUISITE: Mgnt 225.
A survey course to cover several legal topics that are specifically covered on the law portion of the CPA exam: agency partnerships, corporations, anti-trust, securities, regulations and accountants' liabilities.

Acct 400 Seminar
On demand. 1 cr. Sem. Maximum 3 cr.
PREREQUISITE: Acct 229.
Discussion, outside speakers and stimulus for individual study.

Acct 424 Advanced Accounting II
A,S. 3 cr. Lect.
PREREQUISITE: Acct 229.
Preparation of accounting statements for consolidating entities and other techniques which aid in the reporting process.
Business—Business Education

Faculty of Management
994-4681

See Business—Management for faculty listing

BuEd 200 Seminar
On demand. 1 cr. Sem. Maximum 3 cr.
PREREQUISITE: Sophomore standing.
Discussion, outside speakers and stimulus for individual study. Current business education problems and current writings of people in the profession.

BuEd 220 Business Data Processing
A.W,S,Su. 3 cr. Lect.
Fundamental business data processing concepts including systems, hardware, programming, flow-charting, and business applications. Introduction to the BASIC language.

BuEd 250 Supervised Office and Retail Experience
A.W,S,Su. 1-6 cr. Ind. St. Maximum 6 cr.
PREREQUISITE: Sophomore standing.
Individual internship experience in an office or retail situation; projects enabling students to apply academic preparation in their work situation. Students may enroll for three credits per quarter except Summer Quarter when they may enroll for six credits.

BuEd 270 Individual Problems
A.W,S,Su. 1-4 cr. Ind. St. Maximum 6 cr.
PREREQUISITE: Sophomore standing or consent of instructor.
Directed research and study on an individual basis. Topics arrived at by agreement between student and instructor.

BuEd 280 Special Topics
On demand. 1-4 cr. Lect.
PREREQUISITE: Sophomore standing.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

BuEd 320 Principles of Business and Marketing Education
A. 3 cr. Lect.
PREREQUISITE: Junior standing.
Foundations and principles of business education; professionals in business, office, and marketing education curriculum patterns; and special topics.

BuEd 321 Managerial/Business Communications
A.W,S,Su. 4 cr. Lect.
PREREQUISITE: Junior standing.
Strategies for written, oral and nonverbal communications in a business environment. Written communications including letters, memos, and business reports; dictation skills, presentations, interviewing, managing meetings, managing conflict and change, and communicating via electronic media.

BuEd 400 Seminar
On demand. 1 cr. Sem. Maximum 3 cr.
PREREQUISITE: Senior standing.
Discussion, outside speakers and stimulus for individual study.

BuEd 420 Administration and Supervision of Cooperative Office and Marketing Education Programs
W. 4 cr. Lect.
PREREQUISITE: BuEd 320.
Project proposals, training agreements, training plans, coordination practices, student selection, youth clubs and related instruction in marketing education and office education.

BuEd 423 Special Needs in Business Teacher Education
S. 3 cr. Lect.
PREREQUISITE: BuEd 320.
Mainstreaming issues, sex equity, multicultural concerns, language arts skills, computer literacy and other special needs for the business teacher.

BuEd 470 Individual Problems
A.W,S,Su. 1-4 cr. Ind. St. Maximum 6 cr.
PREREQUISITE: Senior standing or consent of instructor.
Directed research and study on an individual basis.

BuEd 480 Special Topics
On demand. 1-4 cr. Lect.
PREREQUISITE: Senior standing.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Graduate Courses in Business Education

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

BuEd 500 Seminar
A.W,S,Su. 1 cr. Sem. Maximum 6 cr.
Subjects of current interest in business, office, and distributive education.

BuEd 501 Seminar: Current Literature in Business Education
On demand. 2 cr. Sem.
PREREQUISITE: Graduate standing or teaching experience.
A survey of current literature in the field from the major journals and yearbooks.

BuEd 502 Seminar: Insurance Education for Teachers
Su on demand. 2 cr. Sem.
PREREQUISITE: Graduate standing or teaching experience.
Presentation and discussion of topics in the insurance field for business education majors.

BuEd 503 Seminar: Career Education for Business
On demand. 2 cr. Sem.
PREREQUISITE: Graduate standing or teaching experience.
Presentation and discussion of career education models for the business education curriculum. Emphasis on career guidance.

BuEd 504 Seminar: Business Education Materials and Equipment
On demand. 2 cr. Sem.
PREREQUISITE: Graduate standing or teaching experience.
A survey of current materials and equipment with application to the business education curriculum.

BuEd 505 Seminar: Business and Its Economic Environment
Su on demand. 2 cr. Sem.
PREREQUISITE: Graduate standing or teaching experience.
Current economics issues and concepts, and how these issues and concepts impact on business, the business curriculum and the business teacher.

BuEd 506 Seminar: Office Simulation
Su on demand. 2 cr. Sem.
PREREQUISITE: Graduate standing or teaching experience.
Role of simulation in business education. Types of simulations and methods of integrating into curriculum.

BuEd 507 Seminar: Information Processing Systems
On demand. 2 cr. Sem.
PREREQUISITE: Graduate standing or teaching experience.
Research and analysis of information processing systems. Curriculum development, materials review, and advanced system operation.

BuEd 511 Post-secondary Programs in Business Education
On demand. 3 cr. Lect.
PREREQUISITE: BuEd 320.
The post-secondary student, curriculum, methods of teaching the post-secondary student in business, office and marketing education.

BuEd 512 Vocational Guidance in Business Education
W,Su. 3 cr. Lect.
PREREQUISITE: EdFd 411.
Counseling and guidance techniques to prepare the business education teacher for assisting young people in making intelligent educational and occupational decisions.

BuEd 513 Instructional Improvement in Basic Business
Su on demand. 3 cr. Lect.
PREREQUISITE: Graduate standing or teaching experience.
Teaching methods and materials in basic business subjects including American business principles, general business, business law, economics, consumer economics, business math and business communications.

BuEd 514 Instructional Improvement in Marketing Education
Su on demand. 3 cr. Lect.
PREREQUISITE: Graduate standing or teaching experience.
Teaching methods and materials in marketing education at various levels of instruction.

BuEd 515 Instructional Improvement in Office Education
Su on demand. 3 cr. Lect.
PREREQUISITE: Graduate standing or teaching experience.
Teaching methods and materials in office education at various levels of instruction.

BuEd 516 Instructional Improvement in Information Processing
On demand. 3 cr. Lect.
PREREQUISITE: BuEd 220 or Acct 321; graduate standing or teaching experience.
Computers in business and marketing education. Methods, materials and procedures for the teaching of data processing.

BuEd 522 Administration and Supervision in Business Education
S,Su. 3 cr. Lect.
PREREQUISITE: Mgmt 340.
Administration and supervision of business, office and marketing education. Hiring, evaluation, policy development, PR budgeting and other supervisor responsibilities.

BuEd 523 Business Education Curriculum
A.Su. 3 cr. Lect.
PREREQUISITE: BuEd 320.
Philosophy and methods of curriculum construction in business education. Curricula development for business office and marketing education programs in the junior and senior high school.
BuEd 524 Research in Business Education
A,W,S,Su. 3 cr. Lect.
PREREQUISITES: Stat 230, Mgmt 231 and graduate standing.
Business education research methods and procedures developed into a research proposal.

BuEd 528 Trends in Business Education
S,Su. 3 cr. Lect.
PREREQUISITE: BuEd 524.
Major issues and trends in business, office and marketing education.

BuEd 570 Individual Problems
PREREQUISITES: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies.
Directed research and study on an individual basis.

BuEd 575 Professional Project
A,W,S,Su. 1-6 cr. Ind. St. Maximum 6 cr.
PREREQUISITE: Graduate standing.
A professional project written on a business education topic mutually agreed upon by the student and his or her major advisor.

BuEd 576 Internship
A,W,Su. 1-9 cr. Ind. St.
PREREQUISITE: Graduate standing and consent of department head.
An individualized program of field experience in an educational institution, organization or agency in business, office or marketing education.

BuEd 580 Special Topics
On demand. 1-5 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

BuEd 589 Graduate Consultation
A,W,Su. 3 cr. Tut.
PREREQUISITES: Master's standing and approval of the Dean of Graduate Studies.
This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) for a master's degree but who need additional faculty help or time.

BuEd 590 Master's Thesis
A,W,S,Su. 5-12 cr. Ind. St. May be repeated.
PREREQUISITE: Master's standing.

Introduction to the principal areas of finance with particular emphasis on the application and integration of financial concepts in financial decision making.

Fin 306 Financial Management
PREREQUISITES: Econ 304, Fin 305.
In-depth study of financial management topics: risk, valuation, cost of capital, capital budgeting, capital structure, long-term financing decisions, and working capital management.

Fin 400 Finance Seminar
On demand. 3 cr. Sem.
PREREQUISITES: Senior standing. Advanced study of topic areas in finance.

Fin 405 Investments
PREREQUISITES: Senior standing, Fin 306.
Introduction to the areas of investments including investment practices, investment risks, investment analysis and investment policies. In-depth study of investment principles.

Fin 406 Investment Management
S. 4 cr. Rec.-Dis.
PREREQUISITES: Senior standing, Fin 405.
Overview of financial markets and the intermediary role of major financial institutions such as savings institutions, insurance companies, and pension funds.

Fin 408 Managerial Finance
S. 4 cr. Rec.-Dis.
PREREQUISITES: Senior standing, Fin 306.
Incorporation of the effects of uncertainty into the concepts of finance. Focus is on managerial decision making in a business environment.

Fin 409 Managerial Finance
S. 4 cr. Rec.-Dis.
PREREQUISITES: Senior standing, Fin 306.
Introduction to the areas of investments including investment practices, investment risks, investment analysis and investment policies. In-depth study of investment principles.

Fin 480 Special Topics
On demand. 1-4 cr. Lect.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Business—Management

Faculty of Management
994-4861
See Business—Management for faculty listing.

Fin 280 Special Topics
On demand. 1-4 cr. Lect.
To be used for courses not required in the finance option at the sophomore level for which there is a particular need, or given on a trial basis to determine need.

Fin 305 Finance
A,W,Su. 4 cr. Rec.-Dis.
PREREQUISITES: Junior standing, Acct 225, BuEd 220, Econ 202 and 204, Mgmt 231 and, for students majoring in business, formal admission to the College.
Introduction to the principal areas of finance with emphasis on the application and integration of financial concepts in financial decision making.

Fin 306 Financial Management
PREREQUISITES: Econ 304, Fin 305.
In-depth study of financial management topics: risk, valuation, cost of capital, capital budgeting, capital structure, long-term financing decisions, and working capital management.

Fin 480 Special Topics
On demand. 1-4 cr. Lect.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Business—Management

Faculty of Management
994-4861

Head of Departments: Dr. J.C. Rogers.

Professors: R.L. Swinth.

Mgmt 101 Orientation to Upper Division Business
A. 1 cr. Lect.
Overview of lower division business curriculum, self assessment using interest and skills inventories, introduction to typical lower division teaching/learning processes, study skills development, introduction to career planning, preparation of lower division course plans.

Mgmt 140 Introduction to Business
A,W. 3 cr. Lect.
PREREQUISITE: Restricted to freshmen and sophomores.

Broad concepts of business to provide a foundation for understanding the interrelationship among business functions; exploration of various business fields to determine area of interest. Recommended as an exploratory course for students interested in business.

Mgmt 201 Orientation to Upper Division Business
On demand. 1 cr. Lect.
PREREQUISITE: Mgmt 101.
Overview of upper division business curriculum, career planning project including structured interviewing and research into specific job requirements, development of a course plan for the upper division.

Mgmt 225 Introduction to Law
A,W. 4 cr. Lect.
Basic legal concepts and institutions; basic law of contracts and sales (UCGC).

Mgmt 231 Business Statistics
A,W,Su. 4 cr. Lect.

Mgmt 280 Special Topics
On demand. 1-4 cr. Lect.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Mgmt 325 Legal Framework of Business Regulations
A,W. 5 cr. Lect.
PREREQUISITE: Mgmt 225.
Study of the framework of laws and institutions within which regulation of business takes place. The principles studied are applicable to all types of regulation, from local zoning to regulation by the Federal Trade Commission.

Mgmt 327 Antitrust Law
W. 5 cr. Rec.-Dis.
PREREQUISITE: Mgmt 225.

Mgmt 332 Management Information Systems
On demand. 3 cr. Lect.
PREREQUISITES: Fin 305, Mgmt 333 and 340.
Overview of systems methodology as it applies to MIS design. Developing data bases for planning, operational control and managerial/financial control of organizations. MIS interface considerations with the organization's EDP system.

Mgmt 333 Production and Operations Management
A,W,Su. 4 cr. Lect.
PREREQUISITES: Mgmt 231 and 340.
Terminology, functions and processes of production and operations management. Quantitative techniques needed to analyze POM problems.

Mgmt 340 Management and Organization
A,W,Su. 4 cr. Lect.
PREREQUISITES: Junior standing, Psy 103, Econ 204 and, for majors in business, formal admission to the College.
Concepts and control of organizations with emphasis on work groups, individual behavior, interpersonal relations, communication, leadership, organizational structure, decision making, planning, control, staffing, motivation.
Mgmt 341 Human Problems in Organization
PREREQUISITE: Mgmt 340.
Applications and experiential exercises focusing on technology and job satisfaction, motivation theory, perception, group dynamics, conflict management, functions and roles of leadership, change theory, job enrichment, and inter-group communication.

Mgmt 400 Seminar in Management
On demand. 1 cr. Sem.
PREREQUISITES: Senior standing, Mgmt 340.
Advanced study of topic areas in management.

Mgmt 431 Quantitative Models for Business
On demand. 3 cr. Lect.
PREREQUISITES: Senior standing, Mgmt 333.
Computer models for generating management information. Some of the particular models examined are simulation, factor analysis, discriminate analysis and clustering techniques.

Mgmt 433 Advanced Topics in Operations Management
A,W,S. 4 cr. Lect.
PREREQUISITES: Senior standing, Mgmt 333.
Advanced topics in the field of operations management. Case studies using analysis as the basis for decision making and action.

Mgmt 441 Senior Practicum
A,W,S. 3 cr. Ind. St.
PREREQUISITES: Senior standing, Fin 305, Mgmt 340 and Mkgt 355 required, Mgmt 448 recommended.
Studying the opportunities and problems of actual organizations and presenting the owner-managers with analyses and recommendations.

Mgmt 442 Entrepreneurship
A,W,S. 4 cr. Lect.
PREREQUISITES: Senior standing, Fin 305, Mgmt 340 and Mkgt 355.
Entrepreneurial roles, risks and characteristics. Evaluation of business opportunities and potential acquisitions. Start-up problems, tax aspects, legal forms, forecasts, feasibility studies, venture financing and promotion.

Mgmt 443 Personnel Administration
A,S. 4 cr. Lect.
PREREQUISITE: Mgmt 340.
The functions and tools used in procurement, development, compensation, integration and maintenance of manpower resources and their impact on the effective attainment of organizational goals.

Mgmt 444 Industrial Relations and the Collective Bargaining Process
A,W,S. 4 cr. Lect.
PREREQUISITES: Senior standing, Econ 312, Mgmt 443.
The evolution of collective bargaining as a process of conflict resolution. A behavioral look at efforts to resolve the problems of management practice and prerogatives versus labor rights and human needs.

Mgmt 445 International Management
W. 3 cr. Lect.
PREREQUISITES: Mgmt 340, Econ 314 recommended.
Management concepts and practices of multinational and foreign firms. Issues treated include: political, economic, cultural environments; production and technology choices; marketing problems; financial issues; and organizational issues.

Mgmt 446 Business and Environment
A,W,S. 3 cr. Lect.
PREREQUISITES: Senior standing, Mgmt 225 and 340.
The role of business in causing and solving current problems is examined in the broad context of our nation and society. The course will take an analytical, problem-solving approach rather than concentrating solely on problem identification.

Mgmt 447 Organizational Theory
On demand. 3 cr. Lect.
PREREQUISITES: Senior standing, Mgmt 340.
Analysis of strategies for studying organizations. Issues treated include organizational structure, goal formation, human and social factors, communications, control, technology, decision making and organizational dynamics in the administrative process.

Mgmt 448 Small Business Management
A,S. 4 cr. Lect.
PREREQUISITES: Senior standing, Mgmt 325 and 340, Mkt 555.
Small business opportunities, problems and applications emphasizing innovation, management planning, financing, marketing, tax aspects, governmental regulations and microcomputer systems. Developing, evaluating and funding opportunities for innovation, growth and expansion.

Mgmt 449 Business Strategy and Policy
A,W,S. 4 cr. Lect.
PREREQUISITES: Senior standing, completion of business core (concurrent enrollment in Mgmt 446 is acceptable). To be taken during a student's last quarter, or next to last quarter if necessary, by schedule conflicts.
Course focuses on strategic management function and implications for managerial decision making. Comprehensive case analyses and computerized simulations utilized. An integrative, capstone experience for all business students.

Mgmt 450 International Practicum
S alternating years with Mgmt 446, offered S 1986. 3 cr. Lect.
PREREQUISITES: Senior standing, Econ 304, Mgmt 448.
Studying the opportunities and problems of actual organizations and presenting the owner-managers with analyses and recommendations.

Mgmt 451 Senior Practicum
A,W,S. 3 cr. Ind. St.
PREREQUISITES: Senior standing, Fin 305, Mgmt 340 and Mkgt 355.
Advanced topics in the field of operations management. Case studies using analysis as the basis for decision making and action.

Mgmt 452 Entrepreneurship
A,W,S. 4 cr. Lect.
PREREQUISITE: Mgmt 340.
Entrepreneurial roles, risks and characteristics. Evaluation of business opportunities and potential acquisitions. Start-up problems, tax aspects, legal forms, forecasts, feasibility studies, venture financing and promotion.

Mgmt 453 Personnel Administration
A,S. 4 cr. Lect.
PREREQUISITE: Mgmt 340.
The functions and tools used in procurement, development, compensation, integration and maintenance of manpower resources and their impact on the effective attainment of organizational goals.

Mgmt 454 Industrial Relations and the Collective Bargaining Process
A,W,S. 4 cr. Lect.
PREREQUISITES: Senior standing, Econ 312, Mgmt 443.
The evolution of collective bargaining as a process of conflict resolution. A behavioral look at efforts to resolve the problems of management practice and prerogatives versus labor rights and human needs.

Mgmt 455 International Management
W. 3 cr. Lect.
PREREQUISITES: Mgmt 340, Econ 314 recommended.
Management concepts and practices of multinational and foreign firms. Issues treated include: political, economic, cultural environments; production and technology choices; marketing problems; financial issues; and organizational issues.

Mgmt 456 Business and Environment
A,W,S. 3 cr. Lect.
PREREQUISITE: Mgmt 340.
The role of business in causing and solving current problems is examined in the broad context of our nation and society. The course will take an analytical, problem-solving approach rather than concentrating solely on problem identification.

Mgmt 457 International Practicum
S alternating years with Mgmt 446, offered S 1986. 3 cr. Lect.
PREREQUISITES: Senior standing, Econ 304, Mgmt 448.
Studying the opportunities and problems of actual organizations and presenting the owner-managers with analyses and recommendations.

Mgmt 458 Marketing Research
A,W,S. 4 cr. Lect.
PREREQUISITE: Mgmt 355.
The application of marketing research to retail management problems. Topics include: the structure of the retail industry and nature of competition; merchandise planning, budgeting and control; and pricing and location theory.

Mktg 280 Special Topics
On demand. 1-4 cr. Lect.
Courses not required in marketing option at the sophomore level for which there is a particular need, or given on a trial basis to determine need.

Mktg 355 Marketing Concepts
A,W,S,Su. 4 cr. Lect.
PREREQUISITES: Junior standing, Psy 103, Econ 204, Mktg 231 and, for majors in business, formal admission to the College.
Introduction to marketing management decision making in the product, price, promotion and distribution areas. Consideration of the behavioral, legal, ethical, economic, and societal environments as they affect such decisions in the domestic and international organization.

Mktg 400 Seminar in Marketing
On demand. 3 cr. Sem.
PREREQUISITES: Senior standing, Mktg 355.
Advanced study of topic areas in marketing.

Mktg 456 Promotion
A,W,S. 4 cr. Lect.
PREREQUISITE: Mktg 355.
Explores the use of advertising, sales promotion and personal selling as methods for promoting goods and services. Taught from the perspective of the marketing manager, with emphasis on the theory, strategy and tactics of promotion.

Mktg 457 Retail Management
A,W,S. 4 cr. Lect.
PREREQUISITE: Mktg 355.
The application of marketing theory to retail management problems. Topics include: the store physical environment, store location, merchandise planning and location theory.

Mktg 458 Marketing Research
A,W,S. 4 cr. Lect.
PREREQUISITE: Mktg 355.
The application of scientific research methods to marketing problems. While various research methods are discussed, the emphasis is on survey methodology.

Mktg 459 Sales Management
On demand. 4 cr. Lect.
PREREQUISITE: Mktg 355.
Sales and market potential, forecasting, budgeting and control. Sales organization, including structure, training, motivation and compensation. Evaluation of sales goals and individual performance.

Mktg 460 Marketing Management
A,W,S. 4 cr. Lect.
PREREQUISITES: Senior standing and completion of (or concurrent enrollment in) other courses required by marketing option.
Past course work in marketing is integrated with the design of product or service and the determination of price.
Mktg 480 Special Topics
On demand. 1-4 cr. Lect.
PREREQUISITES: Senior standing.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Business—Office Systems
Faculty of Management
994-4681
See Business—Management for faculty listing.

OS 110 Stenography I
A,W. 4 cr. Lect. 3; Lab. 1.
Fundamentals of Gregg Shorthand system with emphasis on theory development.

OS 111 Stenography II
W,S. 4 cr. Lect.; 3; Lab. 1.
PREREQUISITE: OS 110.
Speed dictation, transcribing techniques, and the acquisition of language art skills through transcription.

OS 112 Stenography III
A,S. 4 cr. Lect.; 3; Lab. 1.
PREREQUISITE: OS 111.
Speed dictation, transcribing techniques and mailing transcripts.

OS 114 Keyboarding for Computers
A,W. 2 cr. Lab.
Keyboard and number pad skills for microcomputers and terminals.

OS 118 Beginning Keyboarding
A,W,S. 2 cr. Lab.
Controlling the keyboard by touch with emphasis on developing speed and accuracy.

OS 119 Intermediate Keyboarding
A,W. 2 cr. Lab.
PREREQUISITE: OS 118.
Office typing procedures with continued development of speed and accuracy. Requires a minimum competency of 45 words a minute.

OS 120 Advanced Keyboarding
A,W,S. 2 cr. Lab.
PREREQUISITE: OS 119.
Office typing production with continued development of basic skills. Requires a minimum competency of 40 words a minute.

OS 131 Business Machines
A,W. 1 cr. Lab.
Skills necessary to efficiently operate a variety of calculating machines.

OS 200 Seminar
On demand. 1 cr. Sem. Maximum 3 cr.
PREREQUISITE: Sophomore standing.
Discussion, outside speakers and stimulus for individual study.

OS 221 Advanced Stenography
A,W. 4 cr. Lect.; 3; Lab. 1.
PREREQUISITES: OS 112 and 120.
Speed building in taking dictation, transcribing, and mailing transcripts. Minimum entrance requirements for OS 221 include a performance level of 80 words a minute for three minutes.

OS 223 Administrative Office Procedures
S. 3 cr. Lect.; 2; Lab. 1.
PREREQUISITES: OS 120 and sophomore standing.
Modern office procedures; an opportunity to apply previously acquired competencies. The latest developments in office information, technology and equipment.

OS 225 Copy Processing
A,W,S. 3 cr. Lect.; 2; Lab. 1.
PREREQUISITE: OS 118.
Duplicating processes, techniques and equipment; opportunity for student to prepare projects, exploration of careers in copy processing.

OS 227 Records Management
W,S. 3 cr. Lect.
Controlling the quantity, quality and costs of business records from their creation to final disposition.

OS 229 Word Processing
A,W. 3 cr. Lect.; 2; Lab. 1.
PREREQUISITE: OS 120.
A system for efficiently converting ideas into printed words. Use of automated equipment and proper procedures in producing documents rapidly.

OS 236 Office Communications
A,W. 3 cr. Lect.
PREREQUISITE: OS 112.
Office communications skills needed by office personnel.

OS 242 Microcomputer Applications
W,S. 3 cr. Lect.
PREREQUISITE: BuEd 220.
Application packages used by businesses. Spreadsheets, data base, graphics and word processing are covered.

OS 250 Supervised Office Experience
A,W,Su. 1-6 cr. Ind. St. Maximum 6 cr.
PREREQUISITE: Sophomore standing.
Individual internship experience in an office situation; projects involving preparation for becoming an office employee. Students may enroll for 3 credits per quarter except summer quarter when they may enroll for 6 credits.

OS 269 Word Processing Applications
S,Su. 3 cr. Lect.; 2; Lab. 1.
PREREQUISITE: OS 114.
Skills and procedures necessary for operating word processing programs for document production.

OS 270 Individual Problems
A,W,S. 1-6 cr. Ind. St. Maximum 6 cr.
PREREQUISITE: Sophomore standing and consent of instructor.
Directed research and study on an individual basis. Topics arrived at by agreement between the student and the instructor.

OS 280 Special Topics
On demand. 1-4 cr. Lect.
PREREQUISITE: Sophomore standing.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

OS 320 Office Systems Analysis
S. 3 cr. Lect.
PREREQUISITES: OS 242 and 269.
Phases and methods of analysis in the development and design of an information system. Identification of procedures and techniques utilized in communication of analysis findings.

OS 333 Information Systems
A,W,S. 3 cr. Lect.
An introduction to the analysis and design of an interdisciplinary business information system utilizing current technology and procedures.

OS 400 Seminar
PREREQUISITE: Senior standing.
Discussion, outside speakers and stimulus for individual study. Subjects of current interest in office administration.

OS 420 Office Automation
W. 3 cr. Lect.
PREREQUISITES: BuEd 320 and OS 520.
Utilization of computer technology to support the flow of information in the office environment. Audio, voice, conferencing, text and voice mail are utilized.

OS 442 Microcomputer Applications for Business
S. 3 cr. Lect.
Utilization of business applications for microcomputers. Accounting, inventory, planning and financial analysis are among the topics covered.

OS 460 Administrative Services Systems
S. 3 cr. Lect.
PREREQUISITES: OS 420 and 442.
Major advancements, developments and trends in the field of office systems management, and administrative services. A review of office procedures and how changes have affected these practices. Emphasis on the systems approach.

OS 469 Word Processing Systems
A. 3 cr. Lect.; 2; Lab. 1.
PREREQUISITE: OS 250.
Utilization of word processing and microcomputers. Accounting, inventory, planning and financial analysis are among the topics covered.

Chemical Engineering
994-2221

Head of Department: Dr. J.T. Sears.
Associate Professors: M.C. Deibert, D.L. Shaffer
Assistant Professor: R.W. Larsen
Adjunct Professor: W.G. Characklis
Adjunct Assistant Professor: T. Sabin.

Che 101 Freshman Seminar
A. 1 cr. Sem.
An introduction to chemical engineering.

Che 102 Freshman Seminar
W. 1 cr. Sem.
An introduction to chemical engineering industry and its applications to society.

Che 200 Sophomore Seminar
S. 1 cr. Sem.
Introduction to chemical engineering projects. Educational guidance for sophomore chemical engineering students. Continuation of Che 102.
CHE 215 Industrial Stoichiometry I  
A.S. 3 cr. Lect.  
PREREQUISITES: Chem 132 and Math 182.  

CHE 216 Industrial Stoichiometry II  
A.W. 3 cr. Lect.  
PREREQUISITE: CHE 215.  
Energy balance computations applied to process industry operations. Properties of gases, vapors, liquids and solids in industrial operations.

CHE 217 Industrial Stoichiometry III  
W.S. 3 cr. Lect.  
PREREQUISITE: CHE 216.  
Combined process material and energy balances applied to the industries in steady and unsteady state operations. Development of material and energy balances in design process case studies.

CHE 280 Special Topics  
On demand. 1-5 cr. Maximum 8 cr. Maximum of CHE 280 plus CHE 480, 16 cr.  
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

CHE 300 Junior Seminar  
W. 1 cr. Sem.  
PREREQUISITE: Junior standing in CHE.  
Introduction to chemical engineering design projects. The professional aspects of a chemical engineering career. Guest speakers from industry.

CHE 301 Chemical Process Industries  
S. 3 cr. Lect.  
PREREQUISITE: Chem 153.  
Fundamentals of inorganic chemistry as applied to present-day chemical process industries. Compounds and reactions which may assume industrial importance in future.

CHE 304 Chemical Engineering Computation  
A. 2 cr. Lect. 1; Rec.-Dis. 1.  
Effective methods for applying the computer to common numerical problems encountered in chemical engineering. Chemical engineering examples will provide a basis for more comprehensive problems encountered in the other professional-level courses.

CHE 322 Transport Processes and Unit Operations I  
A. 4 cr. Lect.  
PREREQUISITES: CHE 217 and Math 224.  
Theory and equipment for fundamental chemical engineering operations involving fluid mechanics. Computations of operational rates. Equipment design for specified conditions.

CHE 323 Transport Processes and Unit Operations II  
W. 4 cr. Lect.  
PREREQUISITE: CHE 322.  
Theory and equipment for fundamental chemical engineering operations involving heat transfer. Computations of operational rates. Equipment design for specified conditions.

CHE 324 Transport Processes and Unit Operations III  
S. 4 cr. Lect.  
PREREQUISITE: CHE 323.  
Theory and equipment for fundamental chemical engineering operations involving mass transfer. Computations of operational rates. Equipment design for specified conditions.

CHE 363 Industrial Inspection Trip  
S. 0 cr.  
PREREQUISITE: Junior standing.  
Students seeking a bachelor of science degree in chemical engineering must participate in inspection trips during junior and senior years.

CHE 400 Seminar  
A.W.S. 1 cr. Sem.  
Chemical engineering processes and problems.

CHE 402 Chemical Process Industries  
A. 3 cr. Lect.  
PREREQUISITE: Chem 273.  
Fundamentals of organic chemistry as applied to present-day chemical process industries. Compounds and reactions which may assume industrial importance in future.

CHE 405 Chemical Engineering Thermodynamics I  
A. 3 cr. Lect.  
PREREQUISITES: CHE 216 and Math 224.  
Basic applications of the first and second laws of thermodynamics to open and closed system processes and cycles, properties of fluids.

CHE 406 Chemical Engineering Thermodynamics II  
W. 3 cr. Lect.  
PREREQUISITE: CHE 405.  
Applications of the first and second laws of thermodynamics to phase equilibrium.

CHE 407 Chemical Engineering Thermodynamics III  
S. 3 cr. Lect.  
PREREQUISITE: CHE 406.  
Application of the first and second laws of thermodynamics to chemical equilibrium.

CHE 408 Chemical Engineering Materials  
S. 4 cr. Lect.  
PREREQUISITES: Chem 131, 152 and 272.  
Chemistry of internal structure of solids and the relation of structure to chemical and physical properties of metals and nonmetallic solids.

CHE 411 Chemical Engineering Design I  
A. 4 cr. Lect.  
PREREQUISITES: CHE 304 and 324.  
Design of chemical engineering plants, equipment and processes.

CHE 412 Chemical Engineering Design II  
W. 2 cr. Lab.  
PREREQUISITE: CHE 324 and 411.  
Design of chemical engineering plants, equipment and processes. Continuation through CHE 411, 412 and 413 is accomplished in the same academic year.

CHE 413 Chemical Engineering Design III  
S. 2 cr. Lab.  
PREREQUISITE: CHE 412.  
Design of chemical engineering equipment and processes. Continuation through CHE 411, 412 and 413 is accomplished in the same academic year.

CHE 414 Chemical Engineering Design Case Studies  
S. 3 cr. Lect. 1; Rec.-Dis. 2.  
PREREQUISITES: CHE 411, 428.  
Design of chemical processes, equipment and plants utilizing open-ended case problems.

CHE 419 Petroleum Refinery Design I  
A. 4 cr. Lect.  
PREREQUISITES: CHE 304 and 324.  
Design and trouble-shooting of petroleum refining plants, equipment and processes.

CHE 420 Petroleum Refinery Design II  
W. 2 cr. Lab.  
PREREQUISITE: CHE 324 and 419.  
Design and trouble-shooting of petroleum refining plants, equipment and processes.

CHE 421 Petroleum Refinery Design III  
S. 2 cr. Lab.  
PREREQUISITE: CHE 420.  
Design and trouble-shooting of petroleum refining plants, equipment and processes.

CHE 423 Petroleum Refinery Technology  
On demand. 4 cr. Lect.  
PREREQUISITE: Senior standing.  
Methods, equipment and processes in petroleum refining industry.

CHE 428 Chemical Reaction Engineering I  
A. 3 cr. Lect.  
PREREQUISITES: CHE 304, CHE 407 or Chem 304.  
Application of chemical kinetics of homogeneous reactions to the design of chemical processing equipment.

CHE 429 Chemical Reaction Engineering II  
W. 3 cr. Lect.  
PREREQUISITE: CHE 428.  
Application of chemical kinetics of heterogeneous reactions to the design of chemical processing equipment.

CHE 436 Air Pollution Control  
S. 3 cr. Lect.  
PREREQUISITE: Senior standing.  
Study of chemical pollutants and the chemical engineering processes used to control them.

CHE 437 Introduction to Polymer Engineering  
S. 3 cr. Lect.  
PREREQUISITES: Chem 273, CHE 523, 402.  
The nature and special characteristics of synthetic high polymers and the technology of their manufacture and processing.

CHE 441 Chemical Engineering Laboratory I  
W. 3 cr. Lab.  
PREREQUISITES: CHE 322 and Engl 121.  
Experimental studies of unit operations, Pilot plant studies. Design of processes and equipment from experimental studies.

CHE 442 Chemical Engineering Laboratory II  
S. 3 cr. Lab.  
PREREQUISITE: CHE 323 and Engl 121.  
Experimental studies of unit operations, Pilot plant studies. Design of processes and equipment from experimental studies.

CHE 443 Chemical Engineering Laboratory III  
A.Su. 3 cr. Lab.  
PREREQUISITES: CHE 324 and Engl 121.  
Experimental studies of unit operations, Pilot plant studies. Design of processes and equipment from experimental studies.

CHE 447 Modeling and Transport Processes I  
A. 4 cr. Lect.  
PREREQUISITES: CHE 324 and Math 226.  
Deterministic modeling techniques are applied to one-dimensional processes for the transport of momentum, energy and mass. Analytical and numerical solution techniques for the differential equations commonly encountered in the transport processes.

CHE 449 Modeling and Transport Processes II  
W. 3 cr. Lect.  
PREREQUISITE: CHE 447.  
A continuation of the concepts in CHE 447 for multidimensional systems.
ChE 451 Process Dynamics, Control and Instrumentation
S. 4 cr. Lect.
PREREQUISITES: ChE 304, 324, Math 226.
Transient response analysis of chemical industry processes. Response characteristics of controllers and instruments. Design of chemical process control systems.

ChE 461 Industrial Inspection Trip
A. 0 cr.
PREREQUISITE: Senior standing.
Students seeking a bachelor of science degree in chemical engineering must participate in inspection trips during junior and senior years.

ChE 470 Individual Problems
A,W,Su. 1-5 cr. Ind. St. Maximum 6 cr.
PREREQUISITES: Consent of instructor and department.
Directed research and study on an individual basis.

ChE 470 Individual Problems
A,W,Su. 1-5 cr. Ind. St. Maximum 6 cr.
PREREQUISITES: Consent of instructor and department.

ChE 480 Special Topics
On demand. 1-6 cr. Lect.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

ChE 490 B.S. Thesis
S. 3 cr. Ind. St.
PREREQUISITE: Senior standing, science option only.
Individual projects for students enrolled in the science option culminating in the writing of a B.S. Thesis; staff supervision.

Graduate Courses in Chemical Engineering

*There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.*

ChE 500 Seminar
A,W,Su. 1 cr. Sem. May be repeated. Maximum 8 cr.
PREREQUISITE: Graduate standing.
Presentation of technical reports by staff and students.

ChE 502 Chemical Reaction Equilibria
A. 3 cr. Lect.
PREREQUISITE: ChE 407.
Determination of equilibrium compositions for typical industrial chemical reactions. Particular emphasis on heterogeneous reactions and systems involving multiple reactions.

ChE 503 Applied Solution Thermodynamics
W. 3 cr. Lect.
PREREQUISITE: ChE 407.
Chemical engineering applications of thermodynamics to phase equilibrium. Emphasis on liquid-liquid and vapor-liquid systems.

ChE 506 Distillation
On demand. 4 cr. Lect.
PREREQUISITE: ChE 324.
Determination and treatment of vapor-liquid equilibria data, methods of calculation for binary and multi-component mixtures, calculation and comparison of batch and distillation and treatment of various distillation systems including azeotropic and extractive.

ChE 510 Reaction Engineering and Reactor Modeling
On demand. 4 cr. Lect.
PREREQUISITE: ChE 429.
Theory and practice of industrial reactions, kinetics of homogeneous and heterogeneous reactions, high-pressure synthesis, factors in catalytic activity, modeling of fixed and fluidized beds, process design problems.

ChE 511 Catalysis
On demand. 4 cr. Lect.
PREREQUISITE: ChE 429.
The fundamental principles of catalysis and catalytic reactor design at a working research level.

ChE 515 Fluidized Bed Phenomena
On demand. 4 cr. Lect.
PREREQUISITES: ChE 324, 429.
The fundamental principles of the fluidized bed phenomena and its application to heat and mass transfer and chemical reaction.

ChE 519 Advanced Chemical Engineering Instrumentation
On demand. 2 Lect.
PREREQUISITE: ChE 451.
Advanced and detailed consideration of instrumentation in chemical process control.

ChE 522 Mathematical Problems in Chemical Engineering
On demand. 4 cr. Lect.
PREREQUISITE: ChE 407.
Mathematical problems involved in chemical engineering processes. Emphasis on relationship between mathematical solutions and actual physical situations.

ChE 523 Process Control
On demand. 4 cr. Lect.
PREREQUISITE: ChE 451.
Mathematical analysis of open- and closed-loop systems in chemical industry.

ChE 531 Fluid Dynamics
On demand. 5 cr. Lect.
PREREQUISITE: ChE 447.
Fluid dynamics with special emphasis on aspects important in the chemical process industries.

ChE 532 Heat Transfer
On demand. 5 cr. Lect.
PREREQUISITE: ChE 447.
Theory of energy transfer as heat, mathematical techniques and applications.

ChE 534 Mass Transfer
On demand. 5 cr. Lect.
PREREQUISITES: ChE 447, 449.
Mass transfer theory, transport in liquids, porous solids, interfacial effects, related mathematical techniques and applications.

ChE 546 Microbial Process Analysis
A. 3 cr. Lect.
PREREQUISITES: Chem 131, 132, 134, Math 183 and Graduate standing.
Fundamentals of process analysis applied to microbial reactors. Kinetics and stoichiometry of microbial processes. (Continuation: CE 547 Dynamics of Microbial Processes.)

ChE 570 Individual Problems
A,W,Su. 1-5 cr. Ind. St. Maximum 9 cr.
PREREQUISITES: Consent of instructor, approval of department head and Graduate Dean.
Directed research and study on an individual basis.

ChE 580 Special Topics
On demand. 1-8 cr. Maximum 15 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

ChE 580 Special Topics
A,W,Su. 1-5 cr. Ind. St. Maximum 9 cr.
PREREQUISITES: Consent of instructor, approval of department head.
Directed research and study on an individual basis.

ChE 590 Master's Thesis
A,W,Su. 3-12 cr. Ind. St. May be repeated.
PREREQUISITE: Master's standing.

ChE 690 Doctoral Thesis
A,W,Su. 3-12 cr. Ind. St. May be repeated.
PREREQUISITE: Doctoral standing.

Chemistry

994-4801

Head of Department: Dr. E.H. Abbott.
Assistant Professors: E.S. Hood.

Chem 121N Introductory General Chemistry
A,W,Su. 3 cr. Lect.
PREREQUISITE: High school algebra, Chem 121 may serve as a prerequisite for Chem 122, Chem 151, and Chem 134, but not other chemistry courses. Credit will be allowed for both Chem 121 and Chem 131 only if Chem 121 is taken first.
COREQUISITE: Chem 125. (May be waived with written approval of department head.)
Introductory course for students lacking a good high school background in science. Atomic structure, chemical bonding, chemical reactions, acid-base systems, and nuclear chemistry.

Chem 122N Introductory Biological and Organic Chemistry
W,Su. 3 cr. Lect.
PREREQUISITE: High school chemistry or Chem 121.
COREQUISITE: Chem 126. (May be waived with written approval of department head.)
Selected areas of organic and biological chemistry.

Chem 125N Introductory General Chemistry Laboratory
A,W,Su. 1 cr. Lab.
COREQUISITE: Chem 121. (May be waived with written approval of department head.)
Laboratory to accompany Chem 121. Experiments with basic laboratory techniques to illustrate principles of general chemistry discussed in lecture.

Chem 126N Introductory Biological and Organic Chemistry Laboratory
W,Su. 1 cr. Lab.
COREQUISITE: Chem 122. (May be waived with written approval of department head.)
Basic experiments in basic organic and biological chemistry laboratory principles.

Chem 131N General Chemistry I
A,W,Su. 5 cr. Lect.
PREREQUISITE: One year of high school algebra or Chem 121 or Math 140.
COREQUISITES: Chem 125. (May be waived with written approval of department head.)
The first of a two-quarter sequence on the general principles of modern chemistry with emphasis on atomic structure, chemical bonding, the periodic system, equilibria and elementary thermodynamics of chemical systems. It is intended that students should take both courses in the sequence Chem 151-152.
Chem 132N General Chemistry II  
W,Su. 3 cr. Lect. Continuation of sequence.  
PREREQUISITE: Chem 131.  
COREQUISITE: Chem 136. (May be waived with written approval of department head.) 
The second of a two-course sequence. See course description for Chem 131.

Chem 133N Inorganic Chemistry and Qualitative Analysis  
S,Su. 5 cr. Lect.; Lab. 2.  
PREREQUISITE: Chem 132 and 136 or Chem 142 and 138.  
Inorganic chemistry and chemical equilibrium with laboratory work in the application of equilibrium principles to chemical systems.

Chem 134 Fundamentals of Organic Chemistry  
A,Su. 4 cr. Lect.; Rec.-Dis. 1.  
PREREQUISITE: Chem 121 or 131 or high school chemistry.  
COREQUISITE: Chem 159. (May be waived with written approval of department head.) 
Nomenclature, properties, synthesis and typical reactions of common monofunctional organic compounds.

Chem 135N General Chemistry I Laboratory  
A,W,Su. 1 cr. Lab.  
COREQUISITES: Chem 131. (May be waived with written approval of department head.) 
The first of a two-quarter introductory laboratory sequence to accompany General Chemistry I and II. Experiments with basic laboratory techniques to illustrate principles of chemistry discussed in Chem 131. It is intended that students should take both courses in the sequence Chemistry 135-136.

Chem 136N General Chemistry II Laboratory  
W,Su. 1 cr. Lab. Continuation of sequence.  
COREQUISITE: Chem 132. (May be waived with written approval of department head.) 
Experiments with basic laboratory techniques to illustrate principles of chemistry discussed in Chem 132.

Chem 137N Advanced General Chemistry Laboratory  
A. 1 cr. Lab.  
COREQUISITES: Chem 141. (May be waived with written approval of department head.) 
The first of two beginning courses for students preparing for independent laboratory work. Emphasis on quantitative laboratory skills and planning of experiments.

Chem 138N Advanced General Chemistry II Laboratory  
W. 1 cr. Lab. Continuation of sequence.  
COREQUISITE: Chem 142. (May be waived with written approval of department head.) 
The second of two beginning courses for students preparing for independent laboratory work. Emphasis on quantitative laboratory skills and planning of experiments.

Chem 139 Fundamentals of Organic Chemistry Laboratory  
A,Su. 1 cr. Lab.  
COREQUISITE: Chem 134. (May be waived with written approval of department head.) 
Introductory laboratory to accompany lectures in Fundamentals of Organic Chemistry.

Chem 141N Advanced General Chemistry I  
A. 3 cr. Lect.  
PREREQUISITES: High school chemistry. High school algebra and some additional mathematics recommended.  
COREQUISITE: Chem 137. (May be waived with written approval of department head.) 
The first of a three-quarter course sequence on chemical bonding, periodicity, atomic and molecular structures, chemical equilibria, introductory quantum chemistry, elementary thermodynamics and chemical reactivity.

Chem 142N Advanced General Chemistry II  
W. 3 cr. Lect. Continuation of sequence.  
PREREQUISITES: Chem 131 or 141.  
COREQUISITE: Chem 158. (May be waived with written approval of department head.) 
The second quarter of the Chemistry 141-142-143 sequence. See description for Chem 141.

Chem 143 Advanced General Chemistry III  
S. 5 cr. Lect.; Lab. 2.  
PREREQUISITES: Chem 132 or 142.  
The third quarter of the Chemistry 141-142-143 sequence. See description for Chem 141.

Chem 200 Undergraduate Seminar  
S. 1 cr. Sem. Maximum 3 cr.  
PREREQUISITE: Chem 133 or 143.  
Survey of current chemical research with emphasis on the chemical literature. Various reports and information retrieval projects will be required.

Chem 211 Biochemistry I  
W,Su. 3 cr. Lect.  
PREREQUISITE: Chem 134.  
A survey course covering the structure and role of biological molecules including proteins, amino acids, enzymes, coenzymes and nucleic acids.

Chem 212 Biochemistry Laboratory I  
W. 2 cr. Lab. 1; Rec.-Dis. 1.  
PREREQUISITE: Chem 211 (Chem 211 may be taken concurrently with Chem 212).  
Laboratory principles of pH and buffering action, chromatography of amino acids, protein quantitation, peptide sequencing and properties of enzymes.

Chem 213 Biochemistry II  
S,Su. 3 cr. Lect.  
PREREQUISITE: Chem 211.  
A survey of cellular metabolism. Includes oxidative phosphorylation, hormones, control and regulation, photosynthesis and protein biosynthesis.

Chem 214 Biochemistry Laboratory II  
S. 2 cr. Lab. 1; Rec.-Dis. 1.  
PREREQUISITE: Chem 213 (Chem 213 may be taken concurrently with Chem 214).  
Continuation of Chem 212 with emphasis on carbohydrates, lipids, end enzyme reactions. Biochemical analyses of blood, urine and food.

Chem 227 Analytical Chemistry  
A. 5 cr. Lect.; Lab. 5.  
PREREQUISITE: Chem 133 or 143.  
Introduction to volumetric, gravimetric and color metric analyses. Emphasis on development of lab skills, analysis of data, and on understanding the details of routine chemical analyses.

Chem 228 Introduction to Modern Analytical Chemistry  
S. 5 cr. Lect.; Lab. 3.  
PREREQUISITE: Chem 227.  
Introduction to chemical instrumentation and its use in solving lab problems in chemistry and allied fields. Topics include electrochemical analyses; spectrophotometric, flame absorption and emission methods; and elementary chromatography.

Chem 271 Organic Chemistry I  
A. 3 cr. Lect.  
PREREQUISITE: Chem 133 or 143.  
COREQUISITE: Chem 274. (May be waived with written approval of department head.) 
The first half of a three-quarter course sequence presenting organic chemistry primarily for chemistry, chemical engineering and preprofessional majors. Emphasis on theory, energetics and reaction mechanisms as well as descriptive chemistry. Not recommended for less than three quarters, it is intended that students should register for the entire sequence.

Chem 272 Organic Chemistry II  
W. 5 cr. Lect. Continuation of sequence.  
PREREQUISITE: Chem 271.  
COREQUISITE: Chem 275.  
The second of a three-quarter sequence. See course description for Chem 271.

Chem 273 Organic Chemistry III  
S. 3 cr. Lect. Continuation of sequence.  
PREREQUISITE: Chem 272.  
COREQUISITE: Chem 276.  
The third of a three-quarter sequence. See course description for Chem 271.

Chem 274 Organic Chemistry I Laboratory  
A. 2 cr. Lab.  
COREQUISITE: Chem 271. (May be waived with written approval of department head.) 
Chemistry 274 is approximately the first third of a sequence of a laboratory to accompany Chem 271-272-273.

Chem 275 Organic Chemistry II Laboratory  
W. 2 cr. Lab. Continuation of sequence.  
PREREQUISITE: Chem 274.  
COREQUISITE: Chem 272. (May be waived with written approval of department head.) 
The second part of a laboratory sequence; accompanies Chem 272.

Chem 276 Organic Chemistry III Laboratory  
S. 2 cr. Lab. Continuation of sequence.  
PREREQUISITE: Chem 275.  
COREQUISITE: Chem 273. (May be waived with written approval of department head.) 
The third part of a laboratory sequence; accompanies Chem 273.

Chem 277 Organic Chemistry for Professionals I  
A. 1 cr. Lect.  
COREQUISITE: Chem 271.  
The first third of a sequence designed to give additional depth and breadth in subject matter of Chem 271-272-273. The objective is to amplify and extend the treatment of material covered in the 271 series, not to duplicate it. Most of the effort will be directed toward the theoretical topics, not toward the descriptive chemistry.

Chem 278 Organic Chemistry for Professionals II  
W. 1 cr. Lect. Continuation of sequence.  
COREQUISITE: Chem 272.  
The second course in the Chem 277-278-279 sequence.

Chem 279 Organic Chemistry for Professionals III  
S. 1 cr. Lect. Continuation of sequence.  
COREQUISITE: Chem 273.  
The third part of the Chem 277-278-279 sequence.

Chem 280 Special Topics  
PREREQUISITE: Consent of instructor.  
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Chem 301 Elements of Physical Chemistry I  
A,Su. 5 cr. Lect.  
PREREQUISITES: Chem 133, Math 170 or 182.  
The first half of a course sequence on elementary physical chemistry primarily for life science majors.
Chem 302 Elements of Physical Chemistry II
W,Su. 4 cr. Lect. 3; Lab. 1. Continuation of sequence.
PREREQUISITE: Chem 301.

The second half of the Chem 301-302 sequence on elementary physical chemistry for life science majors.

Chem 303 Physical Chemistry I
A. 3 cr. Lect. 2; Rec-Disc. 1.
PREREQUISITES: Chem 133 or 143, Math 183 and Phys 207, 229 or 230.
The first course of a two-course sequence on kinetic theory of quantum concepts, classical and statistical thermodynamics, including phase equilibria, solutions, elementary electrochemistry, rate processes and chemical kinetics. It is intended that students should take both courses in the sequence and either Chem 305 or 310.

Chem 304 Physical Chemistry II
W. 3 cr. Lect. 2; Rec-Disc. 1. Continuation of sequence.
PREREQUISITE: Chem 303.
The second course in a two-course sequence. See description for Chem 303.

Chem 305 Physical Chemistry IV
S. 3 cr. Lect.
PREREQUISITES: Chem 133 or 143, Math 183 and Phys 207 or 229 or 230.
Elementary quantum chemistry and chemical bonding, atomic and molecular spectroscopy.

Chem 306 Experimental Physical Chemistry I
W. 2 cr. Lab.
PREREQUISITES: Chem 303 and 227 (Chem 303 and 227 may be taken concurrently with Chem 306).
The first half of a laboratory sequence on modern experimental methods of physical chemistry.

Chem 307 Experimental Physical Chemistry II
S. 2 cr. Lab. Continuation of sequence.
PREREQUISITE: Chem 306.
The second half of the Chem 306-307 sequence.

Chem 310 Physical Chemistry III
S. 3 cr. Lect.
PREREQUISITE: Chem 304.
A continuation of Chem 303 and 304. Applications of equilibrium and nonequilibrium thermodynamics to electrochemistry, polymers, colloids, solutions, transport processes.

Chem 334 Inorganic Chemistry I
A. 3 cr. Lect.
PREREQUISITES: Chem 301 or 303.
The first half of a course sequence covering the systematic presentation of atomic structure and chemical bonding with emphasis on properties, structure and the reactions of representative members of various families of the periodic table. It is intended that students should take both courses in the sequence, Chem 334-335.

Chem 335 Inorganic Chemistry II
W. 3 cr. Lect. Continuation of sequence.
PREREQUISITES: Chem 301 or 303, 334.
The second course of the sequence Chem 334-335. See course description for Chem 334.

Chem 351 Glassblowing
On demand. 2 cr. Lab.
Exercises such as metal-to-glass seals, ground joints, graded seals and vacuum systems. Projects give students experience in the use of glass in constructing objects most beneficial to them.

Chem 411 Aquatic Chemistry
W. 3 cr. Lect.
PREREQUISITES: Chem 227 and 302.
Detailed chemical discussion of natural water systems with particular attention given to equilibrium models.

Chem 417 Intermediate Organic Chemistry
A. 3 cr. Lect.
PREREQUISITE: Chem 273.
In-depth mechanistic and reaction chemistry for advanced students. Modern reagents and transformations are treated in detail, along with relevant theoretical and mechanistic considerations.

Chem 418 Organic Analytical Chemistry
W. 4 cr. Lect. 2; Lab. 2.
PREREQUISITE: Chem 273.
Identification and characterization of organic compounds by classical and instrumental methods.

Chem 427 Advanced Analytical Chemistry I
W. 4 cr. Lect. 2; Lab. 2
PREREQUISITE: Chem 303 (Chem 303 may be taken concurrently with Chem 427).
Modern methods of chemical analysis, concerned primarily with electrochemical methods.

Chem 428 Advanced Analytical Chemistry II
S. 3 cr. Lect.
PREREQUISITE: Chem 303. (Chem 303 may be taken concurrently with Chem 428).
Modern methods of chemical analysis with emphasis on instrumental techniques; concerned primarily with spectroscopic and chromatographic methods.

Chem 429 Instrumental Methods of Analysis Laboratory
S. 2 cr. Lab.
PREREQUISITE: Chem 304, 428 (Both may be taken concurrently with Chem 429).
Lab experience in instrumental analysis.

Chem 432 Electronics for Chemical Instrumentation
S. 4 cr. Lab.
Fundamentals of electronic circuits, measuring techniques, transistors, operational amplifiers and switching and counting circuits with application to modern chemical instrumentation.

Chem 440 Clinical Chemistry
A alternate years, will be offered A 1987. 3 cr. Lect. 1; Lab. 2.
PREREQUISITE: Chem 227.
Modern methods of chemical analysis employed in clinical laboratories. Principles of spectrophotometry and applications of enzymology to analysis of biological fluids are stressed.

Chem 441 General Biochemistry I
A. 3 cr. Lect.
PREREQUISITE: Chem 273.
The first of a three-course sequence covering the general properties of proteins, nucleic acids, carbohydrates and lipids. Problems of biochemical dynamics, especially biological oxidation and metabolism of proteins, nucleic acids, carbohydrates and lipids.

Chem 442 General Biochemistry II
W. 3 cr. Lect. Continuation of sequence.
PREREQUISITE: Chem 441.
The second course of the sequence Chem 441-442-443. See description for Chem 441.

Chem 443 General Biochemistry III
S. 3 cr. Lect. Continuation of sequence.
PREREQUISITE: Chem 442.
The third part of the sequence Chem 441-442-443. See Chem 441 for course descriptions.

Chem 447 Biochemical Toxicology
S alternate years, will be offered S 1987. 3 cr. Lect.
General principles of toxicology are discussed in the course. An emphasis is placed on the biochemical basis of the various toxic effects. Methods for analyzing genetically toxic compounds are covered in detail.

Chem 451 Thesis Preparation
S. 1 cr. Rec-Disc.
Format and style will be illustrated, discussed and monitored. Draft portions of manuscripts are to be completed on a regular schedule. Required of all candidates for departmental honors.

Chem 470 Individual Problems
A,W,Su. 1-6 cr. Ind. St. Maximum 6 cr.
PREREQUISITES: Junior standing or consent of instructor and department head.
Directed research and study on an individual basis.

Chem 480 Special Topics
PREREQUISITE: Junior standing.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Chem 490 Undergraduate Research
PREREQUISITE: Graduate standing.
Skills of literature survey and oral presentation thereof.

Graduate Courses in Chemistry
There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

Chem 501 Literature Reporting
PREREQUISITE: Graduate standing.

Chem 514 Applications of Bonding Theory
A. 3 cr. Lect.
PREREQUISITE: Graduate standing.
Atomic orbitals, valence bond calculations, symmetry and microsymmetry, character tables, molecular orbitals, secular equation. LCAO, energy and orbital calculations, correlations with experiments and introduction to approximate SCF methods (CND0).

Chem 515 Structure and Bonding of Inorganic Compounds
A. 3 cr. Lect.
PREREQUISITES: Chem 303, 304 or 334, 335.
Development of bonding theory spectral interpretation, structure and reactivity.

Chem 516 Mechanisms of Inorganic Reactions
W. 3 cr. Lect.
PREREQUISITES: Chem 303, 304 or 334, 335.
Mechanisms of inorganic reactions; substitution, electron transfer and catalysis.

Chem 517 Organometallic Chemistry
S. 3 cr. Lect.
PREREQUISITES: Chem 303, 304 or 334, 335.
Emphasis on rapidly developing areas of inorganic chemistry.

Chem 521 Chemical Thermodynamics
A on demand. 3 cr. Lect.
PREREQUISITE: Chem 558.
Advanced classical and statistical thermodynamics, with application to phase equilibria.

Chem 524 Modern Methods of Analytical Chemistry
A. 3 cr. Lect.
PREREQUISITE: Chem 428.
Modern methods of chemical analysis; concerned primarily with spectroscopic and chromatographic methods.

Chem 525 Advanced Electroanalysis
S. 3 cr. Lect.
PREREQUISITE: Chem 524.
Advanced methods of electroanalysis; emphasis on polarographic, amperometric and voltammetric methods.

Chem 527 Chemical Thermodynamics II
PREREQUISITE: Graduate standing.
Directed research and study on an individual basis.

Chem 528 Modern Methods of Analytical Chemistry II
S. 3 cr. Lect.
PREREQUISITE: Chem 524.
Modern methods of chemical analysis; concerned primarily with spectroscopic and chromatographic methods.
## Chemistry

### Chem 525 Modern Methods of Analytical Chemistry II
- **A. 3 cr. Lect.**
- **PREREQUISITE:** Chem 428.
- Non-instrumental methods of chemical analysis.
- The chemical equilibria underlying techniques utilizing acid-base, oxidation-reduction and complexation reactions in aqueous and non-aqueous solvents; and the chemical and physical basis of chemical separations are emphasized.

### Chem 526 Modern Methods of Analytical Chemistry III
- **W alternate years, will be offered W 1987. 3 cr. Lect.**
- **PREREQUISITE:** Chem 428.
- Theory of advanced instrumental methods.

### Chem 533 Advanced Organic Chemistry I
- **A. 3 cr. Lect.**
- **PREREQUISITE:** Chem 417.
- Mechanistic reasoning ability and the understanding of the energetics of organic reactions.

### Chem 534 Advanced Organic Chemistry II
- **W. 3 cr. Lect.**
- **PREREQUISITE:** Chem 417.
- The scope, mechanism and stereochemistry of organic reactions. Reactions grouped by transition state types and include carbonium ion, carbanion, radical, electrondeficient and orbital symmetry controlled.

### Chem 535 Organic Reagent Chemistry
- **S. 3 cr. Lect.**
- **PREREQUISITE:** Chem 417.
- Single reaction transformations with emphasis on recent developments. Will not discriminate against heterocyclic systems.

### Chem 536 Physical Organic Chemistry
- **S alternate years, will be offered S 1987. 3 cr. Lect.**
- **PREREQUISITE:** Chem 555 and 502.
- Kinetic, thermodynamic and extrathermodynamic relationships of organic chemistry including thorough discussion of linear free energy relationships.

### Chem 537 Frontiers of Organic Chemistry
- **On demand. 3 cr. Lect.**
- **PREREQUISITE:** Chem 547.
- Review of rapidly developing areas of organic chemistry.

### Chem 540 Organic Synthesis
- **On demand. 3 cr. Lect.**
- **PREREQUISITE:** Chem 535.
- Strategy in organic synthesis with emphasis on the logic thereof.

### Chem 541 Lipids
- **A alternate years, will be offered A 1987. 3 cr. Lect.**
- **PREREQUISITE:** Chem 442.
- Biochemistry of lipids in plants and animals considering the chemistry of the lipids, the enzyme systems that metabolize lipids, the dynamics of lipid metabolism in relation to various physiological and pathological conditions.

### Chem 542 Carbohydrates
- **On demand. 3 cr. Lect.**
- **PREREQUISITE or COREQUISITE:** Chem 442.
- Chemistry and biochemistry of carbohydrates including glycopolymers, protein glycosides, mucopolysaccharides and lipopolysaccharides.

### Chem 543 Proteins
- **W alternate years, will be offered W 1988. 3 cr. Lect.**
- **PREREQUISITE:** Chem 443.

### Chem 544 Molecular Biology
- **W alternate years, will be offered W 1987. 3 cr. Lect.**
- **PREREQUISITE:** Chem 445.
- Reviews the chemistry of nucleic acids and current concepts of protein biosynthesis.

### Chem 545 Regulatory Mechanisms in Metabolism
- **A alternate years, will be offered A 1986. 3 cr. Lect.**
- **PREREQUISITE:** Chem 445.
- Intermediary metabolism to include oxidative phosphorylation, regulation of metabolism and other selected topics.

### Chem 546 Enzymes
- **S alternate years, will be offered S 1988. 3 cr. Lect.**
- **PREREQUISITE:** Chem 445.
- A study of the general properties and functions of enzymes. Enzyme kinetics, catalytic mechanisms, dynamics and allosteric will be included.

### Chem 553 Chemistry of Heterocyclic Systems
- **On demand. 3 cr. Lect.**
- **PREREQUISITE:** Chem 535.
- Chemistry of heterocyclic molecules, including natural products. Emphasis on reactions and electric properties.

### Chem 554 Organic Structure Elucidation
- **W. 3 cr. Lect.**
- **PREREQUISITE:** Chem 418.
- Modern techniques in separation science, spectral analysis and chemical transformations as applied to the isolation and identification of natural products. Each area will be discussed from a historical perspective, outlining the developments in the field over time and emphasizing current state-of-the-art.

### Chem 557 Quantum Mechanics and Spectroscopy
- **A. 3 cr. Lect.**
- **PREREQUISITE:** Chem 505 or 310.
- Introductory quantum mechanics and spectroscopy.

### Chem 558 Statistical and Classical Thermodynamics
- **W. 3 cr. Lect.**
- **PREREQUISITE:** Chem 505 or 310.
- Thermodynamics including statistical thermodynamics.

### Chem 559 Rate Processes
- **S. 3 cr. Lect.**
- **PREREQUISITE:** Chem 558.
- Rate process, kinetics, electrochemistry.

### Chem 564 Quantum Chemistry I
- **On demand. 3 cr. Lect.**
- **PREREQUISITE:** Chem 557 or 514 or 305.
- Quantum mechanical principles and methods applied mainly to stationary molecular ground and excited states.

### Chem 565 Quantum Chemistry II
- **On demand. 3 cr. Lect.**
- **PREREQUISITE:** Chem 564.
- Time dependent quantum mechanics with main application to molecular spectroscopy and dynamics.

### Chem 566 X-ray Crystallography
- **On demand. 1 cr. Lect.**
- **PREREQUISITE:** Graduate standing.
- Methods of determining precise structures of crystalline materials by diffraction methods, including determination of crystal symmetry, lattice dimensions and atomic positions. Direct and Patterson methods for solution of the phase problem are considered in detail, as well as experimental techniques for data collection.

### Chem 570 Individual Problems
- **A.W,Su. 1-6 cr. Maximum 9 cr.**
- **PREREQUISITES:** Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies.
- Directed research and study on an individual basis.

### Chem 580 Special Topics
- On demand. 1-5 cr. Maximum 15 cr.
- Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

### Chem 589 Graduate Consultation
- **A,W,Su. 3 cr. Tut.**
- **PREREQUISITES:** Master's standing and approval of the Dean of Graduate Studies.
- This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) for a master's degree but who need additional faculty help or time.

### Chem 590 Master's Thesis
- **A,W,S. 3-12 cr. Ind. St. May be repeated.**
- **PREREQUISITE:** Master's standing.

### Chem 690 Doctoral Thesis
- **A,W,S. 3-12 cr. Ind. St. May be repeated.**
- **PREREQUISITE:** Doctoral standing.

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## Civil Engineering

### Department of Civil Engineering and Engineering Mechanics

**994-2111**

**Head of Department:** Dr. T.E. Lang, (Acting).


**Associate Professors:** N.E. Cook, Jr., J.D. Dent, R.D. VanLucbene.

**Assistant Professors:** A.B. Cunningham, R.G. Oakberg.

**CE 201 Civil Engineering Measurements**
- **S. 4 cr. Lect., 2; Lab. 2.**
- **PREREQUISITES:** ME III and concurrent enrollment in Math 181.
- Surveying field practice, error propagation analysis, survey for project design.

**CE 280 Special Topics**
- **On demand. 1-5 cr. Lect. Maximum of CE 280 plus CE 480, not to exceed 16 cr.**
- Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

**CE 301 Professional Practice**
- **A.W.S. 1 cr. Rec-Disc.**
- **PREREQUISITE:** Junior standing in Civil Engineering.
- Discussion of the design process including data acquisition, preliminary and final design, plans, specifications, financing and construction inspection.

**CE 305 Construction Materials**
- **A. 3 cr. Lect., 2. Lab. 1.**
- **PREREQUISITES:** Chem 152, Phys 229, EM 253.
- Portland cement, concrete, wood and steel properties. Laboratory materials testing, emphasis on field control.

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CE 306 Organization and Administration of Construction Projects  
A. 4 cr. Lect.  
PREREQUISITE: Junior standing.  
Contract documents, insurance, bonding, specifications, drawings, labor and labor law, business ownership, construction management, estimating and bidding, project cost accounting and human relations.

CE 314 Steel Structures  
W.S. 3 cr. Lect.  
PREREQUISITE: EM 313.  
Basic structural design of members used in buildings and bridges.

CE 315 Concrete Structures  
A.S. 3 cr. Lect.  
PREREQUISITE: CE 314.  
Basic structural design of members used in buildings and bridges.

CE 316 Wood Design  
W.S. 1 cr. Ind. St.  
PREREQUISITE: Concurrent enrollment in CE 314.  
Structural design using wood; wood design project.

CE 317 Masonry Design  
A.S. 1 cr. Ind. St.  
PREREQUISITE: Concurrent enrollment in CE 315.  
Structural design using reinforced masonry; masonry design project.

CE 320 Soil Mechanics  
A.S. 4 cr. Lect.; 3; Lab. 1.  
PREREQUISITE: EM 253.  
Soil testing methods, structural properties of soils and their relation to design of structures, highways, airports and embankments.

CE 330 Water Resources Engineering  
W.S. 3 cr. Lect.  
PREREQUISITE: EM 335.  
Open channel hydraulics and descriptive and quantitative hydrology with application to water resources engineering projects.

CE 350 Highway Transportation Engineering  
W.S. 4 cr. Lect.  
PREREQUISITE: CE 201.  
Urban and rural highway transportation system planning, administration and finance; traffic characteristics; highway capacity and safety; introduction to geometric design.

CE 361 Legal Principles in Surveying  
A alternate years, will be offered A 1986. 4 cr. Lect.  
PREREQUISITE: Four credits of surveying.  
Principles of the profession; case law; legal aspects of boundary location; monumentation; and property descriptions.

CE 362 Laws Governing Surveying  
A alternate years, will be offered A 1987. 4 cr. Lect.  
PREREQUISITE: Four credits of surveying.  
Federal and state laws and regulations governing legal land surveying; case studies and professional responsibilities.

CE 400 Seminar  
A.W.S. 1 cr. Sem.  
PREREQUISITE: Senior standing.  
Presentation and discussion of items of professional interest.

CE 404 Construction Engineering  
A.W. 4 cr. Lect.; 3; Lab. 1.  
PREREQUISITES: CE 320 or CET 303, I&ME 325.  
Construction planning, equipment and methods including: construction equipment applications, production and economics.

CE 407 Estimating and Scheduling  
W.S. 4 cr. Lect.; Lab. 1.  
PREREQUISITE: CE 404 or CET 404.  
Preparation of estimates and bids for construction projects. Critical path network preparation and use for construction projects.

CE 408 Construction Management  
A.S. 4 cr. Lect.; 3; Lab. 1.  
PREREQUISITE: CE 407.  
Preparation and control of a professional construction management organization to assure cost effectiveness and early completion of a project. Construction safety.

CE 413 Reinforced Concrete Structures  
W. 4 cr. Lect.  
PREREQUISITE: CE 351.  
Design of reinforced concrete floor system and retaining walls. Analysis and design of prestressed concrete members.

CE 414 Steel Structures  
A. 4 cr. Lect.  
PREREQUISITE: CE 314.  
Design of steel structures using current design specifications.

CE 415 Design Project  
A.W.S. 1-3 cr. Lab. Maximum 5 cr.  
PREREQUISITE: CE 303.  
Application of soil mechanics to foundation engineering with emphasis on dimension design of foundation elements, lateral earth pressure and slope stability.

CE 420 Foundation Engineering  
A. 4 cr. Lect.  
PREREQUISITE: CE 320.  
Application of soil mechanics to foundation engineering with emphasis on dimension design of foundation elements, lateral earth pressure and slope stability.

CE 431 Open Channel Hydraulics  
A. 4 cr. Lect.  
PREREQUISITE: CE 330.  
Principles of steady open channel flow; hydraulic design of open channel structures.

CE 432 Hydrologic Processes  
A. 3 cr. Lect.  
PREREQUISITE: Senior standing.  
Quantitative hydrology for non-civil engineering majors including hydrologic cycle, hydrologic budget, data collection and analysis, stream flow and precipitation runoff and hydraulics of ground water.

CE 433 Engineering Hydrology  
W. 4 cr. Lect.  
PREREQUISITE: CE 330.  
For agricultural and civil engineers. Modern analytical and statistical methods of estimating temporal and spatial variations in surface runoff and stream flow.

CE 434 Ground Water  
S. 4 cr. Lect.  
PREREQUISITE: EM 335.  
Treatment of ground water problems including water supply, drainage, seepage and quality problems; analytical numerical and modeling techniques.

CE 435 Pipeline Distribution Systems  
A. 4 cr. Lect.; Rec-Dia. 1.  
PREREQUISITE: EM 356.  
Analysis and design of pipe transmission lines and distribution networks for steady and gradually varied flows.

CE 440 Principles of Environmental Engineering  
A.S. 4 cr. Lect.  
Fundamentals of environmental engineering with emphasis on water and wastewater.
CE 470 Individual Problems
A, W, S, Su. 1-5 cr. Ind. St. Maximum 6 cr.
PREREQUISITES: Consent of instructor and department head.
Directed research and study on an individual basis.

CE 476 Career Internship
A, W, S, Su. 3 cr. Ind. St. Maximum 6 cr.
PREREQUISITES: Junior standing in civil engineering and approval of department head.
Internship assignments with off-campus engineering organizations in the private or public sector to provide guided experience in professional practice.

CE 480 Special Topics
On demand. 1-5 cr. Lect. Maximum 16 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

The following courses are available through Civil Engineering Continuing Education. The offering sites will be determined by CECE. These courses are not to be used to fulfill departmental degree requirements, except by permission of the department head.

CE 485 Land Survey Law
On demand. 4 cr. Lect. 2; Lab. 1; Rec.-Dis. 1.
PREREQUISITE: 4 credits of surveying or 2 years of field surveying experience.
Legal references pertinent to land surveying, boundary law; use of legal references and research, preparation of court exhibits, title rights and riparian law.

CE 486 Land Survey Systems
On demand. 4 cr. Lect. 3; Rec.-Dis. 1.
PREREQUISITE: 4 credits of surveying or 2 years of field surveying experience.
Development of land systems, computations, retracement and restoration of lost corners, riparian problems, mineral surveys, oil and gas leases, homestead surveys and grants.

CE 487 Land Survey Descriptions
On demand. 4 cr. Lect. 2; Lab. 1; Rec.-Dis. 1.
PREREQUISITE: 6 credits of surveying or 2 years of field surveying experience or CE 486.
Elements of land description and preparation of acceptable descriptions for land described in the rectangular system or by metes and bounds.

Graduate Courses in Civil Engineering

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

CE 500 Seminar
PREREQUISITE: Graduate standing.
Presentation and discussion of items of technical interest.

CE 512 Structural Dynamics
S alternate years, will be offered S 1988. 3 cr. Lect.
PREREQUISITE: CE 315.
Response of structures to dynamic loads.

CE 515 Advanced Structural Theory
A alternate years, will be offered A 1987. 3 cr. Lect.
PREREQUISITE: CE 315.
Finite element methods for the analysis of two- and three-dimensional structures composed of line and plate elements.

CE 516 Behavior of Steel Structures
A alternate years, will be offered A 1986. 3 cr. Lect.
PREREQUISITE: CE 315.
Behavior of metal structural members and frames; significance of this behavior in design of metal structures.

CE 517 Behavior of Concrete Structures
S alternate years, will be offered S 1987. 3 cr. Lect.
PREREQUISITE: CE 415.
Behavior of reinforced concrete members, connections and frames; continuity and stability in concrete structures.

CE 518 Prestressed Concrete
W. 5 cr. Lect.
PREREQUISITE: CE 413.
Design of concrete structures utilizing pre- and post-tensioned concrete elements.

CE 524 Earth and Foundation Engineering I
W. 4 cr. Lect.
PREREQUISITE: CE 420.
Stresses and strains in soils with applications in settlement, shear strength, seepage, slope stability, dams, retaining structures and foundations.

CE 525 Earth and Foundation Engineering II
S. 4 cr. Lect.
PREREQUISITE: CE 524.
Continuation of CE 524 with emphasis on foundations, excavations, soil-structure interactions, buried conduits, and storage structures.

CE 530 Advanced Hydraulic Engineering
W. 4 cr. Lect.
PREREQUISITE: CE 431.
Advanced topics in open channel flow.

CE 534 Hydraulic Engineering Investigations
A. 3 cr. Lect. 1; Lab. 2.
PREREQUISITES: Two of the following courses: CE 431, 433, 434, 435.
Laboratory and field investigations for design and analysis in hydraulic engineering.

CE 535 Water Resources Simulation
W. 2 cr. Lect.
PREREQUISITES: Two of the following courses: CE 431, 433, 434, 435.
COREQUISITE: CE 536 or 537 or 538.
Current simulation practices for water resources engineering planning, design, operation and research; open channel flow, hydrologic data, ground water, and distribution systems.

CE 536 Water Resources Simulation Projects
W. 2 cr. Lab.
COREQUISITE: CE 535.
Two simulation projects in water resources.

CE 537 Water Resources Simulation Projects
W. 3 cr. Lab.
COREQUISITE: CE 535.
Three simulation projects in water resources.

CE 538 Water Resources Simulation Projects
W. 4 cr. Lab.
COREQUISITE: CE 535.
Four simulation projects in water resources.

CE 539 Water Resources Planning
S. 4 cr. Lect. 3; Rec.-Dis. 1.
PREREQUISITES: CE 534 and 535.
Stochastic and analytical simulation methods applied to planning and management of water resources systems; engineering requirements for multi-purpose projects including planning and feasibility studies.

CE 540 Environmental Engineering Processes
A. 4 cr. Lect.
PREREQUISITE: CE 440.
Physical, chemical and biological processes in water quality management; reactor theory.

CE 541 Water Treatment Processes and Design
W. 4 cr. Lect.
PREREQUISITE: CE 540.

CE 542 Wastewater Treatment Processes and Design
S. 4 cr. Lect.
PREREQUISITE: CE 540.

CE 543 Industrial Water and Wastewater
A on demand. 4 cr. Lect.
PREREQUISITE: CE 540.
Principles and methods of treating industrial water and wastewater.

CE 544 Water Treatment Modeling
W. 2 cr. Lect. 1; Lab. 1.
COREQUISITE: CE 541.
Modeling of water treatment processes using pilot plants; research report preparation and laboratory methodology.

CE 545 Wastewater Treatment Modeling
S. 2 cr. Lect. 1; Lab. 1.
COREQUISITE: CE 542.
Modeling of wastewater treatment processes using pilot plants.

CE 547 Dynamics of Microbial Processes
W. 3 cr. Lect.
PREREQUISITE: CHE 546.
Dynamics of batch and continuous microbial reactors including mixed microbial species and multiple substrates.

CE 548 Environmental Engineering Chemistry
PREREQUISITE: Graduate standing.
Application of physical, organic, qualitative and quantitative chemical principles for solution of environmental engineering problems.

CE 570 Individual Problems
A, W, S, Su. 1-5 cr. Ind. St. Maximum 9 cr.
PREREQUISITES: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies.
Directed research and study on an individual basis.

CE 575 Professional Paper
A, W, S, Su. 1-6 cr. Ind. St. Maximum 6 cr.
PREREQUISITE: Graduate standing.
A professional paper written on a civil engineering topic mutually agreed upon by the student and his or her committee.

CE 576 Internship
A, W, S, Su. 9 cr. Ind. St.
PREREQUISITES: Graduate standing and approval of department head.
Internship assignments with off-campus engineering organizations in the private or public sector to provide guided experience in professional practice.

CE 580 Special Topics
On demand. 1-5 cr. Maximum 16 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

CE 589 Graduate Consultation
A, W, S, Su. 3 cr. Tut.
PREREQUISITES: Master's standing and approval of the Dean of Graduate Studies.
This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) for a master's degree but who need additional faculty help or time.

CE 590 Master's Thesis
A,W,S,Su. 3-12 cr. Ind. St. May be repeated.
PREREQUISITE: Master's standing.

CE 690 Doctoral Thesis
A,W,S,Su. 3-12 cr. Ind. St. May be repeated.
PREREQUISITE: Doctoral standing.

Computer Science

994-4780

Head of Department: Dr. J.D. Starkey.
Professors: J.D. Starkey.
Associate Professors: R.J. Ross, N.J. Weyland.
Assistant Professors: D.G. Barber, M.A. Faulkner, R. W. Gerardy, B.J. Stone, Y.B. Yoo.

CS 150 Computer Literacy
A,W,S. 4 cr. Lect.
PREREQUISITE: Math 140.
Computer hardware and software concepts. Problem solving with computers, word processing and spreadsheet applications, computer crime and social impact of computer use. Experience using a computer.

CS 154 Program Design and Analysis I
W,S. 3 cr. Lect.
PREREQUISITE: Math 144 or 150 or 165.
A corequisite approach to problem solving methods and algorithm development; program design, analysis, implementation, coding, testing, debugging and documentation using a good programming style. Programming language topics covered are procedures, functions, parameters, control structures and recursion.

CS 155 Program Design and Analysis II
A,S. 3 cr. Lect.
PREREQUISITE: CS 154.
A corequisite approach to problem solving. Methods and algorithm development; program design, analysis, implementation, coding, testing, debugging and documentation using a good programming style. The programming language topics covered are multidimensional arrays, character strings, records, linked lists, and sequential files.

CS 156 Advanced Program Design and Analysis
A. 4 cr. Lect.
PREREQUISITE: CS 155 and 171.
Design and development of substantial programs with emphasis on file processing topics. Sequential and indexed file definitions, organization, and access. Secondary storage organization and utilization. Number systems, memory representation, scalar data types and elementary structured data types.

CS 170 Pascal Implementation I
W,S. 1 cr. Lect.
PREREQUISITE: CS 154.
Implementation of program designs in the Pascal programming language. The Pascal programming language topics covered are procedures, functions, parameters, control structures and recursion.

CS 171 Pascal Implementation II
A,S. 1 cr. Lect.
PREREQUISITE: CS 170.
Corequisite: CS 155.
Implementation of program designs in the Pascal programming language. Topics covered are arrays, character strings, records, linked lists, sequential files.

CS 172 FORTRAN Implementation I
W,S. 1 cr. Lect.
PREREQUISITE: Math 170 or 175 or 181.
Corequisite: CS 154.
Implementation of program designs in the FORTRAN programming language. The FORTRAN programming language topics covered are subprograms, functions, parameters and control structures.

CS 173 FORTRAN Implementation II
A,S. 1 cr. Lect.
PREREQUISITE: CS 172.
Corequisite: CS 155.
Implementation of program designs in the FORTRAN programming language. Topics covered are arrays, character strings, records, linked lists, and sequential files.

CS 174 BASIC Implementation I
W,S. 1 cr. Lect.
Corequisite: CS 154.
Implementation of program designs in the BASIC programming language. Topics covered are procedures, functions, parameters and control structures.

CS 175 BASIC Implementation II
A,S. 1 cr. Lect.
PREREQUISITE: CS 174.
Corequisite: CS 155.
Implementation of program designs in the BASIC programming language. Topics covered are arrays, character strings, records, linked lists, and sequential files.

CS 180 Programming Language
W demanding. 2 cr. Lect.
PREREQUISITE: CS 155.
The study and application of a selected programming language not already offered. Emphasis is on the application of programming skills with the particular language. CS 180 will be reserved for new languages and may change each quarter.

CS 181 COBOL
A,S. 3 cr. Lect.
PREREQUISITE: CS 155.
The study and use of COBOL in implementing programs. Programs oriented toward business applications will be developed.

CS 183 LISP
W. 2 cr. Lect.
PREREQUISITE: CS 155.
The study and use of LISP in implementing programs. Programs oriented toward artificial intelligence applications will be developed.

CS 184 SNOBOL
A. 2 cr. Lect.
PREREQUISITE: CS 155.
The study and use of SNOBOL in implementing programs. Programs oriented toward string and text processing applications will be developed.

CS 185 C Programming Language
S. 2 cr. Lect.
PREREQUISITE: CS 155.
The study and use of C in implementing programs. Programs oriented toward general applications will be developed.

CS 186 ADA
S. 3 cr. Lect.
PREREQUISITE: CS 155.
The study and use of ADA in implementing programs. Programs oriented toward general applications will be developed.

CS 187 MODULA 2
A. 2 cr. Lect.
PREREQUISITE: CS 155.
The study and use of MODULA 2 in implementing programs. Programs oriented toward general applications will be developed.

CS 188 Advanced FORTRAN
A. 2 cr. Lect.
PREREQUISITE: CS 173 and Math 182.
The study and use of FORTRAN in implementing programs. Programs oriented toward scientific and engineering applications will be developed.

CS 210 Discrete Mathematics for Computer Science
A. 4 cr. Lect.
Topics in the mathematical elements of computer science including sets, logic, groups, trees, graphs, grammars and automata. Emphasis is on the use of mathematical structures in computer science.

CS 211 Data Structures
W. 4 cr. Lect.
Topics in data structures including queues, stacks, trees and graphs. Application of structures to problem solving including considerations of trade-offs incurred in choice of implementation.

CS 212 Algorithms
S. 4 cr. Lect.
PREREQUISITE: CS 211.
Design and analysis of algorithms with emphasis on time and space complexity.

CS 240 Social and Ethical Issues in Computer Science
W. 4 cr. Lect.
PREREQUISITE: CS 155.
Social, legal and ethical issues in the design and use of computerized technology. Methods of social impact assessment. Labor and other economic issues. Privacy and security versus the need for information.

CS 280 Special Topics
On demand. 1-5 cr. Maximum 8 cr. Maximum of CS 280 plus CS 480, 16 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

CS 304 Computer Organization and Symbolic Programming I
A. 4 cr. Lect.
PREREQUISITE: CS 211.
Hardware organization, machine and assembly language programming of digital computers. Machine and assembly language instructions and their relationship to computer hardware. Application of these concepts in programming assignments.

CS 305 Computer Organization and Symbolic Programming II
W. 4 cr. Lect.
PREREQUISITE: CS 304.
Hardware organization, machine and assembly language programming of digital computers. Macros, interrupts, traps, input/output programming and their relationship to computer hardware. Application of these concepts in programming assignments.

CS 306 Computer Organization and Symbolic Programming III
S. 4 cr. Lect.
PREREQUISITE: CS 305.
Hardware organization, machine and assembly language programming of digital computers. Systems programming topics including assemblers, macro processors, linkers, loaders, microcoding and firmware. Elementary concepts of operating systems. Application of these concepts in programming assignments.
A. 4 cr. Lect. group assignments.

CS 420 Compiler Construction Laboratory
W. 4 cr. Lect.; 3 Lab. 1.
PREREQUISITE: CS 212. The engineering of large software projects. Detailed project design: methodology, verification strategies, complexity analysis. Implementation in a particular programming language and module testing. Application of these concepts in group assignments.

CS 353 Software Engineering II
W. 4 cr. Lect.; 3 Lab. 1.
PREREQUISITE: CS 352. The engineering of large software projects. Detailed project design. Methodology, verification strategies, complexity analysis, implementation in a particular programming language and module testing. Application of these concepts in group assignments.

CS 354 Software Engineering III
S. 4 cr. Lect.; 3 Lab. 1.
PREREQUISITE: CS 353. The engineering of large software projects. Integrated module and system testing, debugging, documentation, acceptance testing and maintenance. Application of these concepts in group assignments.

CS 355 Design of Programming Languages
S. 4 cr. Lect.
PREREQUISITE: CS 304. Design and specification of programming languages.

CS 392 Numerical Computing
A. 4 cr. Lect.
PREREQUISITES: CS 155, Math 225 or Math 183 and 221. An introductory course. The floating point representation of reals, finite precision arithmetic, finite differences, polynomial interpolation, root finding, curve fitting, numerical integration, the solution of linear systems and differential equations by computer.

CS 411 Operating Systems
W. 4 cr. Lect.

CS 414 Data Base Management
W. 4 cr. Lect.
PREREQUISITE: CS 212. File and database management systems. File organization and access methods. Database systems architecture including hierarchical, plex and relational approaches. Logical and physical structure of data. File normalization and data base design.

CS 415 Mathematical Theory of Computation
S. 4 cr. Lect.

CS 419 Compiler Construction
W. 3 cr. Lect.
PREREQUISITE: CS 355. The design and construction of language translation systems. Lexical analysis, parsing, code generation and optimization techniques.

CS 420 Compiler Construction Laboratory
S. 2 cr. Lab.
PREREQUISITE: CS 419. Students will develop and implement a compiler.

CS 421 Computer Simulation
S. 4 cr. Lect.

CS 425 Computer Graphics
A. 4 cr. Lect.

CS 436 Artificial Intelligence
A. 4 cr. Lect.
PREREQUISITE: CS 212. Problem solving, theorem proving, expert system design, game playing, natural languages and heuristic programming.

CS 440 Information Theory
A. 4 cr. Lect.
PREREQUISITES: CS 305 and I&ME 354. The concepts of information and channels, information measures, entropy and channel capacity. Coding theory, error correcting, data encryption and data compression codes.

CS 441 Data Communications and Distributed Computing
W. 4 cr. Lect.

CS 460 Senior Design Project
A,W,S, Su. 2-8 cr. Must be repeated or taken for a total of 8 cr. Ind. St.
PREREQUISITE: CS 354, consent of instructor and department head. The planning, implementation, validation and documentation of a software system for specific practical application of computers.

CS 470 Individual Problems
A,W,S, Su. 1-5 cr. Ind. St. May be repeated for a maximum of 6 cr.
PREREQUISITE: Consent of instructor and department head. Directed research and study on an individual basis. For students participating in research and special problems conducted informally with staff supervision.

CS 474 Undergraduate Consultation
PREREQUISITES: Junior standing and consent of department head. Directed consultation by professional CS students for students in pre-professional courses.

CS 476 Career Internship
A,W,Su. 3-12 cr. Ind. St.
PREREQUISITE: Admission to department professional program and approval of department.
Interns work in a company where they can expand their computer science knowledge and apply their knowledge under the guidance of programmers. The department provides a list of potential employers. Students select and apply to a company. Upon approval by the company, the student, in consultation with the department, determines the number of credits.

CS 480 Special Topics
On demand. 1-5 cr. Lect. Maximum 15 cr. Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Graduate Courses in Computer Science

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

CS 500 Seminar
A,W,S. 1-3 cr. May be repeated. Maximum 4 cr.
PREREQUISITE: Graduate standing. Research topics not covered in regular courses. Students participate by preparing and presenting lectures with faculty guidance.

CS 510 Theoretical Foundations of Computer Science I
A. 3 cr. Lect.
PREREQUISITE: CS 415. Theory of formal languages and their related automata.

CS 511 Theoretical Foundations of Computer Science II
W. 3 cr. Lect.
PREREQUISITE: CS 510. Computability, abstract time and space complexity, the classes P and NP, NP-completeness.

CS 512 Design and Analysis of Algorithms
S alternate years, will be offered S 1988. 3 cr. Lect.

CS 513 Information and Coding Theory
S alternate years, will be offered S 1988. 3 cr. Lect.
PREREQUISITES: CS 440 and I&ME 354. Advanced topics in information and coding theory with applications to data encryption, data compression, pattern recognition, artificial intelligence.

CS 514 Graph Theory: Applications and Algorithms
S alternate years, will be offered S 1988. 3 cr. Lect.

CS 516 Advanced Operating System Design
A. 3 cr. Lect.
PREREQUISITE: CS 411. Concurrent programming, multiprocessing, virtual storage organization and management, external storage management, deadlock, queuing theory and analytic modeling, security, real-time programming support.

CS 517 Systems Programming Research
W alternate years, will be offered W 1987. 3 cr. Lect.
PREREQUISITE: CS 516. Systems programming topics taken from areas of current interest, including (but not limited to) network operating systems, distributed computing, embedded systems, real-time operating systems, supercomputer operating systems, computer security, computer performance monitoring and evaluation, analytic modeling, data encryption.

CS 519 Advanced Design of Programming Languages
A. 3 cr. Lect.
PREREQUISITE: CS 355. Innovative features of various programming languages. Formal semantics, implementation considerations, extensibility, very high level languages, evaluation of language designs.
CS 520 Parsing, Translation and Compiling
S alternate years, will be offered S 1988. 3 cr. Lect.
PREREQUISITES: CS 510 and CS 419.

CS 525 Data Base Systems
A alternate years, will be offered A 1986. 3 cr. Lect.
PREREQUISITE: CS 414.
Advanced techniques of database system development. Semantic description of data. Relational theory. Query languages including natural language interfaces. Applications of data base structures.

CS 536 Information Structures
S. 3 cr. Lect.
PREREQUISITE: CS 414.
Design and evaluation of file organizations. Sorting algorithms; secondary indices optimization; security; differential files.

CS 537 Advanced Artificial Intelligence
W alternate years, will be offered W 1987. 3 cr. Lect.
PREREQUISITE: CS 436.
Construction of intelligent systems. Programming languages and structures for artificial intelligence.

CS 538 Advanced Computer Graphics
W alternate years, will be offered W 1988. 3 cr. Lect.
PREREQUISITE: CS 425.

CS 539 Pattern Recognition
A alternate years, will be offered A 1987. 3 cr. Lect.
PREREQUISITES: Math 225 and I&M 354.
Topics in statistical and syntactical pattern recognition. Bayes classifier, cluster analysis, feature selection, trainable classifiers, syntactic pattern description, recognition grammars, learning and grammatical inference.

CS 540 Image Processing by Digital Computer
W alternate years, will be offered W 1988. 3 cr. Lect.
PREREQUISITES: Math 225 and I&M 354.
Theory and application of digital image restoration, enhancement and processing techniques.

CS 541 Theory of Modeling and Simulation
W alternate years, will be offered W 1988. 3 cr. Lect.
PREREQUISITE: CS 421.
Advanced topics in modeling and simulation. Languages, models, random number and variance generation, input and output analysis.

CS 546 Computer Graphics Research
S alternate years, will be offered S 1987. 3 cr. Lect.
PREREQUISITES: CS 538 and consent of instructor.
Current research in computer graphics, emphasizing three-dimensional graphics software and hardware development.

CS 570 Individual Problems
A,W,S,Su. 1-5 cr. Ind. St. Maximum 9 cr.
PREREQUISITES: Graduate standing. Direct research on an individual basis. For students participating in research and special problems. Conducted informally with staff supervision.

CS 571 Research Experience
A,W,S,Su. 1 cr. Ind. St. Maximum 6 cr.
PREREQUISITE: Graduate standing.
Research experience normally obtained through participation in a supervised research project acceptable to the department graduate committee.

CS 575 Professional Project
A,W,S,Su. 2-6 cr. Ind. St. Maximum 6 cr.
PREREQUISITE: Graduate standing.
A professional project on a computer science topic mutually agreed upon by the student and the major advisor.

CS 580 Special Topics
On demand. 1-9 cr. Maximum 15 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

CS 589 Graduate Consultation
A,W,S,Su. 3 cr. Tut.
PREREQUISITES: Master's standing and approval of the Dean of Graduate Studies.
This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) for a master's degree but who need additional faculty help or time.

CS 590 Master's Thesis
A,W,S,Su. 3-12 cr. Ind. St. May be repeated.
PREREQUISITE: Master's standing.

Construction Engineering Technology

Department of Civil Engineering and Engineering Mechanics
994-2111

See Civil Engineering for faculty listing.

CET 201 Plane Surveying
A. 5 cr. Lect. 3; Lab. 2.
PREREQUISITES: Math 165 and ME 113.
Fundamentals of surveying, taping, leveling, transit traversing, topographic mapping and elementary applied construction surveys.

CET 202 Construction Surveying and Earthwork
S. 5 cr. Lect. 3; Lab. 2.
PREREQUISITES: CET 201 and approved course in computer programming.
Advanced construction and route surveys, earthwork mass diagrams, quantity takeoff, computer analysis.

CET 261 Surveying
A alternate years, will be offered A 1986. 4 cr. Lect. 2; Lab. 2.
PREREQUISITE: Math 165.
Service course for non-majors. Chaining, levels, transits, closures, mapping and construction layout.

CET 280 Special Topics
On demand. 1-5 cr. Lect. or Lab (as required).
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

CET 302 Soils and Aggregates
W. 4 cr. Lect. 2; Lab. 2.
PREREQUISITE: Concurrent enrollment in EM 215.
Physical properties of common construction materials with emphasis on soils and aggregates. Laboratory testing for material classification and field control.

CET 303 Highway Technology
S. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: CET 302.
Principles of geometric and structural design, traffic, drainage, bituminous and concrete pavements; stabilization and surface treatments. Laboratory testing of bituminous materials, and preparation and testing of asphaltic concrete paving mixtures.

CET 305 Concrete Technology
S. 4 cr. Lect. 2; Lab. 2.
PREREQUISITE: CET 302.
Physical properties of concrete, mix design, field practices and laboratory testing for field control. Concrete forming.

CET 311 Materials Science
A. 4 cr. Lect. 3; Lab. 1.
Nature of metallic, ceramic and polymeric materials from micro and macro structure; laboratory to demonstrate properties and test procedures.

CET 312 Building Construction
W. 4 cr. Lect.
PREREQUISITE: CET 311.
Principles, materials and methods of construction used in structural frames of wood, steel and concrete buildings.

CET 363 Advanced Surveying
S alternate years, will be offered in S 1988. 3 cr. Lect. 2; Lab. 1.
PREREQUISITE: CE 201 or CET 202.
Control surveys, triangulation, coordinate systems, engineering astronomy.

CET 401 Computers in Construction I
A. 1 cr. Lab.
PREREQUISITES: CS 154, concurrent enrollment in CET 404.
Use of computers in construction methods applications.

CET 402 Computers in Construction II
W. 1 cr. Lab.
PREREQUISITE: CET 401.
Use of computers in construction management applications.

CET 404 Construction Planning and Methods
A. 4 cr. Lect. 3; Lab. 1.
PREREQUISITES: I&M 325, CET 303.
Construction planning, equipment and methods including: construction equipment applications, production and economics.

CET 411 Excavating and Foundation Construction
A. 5 cr. Lect. 2; Lab. 3.
PREREQUISITE: CET 302.
Behavior of soil and rock. Forms and bracing during excavation and foundation construction. Laboratory testing of soil and rock.

CET 412 Structural Elements
W. 3 cr. Lect.
PREREQUISITE: EM 215.
Building code requirements concerning welding, field procedures, fabrication and erection of steel and concrete buildings.

CET 476 Career Internship
A, W. 5 cr. Lect.
PREREQUISITE: CET 475.
Guided off-campus assignments to broaden the experience of the student and to provide additional faculty help or time.

CET 480 Special Topics
On demand. 1-5 cr. Lect. Maximum 16 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.
Earth Sciences

ESci 410 Introduction to the Earth's Interior
A,W,S. 4 cr. Lect. 5; Lab. 1.
Minerals, climate, heat, magnetism, volcanism, earthquakes, magnetism, gravity, and mountain building processes related to plate tectonics. Lab identification of rocks and minerals and geologic map interpretation.

ESci 412 Surface Water Resources
S alternate years, will be offered S 1987. 5 cr. Lect. 4; Lab. 1.
PREREQUISITES: ESc 102 or Geol 101 or Geol 231; Math 170 and either Chem 121 or Chem 132.
The relationship between groundwater and other parts of the hydrologic cycle: groundwater availability, movement and chemistry, groundwater exploration, aquifer tests. The groundwater resource in terms of regional supply and man's use and intervention.

ESci 440 Groundwater Resources
A. 5 cr. Lect. 4; Lab. 1.
PREREQUISITES: ESc 102 or Geol 101 or Geol 231; Math 170 and either Chem 121 or Chem 132.
The relationship between groundwater and other parts of the hydrologic cycle: groundwater availability, movement and chemistry, groundwater exploration, aquifer tests. The groundwater resource in terms of regional supply and man's use and intervention.

ESci 450 Snow Dynamics and Accumulation
W, 4 cr. Lect. 2; Lab. 2.
PREREQUISITE: ESc 102 or 106, and some ability to ski.
The accumulation, redistribution and metamorphism of snow as related to humans (avalanche, recreation, agriculture, silviculture, runoff and the alpine environment). Field studies are conducted on a regular basis under rigorous physical conditions.

ESci 476 Internship
A,W,S. 6-12 cr. Ind. St. Maximum 12 cr.
PREREQUISITES: Consent of adviser and department head.
A restricted elective opportunity for interning or other experiential learning in career-related situations. Recommendations will be made by the adviser after evaluation of student's preparation and interest; number of placements will depend on availability of positions in cooperating agencies such as federal, state and local planning offices, National Weather Service and other federal, state or private meteorological organizations, and USGS and other federal, state or private geological organizations.

ESci 480 Special Topics
On demand. 1-5 cr. Maximum 12 cr.
PREREQUISITE: Consent of instructor.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

ESci 490 Undergraduate Research
A,W,S,Su. 1-6 cr. Ind. St. Maximum 6 cr.
PREREQUISITES: Junior standing and 2.5 cumulative GPA.
Directed undergraduate research.

Graduate Courses in Earth Science

ESci 500 Seminar—Contemporary Economic Problems
A,W,S,Su. 1 or 2 cr. Sem. Maximum 8 cr.
PREREQUISITE: Econ 105.
Current economic problems and current writings of people in the profession. Topics vary each quarter; students should check with the department before registering.

ESci 501 Intermediate Remote Sensing
W. 4 cr. Lect. 2; Lab. 2.
PREREQUISITES: ESc 102 or Geol 231, 106 or CE 462 or P&S 417.
Earth analysis using satellite, thermal infrared, and radar imagery, and digital computer enhancement of remote sensing data.

ESci 510 Aerial Photo Interpretation
W. 4 cr. Lect. 2; Lab. 2.
PREREQUISITES: ESc 102 or Geol 231, 106 or CE 462 or P&S 417.
Interpretation of aerial photographs to obtain quantitative and qualitative information about the earth's surface—its physical and cultural landscapes.

ESci 515 Physiography of the United States
S. 4 cr. Lect.
PREREQUISITE: ESc 102 or Geol 101 or Geol 231.
The physiographic provinces of the United States, their physical characteristics and evolution and identification.

ESci 520 Special Topics
On demand. 1-5 cr. Maximum 12 cr.
PREREQUISITE: Consent of instructor.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

ESci 525 Physiography of the United States
S. 4 cr. Lect.
PREREQUISITE: ESc 102 or Geol 101 or Geol 231.
The physiographic provinces of the United States, their physical characteristics and evolution and identification.

ESci 530 Aeriel Photo Interpretation
W, 4 cr. Lect. 2; Lab. 2.
PREREQUISITES: ESc 102 or Geol 231, 106 or CE 462 or P&S 417.
Interpretation of aerial photographs to obtain quantitative and qualitative information about the earth's surface—its physical and cultural landscapes.

ESci 540 Groundwater Resources
A. 5 cr. Lect. 4; Lab. 1.
PREREQUISITES: ESc 102 or Geol 101 or Geol 231; Math 170 and either Chem 121 or Chem 132.
The relationship between groundwater and other parts of the hydrologic cycle: groundwater availability, movement and chemistry, groundwater exploration, aquifer tests. The groundwater resource in terms of regional supply and man's use and intervention.

ESci 550 Seminar—Contemporary Economic Problems
A,W,S,Su. 1 or 2 cr. Sem. Maximum 8 cr.
PREREQUISITE: Econ 105.
Current economic problems and current writings of people in the profession. Topics vary each quarter; students should check with the department before registering.

ESci 551 Economic Problems
A,W,S,Su. 1-5 cr. Ind. St. Maximum 9 cr.
PREREQUISITES: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies.
Directed research and study on an individual basis.

ESci 560 Special Topics
On demand. 1-5 cr. Maximum 12 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

ESci 570 Individual Problems
A,W,S,Su. 1-5 cr. Ind. St. Maximum 9 cr.
PREREQUISITES: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies.
Directed research and study on an individual basis.

ESci 580 Special Topics
On demand. 1-5 cr. Maximum 12 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

ESci 581 Quaternary Environments
On demand. 3 cr. Rec.-Dis.
PREREQUISITES: Graduate standing and consent of instructor.
The nature of the last two million years of earth history. Topics covered will depend on student interest, but may include climatic change, sea-level fluctuations, structural movements and their effects on flora, fauna and earth surface processes.

ESci 589 Graduate Consultation
PREREQUISITES: Master's standing and approval of Dean of Graduate Studies.
This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) for a master's degree but who need additional faculty help or time.

ESci 590 Master's Thesis
A,W,S. 3-12 cr. Ind. St. May be repeated.
PREREQUISITES: Master's standing and approval of graduate committee.

Economics

Department of Agricultural Economics and Economics
994-3701

See Agricultural Economics for faculty listing.

Econ 105 The Economic Way of Thinking
A,W,S. 4 cr. Lect.
Introduces students to the economic way of thinking which helps make sense out of complex economic and social issues, including inflation and unemployment, pollution and development of resulting public policies. Presents basic economic principles utilized in making decisions concerning the use of available resources by individuals and firms within the market system.

Econ 200 Seminar—Contemporary Economic Problems
A,W,S,Su. 1 or 2 cr. Sem. Maximum 8 cr.
PREREQUISITE: Econ 105.
Current economic problems and current writings of people in the profession. Topics vary each quarter; students should check with the department before registering.

Econ 202 Macroeconomic Principles
A,W,S. 4 cr. Lect.
PREREQUISITE: Econ 105 or AgEc 103.
Forces which generate fluctuations in the level of economic activity in the nation; analytical tools for study of public policy with respect to national income and employment. To enable students to discuss current policy problems and understand the leading analytical debates.

Econ 204 Microeconomic Principles
A,W,S. 4 cr. Lect.
PREREQUISITE: Econ 105 or AgEc 103.
Elementary economic thinking necessary for a better understanding of specialized courses in economics. A study of how day-to-day decisions by individuals and firms interact to form the functioning economy. The role of prices, the concept of scarcity, supply and demand are discussed. Application of economic principles is sought in current events.

Econ 250 The Political Economy of the Environment
W. 4 cr. Lect.
PREREQUISITE: Econ 105 or AgEc 103.
The relationship of public policy to the impact of people upon the environment; externalities, pressure groups, public goods, legislation and types of regulations.

Econ 280 Special Topics
On demand. 1-6 cr. Lect. Maximum of Econ 280 plus 480, 16 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.
Econ 300 Seminar—Contemporary Economic Problems
A,W,Su. 1 or 2 cr. Sem.
PREREQUISITE: Junior standing.
Current economic problems and current writings of people in the profession. More emphasis on formal economics than in Econ 200. Topics vary each quarter; students should check with the department before registering.

Econ 302 Intermediate Macroeconomic Theory
W,S. 4 cr. Lect.
PREREQUISITES: Econ 202 and Math 170; Econ 313 recommended.
The economic theory of economy-wide aggregates and averages such as national income, levels of employment, income distribution; the determinants of the performance of entire economies: nations, groups of nations and the world.

Econ 304 Intermediate Microeconomic Theory
A,W,Su. 4 cr. Lect.
PREREQUISITES: Econ 204 and Math 170.
A study of microeconomic theory and selected applications with emphasis on theory of consumer behavior, theory of the firm, and price determination in perfectly competitive markets.

Econ 309 Managerial Economics
W,S. 4 cr. Lect.
PREREQUISITE: Econ 204.
An integration of various principles and concepts from different areas of economics. These are combined with a variety of tasks of analysis and related to problems of economic decision making and policy formulation at the firm level.

Econ 312 Labor and Human Resource Economics
W. 4 cr. Lect.
Economics of labor markets, wage determination, and human capital. The theoretical framework of labor market analysis is presented, along with empirical research results and descriptive aspects of current labor issues (i.e., impact of labor unions, the form and extent of job discrimination by race and sex, and the social effects of minimum wage levels).

Econ 313 Money and Banking
W,Su. 4 cr. Lect.
PREREQUISITE: Econ 202.
Principles and problems of money, banking and credit. Monetary and banking history, monetary theory and policy, structure and operation of our financial system.

Econ 314 International Economics
A. 4 cr. Lect.
PREREQUISITES: Econ 202 and 204.
A survey of international economic theory and policy. Major concepts explored are comparative advantage, impacts of tariffs, exchange rates and international payments.

Econ 317 Economic Development
S. 4 cr. Lect.
PREREQUISITE: Econ 202.
The plight of the world's low-income countries, and the many national and international programs devoted to its alleviation. Primary emphasis directed to economic factors, but attention also given to political and social characteristics vital to economic development.

Econ 320 Public Finance
A. 4 cr. Lect.
PREREQUISITES: Econ 202 and 204.
Financing federal, state and local government; principles of taxation; social aspects of public spending, taxation and borrowing.

Econ 332 Economics of Natural Resources
A,S. 4 cr. Lect.
PREREQUISITE: Econ 204.
Economic principles regarding the allocation and use of natural resources and the impact of institutional factors within which those decisions are carried out. Emphasis on methods and criteria for determining benefits and costs in implementing policies.

Econ 351 Economic Measurement Problems and Data Analysis
W. 4 cr. Lect.
Sources of economic data and the interpretation and presentation of data. Construction and use of index numbers and elementary analysis of cross-sectional and time-series data.

Econ 372 Economic History of U.S.
W. 4 cr. Lect.
PREREQUISITE: Econ 105.
Interpretation of American economic growth in the context of economic theory. Examines specific issues in U.S. history while focusing on the question of how the U.S. has been able to sustain continued increases in per capita income. Provides opportunity to apply economic concepts.

Econ 393 Comparative Economic Systems
A. 4 cr. Lect.
PREREQUISITE: Econ 105.
A study of alternative ways of organizing production and distribution in a society. Involves a comparison of economies that are strongly market oriented versus centrally planned economies, with discussion of intermediate cases. Contemporary criticisms of the U.S. economy are also discussed.

Econ 400 Seminar—Contemporary Economic Problems
A,W,S. 1 or 2 cr. Sem. Maximum 8 cr.
PREREQUISITE: Junior standing.
Current economic problems and current writings of people in the profession. Topics vary each quarter; students should check with the department before registering.

Econ 404 Microeconomic Theory
A. 4 cr. Lect.
PREREQUISITE: Econ 304.
Microeconomic theory of price determination with treatment of the analysis of consumer demand and production economics.

Econ 406 Industrial Organization
S. 4 cr. Lect.
PREREQUISITE: Econ 304.
Economic theory of price determination with treatment of the analysis of consumer demand and production economics.

Econ 452 Benefit—Cost Analysis
A. 4 cr. Lect.
PREREQUISITE: Econ 304.
Methods and criteria for evaluating benefits and costs of public policies and investment.

Econ 470 Individual Problems
A,W,Su. 1-4 cr. Ind. St. Maximum 6 cr.
Directed research and study on an individual basis. Student is responsible for filing two copies of memo of agreement with supervising faculty member by end of first full week of quarter. Memo will be treated as a contract and must be acceptable to both student and supervising faculty member.

Econ 480 Special Topics
On demand; 1-6 cr. Lect. Maximum of Econ 280 plus 480, 16 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Econ 490 Undergraduate Research
Intended for economics and agricultural economics majors working on what might be called a senior thesis. The first quarter will be used to develop background material and to do problem analysis. The final quarter's work will be devoted to the final analysis and writing. The student will work closely with the supervising faculty member.

Graduate Courses in Economics
There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

Econ 500 Seminar
Current economic problems and current writings of people in the profession. Topics vary each quarter; students should check with the department before registering.

Econ 501 Microeconomic Theory
W. 4 cr. Lect.
PREREQUISITE: Econ 404.
Microeconomic theory of optimization as they apply to consumer and firm decision-making. Topics covered include utility maximization, revealed preference, firm objective functions, market structures and general equilibrium theory.

Econ 502 Macroeconomic Theory
S. 4 cr. Lect.
PREREQUISITE: Econ 302.
Systematic review of accepted macroeconomic theory and critical study of the functional relationships contained therein.

Econ 561 Econometrics I
W. 4 cr. Lect.
PREREQUISITES: Econ 304 and Stat 356.
The use of regression analysis in the estimation of economic relationships, with emphasis on development of the least squares technique, the properties of estimates, and hypothesis testing in the context of the regression model; some knowledge of calculus, matrix algebra, and probability theory is assumed.

Econ 562 Econometrics II
S. 4 cr. Lect.
PREREQUISITE: Econ 561.
A continuation of Econ 561 with concentration on the effects of heteroscedasticity, auto-regressive disturbances, errors of measurement, multicollinearity, specification error, and non-linearity on the use and interpretation of the multiple regression model; introduction to simultaneous equation models and estimation procedures.

Econ 569 Research Methodology
W. 4 cr. Lect.
PREREQUISITE: Graduate standing.
The research process as a means of acquiring knowledge which is reliable and relevant to problems.

Econ 570 Individual Problems
PREREQUISITES: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies.
Directed research and study on an individual basis. Student is responsible for filing two copies of memo of agreement with supervising faculty member by end of first full week of quarter. Memo will be treated...
Graduate Courses in Adult and Higher Education

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

EdAH 500 Seminar
Interaction with other students as well as University staff, consultants in higher education and others interested in educational matters. Emphasis on graduate programs, research proposals, interdisciplinary studies and other pertinent topics. Quarterly seminars are interrelated.

EdAH 510 College Teaching
S,Su alternate years, will be offered Su 1987. 3 cr. Rec.-Dis.
PREREQUISITES: EdAH 560, graduate standing. Emphasis on planning and organizing clear instruction, guiding learning in group situations, adapting teaching to individual needs and appraising college learning and teaching.

EdAH 515 Organization and Administration of Higher Education
A,Su alternate years, will be offered Su 1987. 3 cr. Lect.
PREREQUISITE: Graduate standing. The diversity of role and structure of higher education institutions in the United States; the roles of trustees, various administrators, faculty and students. State coordination, long-range planning and financial administration.

EdAH 516 Institutional Research
S Alternate years, will be offered S 1987; Su Alternate years, will be offered Su 1988. 4 cr. Lect. 2, Lab 2
PREREQUISITE: EdAH 515. Understanding the role of institutional research in higher education and techniques of analysis used; experience in securing data and developing reports for the decision-makers.

EdAH 525 The Community College
A,Su alternate years, will be offered Su 1986. 3 cr. Lect.
PREREQUISITE: Graduate standing. Growth and development of the community college in the U.S. from inception to present. Relationships to societal trends as they influence the community college mission and purpose, curriculum, faculty and administration, and students. Assessment of current job opportunities.

EdAH 527 Instructional Design for Adult Learning Systems
W alternate years, will be offered W 1987. 3 cr. Lect.
PREREQUISITE: EdAH 510 or 540. Enabling adult educators to accomplish their learning objectives for adult learners through the media of educational technology. Definition of educational technology: a process utilizing tools and techniques to improve the efficiency and effectiveness of instruction.

EdAH 530 Foundations of Adult Education
A,Su alternate years, will be offered Su 1987. 3 cr. Lect.
PREREQUISITE: Graduate standing. Development of an appreciation of the role of adult education in our society as well as the scope and trends of adult education as they relate to philosophical issues and relationships in the basic processes of adult education.

EdAH 540 Adult Learning
W,Su alternate years, will be offered Su 1986. 3 cr. Lect.
PREREQUISITE: Graduate standing. The characteristics and social needs of adult learners as they pertain to changes in capacities and abilities, changes in emotions, interests and values. Developmental tasks and learning needs and theories of learning and change.

EdAH 545 Adult Education Methods
S,Su alternate years, will be offered Su 1987. 3 cr Lect.
PREREQUISITE: Graduate standing. Development of an understanding of the broad range of methods and techniques available for helping adults to learn. The rationale for selecting particular methods and techniques as well as the development of skills in designing learning experiences through the use of combinations of methods and techniques.

EdAH 547 Teaching Reading to Adults
S,Su alternate years, will be offered Su 1986. 3 cr. Rec.-Dis.
PREREQUISITE: EdEH 305. Characteristics of the adult handicapped reader and strategies as well as materials for designing and prescribing effective reading experiences.

EdAH 550 Controversies in Adult Education
S alternate years, will be offered S 1987; Su alternate years, will be offered Su 1986. 3 cr. Lect.
PREREQUISITE: EdAH 530. A critical examination of controversial issues in the field of adult education. Emphasis on developing personal positions on various issues.

EdAH 555 Community Education
W,Su alternate years, will be offered Su 1986. 3 cr. Lect.
PREREQUISITE: Graduate standing. Emphasis on the historical and philosophical development, understanding the concept, goals and objectives, emerging models, the role of the school, institutions and agencies of community education, and the role of the community education coordinator.

Education—Adult and Higher Education

Department of Educational Services
994-4933

See Educational Services for faculty lists.

EdAH 450 Introduction to Adult Education
A. 3 cr. Lect.
Designed to introduce students to the methods and techniques of relating effectively to an adult audience in the informal and voluntary teacher-learner situation.

EdAH 464 Student Leadership
PREREQUISITES: Resident assistant or Orientation Leader status. Student interaction with and adaptation to the campus environment are studied in terms of necessary information, policies, and procedures. Emphasis is given to skill building in the area of working with individuals and small groups in a peer teaching role.

EdAH 470 Individual Problems
A,W,S,Su. 1-5 cr. Ind. St.
PREREQUISITE: Consent of instructor and approval of department head. Directed research and study on an individual basis.

EdAH 480 Special Topics
On demand. 1-5 cr. Lect. Maximum 15 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

EdAH 490 Special Topics
On demand. 1-5 cr. Lect. Maximum 15 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

EdAH 545 Adult Education Methods
S,Su alternate years, will be offered Su 1987. 3 cr Lect.
PREREQUISITE: Graduate standing. Development of an understanding of the broad range of methods and techniques available for helping adults to learn. The rationale for selecting particular methods and techniques as well as the development of skills in designing learning experiences through the use of combinations of methods and techniques.

Education—Adult

Department of Educational Services
994-4933

See Educational Services for faculty lists.

EdAH 450 Introduction to Adult Education
A. 3 cr. Lect.
Designed to introduce students to the methods and techniques of relating effectively to an adult audience in the informal and voluntary teacher-learner situation.

EdAH 464 Student Leadership
PREREQUISITES: Resident assistant or Orientation Leader status. Student interaction with and adaptation to the campus environment are studied in terms of necessary information, policies, and procedures. Emphasis is given to skill building in the area of working with individuals and small groups in a peer teaching role.

EdAH 470 Individual Problems
A,W,S,Su. 1-5 cr. Ind. St.
PREREQUISITE: Consent of instructor and approval of department head. Directed research and study on an individual basis.

EdAH 480 Special Topics
On demand. 1-5 cr. Lect. Maximum 15 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.
of student characteristic and developmental need, and
description of institutional responses.

EdAH 567 Comparative Adult and Higher
Education
W alternate years, will be offered W 1987; Su alternate
years, will be offered Su 1986. 3 cr. Lect.
PREREQUISITES: EdAH 530 or 560, EdAH 515 or
556.
A comparison between Western and non-Western
world systems of adult and higher education in terms
of societal, political, economic and cultural factors
shaping world education. An examination of unique
and common aspects among world educational
systems.

EdAH 570 Individual Problems
A,W,Su. 1-5 cr. Ind. St. Maximum 9 cr.
PREREQUISITES: Graduate standing, consent of
instructor, approval of department head and Dean of
Graduate Studies.
Directed research and study on an individual basis.

EdAH 575 Professional Project
A,W,Su. 1-6 cr. Ind. St. Maximum 12 cr.
PREREQUISITES: Graduate standing and approval of
department head.
Practical field experience related to student’s field
of specialization.

EdAH 580 Special topics
On demand. 1-5 cr. Maximum 15 cr.
Courses not required in any curriculum for which
there is a particular need, or given on a trial basis to
determine demand.

EdAH 589 Graduate Consultation
A,W,Su. 3 cr. Tut.
PREREQUISITES: Master’s standing and approval of
the Dean of Graduate Studies.
This course may be used only by students who
have completed all of their course work (and thesis,
if on a thesis plan) for a master’s degree but who need
additional faculty help or time.

EdAH 590 Master’s Thesis
A,W,Su. 3-12 cr. Ind. St. May be repeated.
PREREQUISITE: Master’s standing.

EdAH 690 Doctoral Thesis
A,W,Su. 3-12 cr. Ind. St. May be repeated.
PREREQUISITE: Doctoral Standing.

Education—Counseling
Department of Educational Services
994-4933
See Educational Services for faculty list.

EdCo 280 Special Topics
On demand. 1-5 cr. Lect.
Courses not required in any curriculum for which
there is a particular need, or given on a trial basis to
determine demand.

EdCo 405 Introduction to Guidance
A. 3 cr. Lect.
Techniques and procedures of educational and per-
sonal counseling programs as organized and con-
ducted by public schools, and community agencies.

EdCo 463 Resident Assistant Training
A. 2 cr. Rec-DIS.
PREREQUISITE: Resident assistant status.
An opportunity for persons working in residence
halls to develop greater self-understanding, increase
interpersonal communications skills and to better
understand the college student environment.

EdCo 470 Individual Problems
A,W,Su. 1-5 cr. Ind. St. Maximum 6 cr.
PREREQUISITE: Approval of department head and consent of
instructor.
Directed research and study on an individual basis.

EdCo 480 Special Topics
On demand. 1-5 cr. Lect. Maximum 15 cr.
Courses not required in any curriculum for which
there is a particular need, or given on a trial basis to
determine demand.

Graduate Courses in Counseling
There are certain implicit prerequisites for 500- and
600-level courses; see Graduate Course Prerequisites,
page 120, for details.

EdCo 500 Seminar
Provides experience in investigating and presenting
issues of topical importance. Open discussion and in-
teraction with students and staff is encouraged.

EdCo 505 Organization and Administration of Guidan
ces Services
A,W,Su. 3 cr. Lect.
PREREQUISITE: Graduate standing.
The development and organization of guidance
services in primary, secondary and community agency
settings with emphasis on philosophy, organization
procedures, faculty, administrator and personnel
involvement.

EdCo 507 Personal Inventory and Interpretation
A,W,Su alternate years, will be offered Su 1987 3 cr. Lect.
PREREQUISITES: Graduate standing, EdFd 501.
Application of information derived from tests and
inventories used in counseling. Experience in inter-
pretation of test data in the counseling conferences.

EdCo 509 Theories of Career Development
A,W,Su alternate years, will be offered Su 1986 3 cr. Lect.
PREREQUISITE: Graduate standing.
A study of the major theories of vocational choice
and the application of these theories to relevant
educational experiences within curricular, classroom,
or individual contexts.

EdCo 510 Counseling Theory
A,Su. 3 cr. Lect.
PREREQUISITE: Graduate standing.
Counseling theories and their practical applications
in educational and community agency settings.

EdCo 511 Comparative Systems of Counseling
and on demand. 3 cr. Lect.
PREREQUISITES: Graduate standing, EdCo 510 and consent of
instructor.
Analysis of functional systems of counseling and
their applicability in actual cases.

EdCo 515 Competency Development in Counseling
A,Su. 2 cr. Lect. I; Lab. 1.
PREREQUISITES: Graduate standing and consent of
instructor.
PRE- OR COREQUISITE: EdCo 510.
Laboratory work in counseling methods and tech-
niques.

EdCo 521 Group Dynamics Laboratory
A,Su. 2 cr. Lab.
PREREQUISITES: Graduate standing and consent of
instructor.
PRE- or COREQUISITE: EdCo 510.

EdCo 522 History and Theory of Groups
W,Su. 3 cr. Lect.
PREREQUISITES: Graduate standing and EdCo 521.

EdCo 531 Multicultural Counseling
A,Su. 3 cr. Lect.
PREREQUISITES: Graduate standing.
PRE- or COREQUISITE: EdCo 510.
Provide didactic information concerning history
of groups, group dynamics, use of specific theories
in groups. Emphasis will be on advantages and disad-
vantages and developmental stages of groups.

EdCo 533 Multicultural Individual Counseling
A,W,Su alternate years, will be offered Su 1986 3 cr.
Lect.
PREREQUISITE: EdCo 531.
Relationship-building skills and competency in the
rehabilitation modalities of Symbolic Projection, Model-
ling and Role Directing.

EdCo 538 Counseling the Indian Student
W. 3 cr. Lect.
PREREQUISITES: Graduate standing, EdCo 510.
A theoretical and practical background for students
planning to serve an Indian clientele in a counseling
capacity; examination of personal, academic, social
and cultural needs of the Indian student; Indian values
in relation to values of the dominant society.

EdCo 540 Counseling Practicum
A,W,Su. 5 cr. Lab.
PREREQUISITES: Graduate standing, EdCo 510, Ed-
Co 515 and consent of instructor.
Supervised experience in counseling. The student
will be assigned to a designated practicum site. Thir-
ty hours of one-to-one counseling is a requirement.

EdCo 541 Advanced Counseling Practicum
On demand. 1-7 cr. Lab.
PREREQUISITES: EdCo 540 and consent of
instructor.
Supervised experience in the application of advan-
ced counseling technique and methodology. Credit
hours and specific requirements are tailored to meet
individual needs.

EdCo 542 Practicum in Group Leadership
On demand. 3 cr. Lab.
PREREQUISITES: EdCo 522, 540 and consent of
instructor.
An opportunity to develop group leadership skills
by actually leading a counseling group under
supervision.

EdCo 570 Individual Problems
A,W,Su. 1-5 cr. Ind. St. Maximum 9 cr.
PREREQUISITES: Graduate standing, consent of
instructor, approval of department head and Dean of
Graduate Studies.
Directed research and study on an individual basis.

EdCo 575 Professional Project
A,W,Su. 1-6 cr. Ind. St. Maximum 6 cr.
PREREQUISITES: Graduate standing, EdFd 506 or con-
current registration in EdFd 506.
A professional project written on an educational
topic mutually agreed upon by the student and ma-
jor adviser.
EdCo 576 Internship
PREREQUISITES: Graduate standing, EdCo 522, 540 and approval of department head.  
Practical field experience related to student's field of specialization.

EdCo 580 Special Topics
On demand. 1-5 cr. Maximum 15 cr.  
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

EdCo 589 Graduate Consultation
A,W,S,Su. 3 cr. Tut.  
PREREQUISITES: Master's standing and approval of Dean of Graduate Studies.  
This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) for a master's degree but who need additional faculty help or time.

EdCo 590 Master's Thesis
A,W,S,Su. 3-12 cr. Ind. St. May be repeated.  
PREREQUISITE: Master's standing.

Education Educational Administration

Department of Educational Services
994-4933

See Educational Services for faculty lists.

EdAd 450 Clerks and School Business Officials Workshop
Su. 2 cr. Rec.-Dis.  
Designed to familiarize school business officials and school district clerks with procedures in accounting, preparation for audit, payroll and related duties, data collection, and report preparations. Recent legislation and current school laws are reviewed.

EdAd 460 School Law and Finance for the Classroom Teacher
S. 3 cr. Lect.  
PREREQUISITE: Admission to a Teacher Education Program.  
Responsibilities for organizational management of public schools, financing of educational programs, and legal responsibilities of teachers are the three main topics, which include legal duties of school boards, administrators and teachers; student rights; due process; state foundation program and budgeting procedures.

EdAd 470 Individual Problems
A,W,S,Su. 1-5 cr. Ind. St.  
PREREQUISITE: Approval of department head and consent of instructor.  
Directed research and study on an individual basis.

EdAd 480 Special Topics
On demand. 1-5 cr. Lect. Maximum 15 cr.  
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Graduate Courses in Educational Administration

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

EdAd 500 Seminar
Presentations on topics such as Law and the Handicapped, and Multicultural Education.

EdAd 505 School Administration I
A,Su. 3 cr. Lect.  
PREREQUISITE: Graduate standing.  
Administrative relationships at federal, state and local levels, and major responsibilities of the school superintendent and board of education.

EdAd 508 School Administration II
Su alternate years, will be offered Su 1986. 3 cr. Lect.  
PREREQUISITES: EdAd 505, post-master's standing.  
School administration at post-master's level for experienced administrators. Includes a study of the theoretical elements, structure of formal organizations, the decision making process, and the executive function, processes and responsibility. Examples are drawn from the general area of management including school administration.

EdAd 510 Elementary School Organization and Administration I
S,Su. 3 cr. Lect.  
PREREQUISITE: Graduate standing.  
Functions of the elementary school principalship in terms of organizing and administering curricula, staff, students, buildings and school services.

EdAd 511 Elementary School Organization and Administration II
Su alternate years, will be offered Su 1986. 3 cr. Lect.  
PREREQUISITE: EdAd 510, post-master's standing.  
Examination and evaluation of current practices, trends, research and problems concerning the role of an effective elementary school principal.

EdAd 520 Secondary School Organization and Administration I
W,Su. 3 cr. Lect.  
PREREQUISITE: Graduate standing.  
A study of the organization of the secondary school. Views the school as a part of a complex social system with attendant problems and interrelationships.

EdAd 521 School Management and Facilities Planning
S,Su alternate years, will be offered Su 1987. 3 cr. Lect.  
PREREQUISITE: Graduate standing.  
Plant maintenance, custodial responsibilities and processes in planning educational facilities to include both remodeling of old and building of new facilities for all grade levels.

EdAd 522 Secondary School Organization and Administration II
Su alternate years, will be offered Su 1987. 3 cr. Lect.  
PREREQUISITES: EdAd 505, 520, post-master's standing.  
The course goes beyond a focus on technical skills, roles and tasks, to the systematic study of administrative behavior and educational decision-making through reviewing the school as an educational/political system.

EdAd 525 Community Relations in Education
W,Su. 2 cr. Lect.  
PREREQUISITE: Graduate standing.  
Principles, practices and content of public relations programs in education; application of these principles and practices to specific problems of interest.

EdAd 526 School Management and Labor Relations
Su. 2 cr. Rec-Diss.  
PREREQUISITE: Graduate standing.  
Designed for teachers and administrators who have responsibility for negotiating. Course will cover Montana's negotiation law, negotiation's strategies, duties of fact finders and arbitrators, and responsibilities of the Board of Personnel Appeals. The course will be taught from an arbitrator's point of view, i.e., both management and teachers' perspectives will be presented.

EdAd 530 Supervision of Instruction I
W,Su. 3 cr. Lect.  
PREREQUISITE: Graduate standing.  
Policies and procedures of improving instruction. Special attention is given supervision of beginning teachers. One of the basic courses of the required sequences in the program of training of principals, supervisors and school administrators.

EdAd 534 Supervision of Instruction II
Su alternate years, will be offered Su 1987. 3 cr. Lect.  
PREREQUISITES: EdAd 530, post-master's standing.  
Supervision of instruction designed for the principal, superintendent or supervisor as administrative specialist. Emphasis on understanding the nature of learning and what to do to bring about more effective classroom learning in the general subject areas at different levels.

EdAd 535 School Law
A,Su. 3 cr. Lect.  
PREREQUISITE: Graduate standing.  
General school law and court decisions relative to schools. Special attention to school laws affecting management and administration of Montana schools.

EdAd 536 Advanced Law and Politics of Education
Su alternate years, will be offered Su 1986. 3 cr. Lect.  
PREREQUISITES: EdAd 505, 535, post-master's standing.  
In-depth analysis of law cases not covered in School Law with particular emphasis on the legal implications for Montana school administrators.

EdAd 540 School Finance
S,Su. 3 cr. Lect.  
PREREQUISITE: Graduate standing.  
National, state and local policies of collection, custody and expenditure of public school funds.

EdAd 541 Advanced Management Systems in Education
Su alternate years, will be offered Su 1987. 3 cr. Lect.  
PREREQUISITES: EdAd 505, 521.  
Focuses on systems and analysis, cost accounting, program planning, goal definition and goal assessment. For experienced administrators and graduate students.

EdAd 542 Economic Policy in Public Education
Su alternate years, will be offered Su 1987. 3 cr. Lect.  
PREREQUISITES: EdAd 540, post-master's standing.  
Focuses on developing solutions to the broad general financial policy questions facing public schools and how school finance can be adapted to the charges in education.

EdAd 552 Organization and Administration of Multicultural Education
S. 3 cr. Lect.  
PREREQUISITES: EdAd 505, graduate standing.  
Examines minority education programs; federal legislation, community relations, political aspects and language considerations associated with educational systems serving minorities. Emphasis on Native Americans.

EdAd 570 Individual Problems
A,W,S,Su. 1-5 cr. Ind. St. Maximum 9 cr.  
PREREQUISITES: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies.  
Directed research and study on an individual basis.

EdAd 571 In-Service Education
On demand. 2-5 cr. Rec-Diss.  
Lab. Maximum 15 cr.  
PREREQUISITES: Graduate standing and employment by sponsoring school organization.  
A carefully supervised group study of an educational problem within a local school. Employees at work in a school system may attempt to solve a major problem of school reorganization, curriculum...
change, instruction or a building program under the
direct supervision of a faculty member of MSU. The
problem selected for study must be approved by the
head of the Department of Educational Services, and
the administrators of the local school. The study will
culminate in a special report, syllabus, blueprint,
course of study or guide book to be filed with the
local school administrator and with the Department
of Educational Services.

EdFd 575  Professional Project
A,W,S,Su. 1-6 cr. Ind. St. Maximum 6 cr.
PREREQUISITE: Graduate standing.
PRE- or COREQUISITE: EdFd 506.
A professional project written on an educational
topic mutually agreed upon by the student and ma-
jor advisor.

EdFd 576  Internship
A,W,S,Su. 3-12 cr. Ind. St. Maximum 12 cr.
PREREQUISITE: Graduate standing.
Practical field experience with practicing school
administrators.

EdFd 580  Special Topics
On demand. 1-5 cr. Maximum 15 cr.
Courses not required in any curriculum for which
there is a particular need, or given on a trial basis to
determine demand.

EdFd 589  Graduate Consultation
A,W,S,Su. 3 cr. Tut.
PREREQUISITE: Master's standing and approval of
the Dean of Graduate Studies.
This course may be used only by students who
have completed all of their course work (and thesis,
if on a thesis plan) for a master's degree but who need
additional faculty help or time.

EdFd 590  Master's Thesis
A,W,S,Su. 3-12 cr. Ind. St. May be repeated.
PREREQUISITE: Master's standing.

EdFd 690  Doctoral Thesis
A,W,S,Su. 3-12 cr. Ind. St. May be repeated.
PREREQUISITE: Doctoral standing.

Education—

Educational Foundations

Department of Secondary Education and Foundations
694-4752

See Secondary Education for faculty list.

EdFd 100  Orientation
A.S. 1 cr. Rec-Disc.
Introduction to public education and its purposes.
A preview of the teaching profession, preparation,
rewards, development, structure, support and control
of schools.

EdFd 208  Educational Psychology
A,W,Su. 5 cr. Lect.
PREREQUISITE: HEc 255 or Psy 103.
A psychological analysis of instruction, covering
learning theory, behavior analysis, individual dif-
fferences and human development.

EdFd 210  School Studies
A,W. 1 cr. Lab. Maximum 3 cr.
PREREQUISITE: Must be taken concurrently with
EdFd 220, may be taken in conjunction with EdFd
100.
Guided opportunities to study the act of teaching
in a real, simulated, or a combination of such situ-
ations.

EdFd 2408  Introduction to Multicultural
Education
The development of multicultural education in the
U.S.; the instructional methods and techniques for
multicultural classrooms.

EdFd 280  Special Topics
On demand. 1-4 cr. Maximum 6 cr.
Courses not required in any curriculum for which
there is a particular need, or given on a trial basis to
determine demand.

EdFd 403  Assessment and Evaluation
A,W,S,Su. 3 cr. Lec.
Planning and constructing teacher-made tests, test-
ing as it relates to learning and teaching, and the
interpretation and use of criterion-referenced and
standardized norm-referenced tests.

EdFd 411  Philosophy of Educational
W,Su. 3 cr. Lec.
PREREQUISITE: EdFd 350.
The philosophy and development of vocational
education; legislation, state policies, school programs,
and non-school agencies and programs.

EdFd 440  Teaching the Multicultural
Child
W alternate years, will be offered W 1987, Su. 3 cr.
PREREQUISITE: Graduate standing.

EdFd 444  Materials Development for Limited
English Proficient Students
W,Su. 3 cr. Rec.-Dis.
PREREQUISITE: Minimum vocational competency
and EdFd 240.
The psychological, cultural, and linguistic aspects
of language learning; the methodology and materials
for teaching English to limited English prof-
cient students.

Education Courses in Educational Foundations

There are certain implicit prerequisites for 500- and
600-level courses; see Graduate Course Prerequisites,
page 120, for details.

EdFd 500  Seminar
S,Su on demand. 1 cr. Sem. Maximum 6 cr.
PREREQUISITE: Graduate standing.
Interaction with other students, University staff,
and others interested in topical educational matters.
Quarterly seminars are interrelated.

EdFd 501  Educational Statistics I
A,S, Su. 4 cr. Rec-Disc.
PREREQUISITES: Stat 216, and graduate standing.
Techniques of inferential statistics applied to educa-
tional settings. Measures of relationship, regression,
structure of hypothesis testing, t distribution, chi
square and analysis of variance.

EdFd 502  Educational Statistics II
W,Su. 4 cr. Rec-Disc. 3; Lab. 1.
PREREQUISITE: EdFd 501.
The design of experiments. Multifactor analysis of
variance, analysis of covariance, multiple regression
and factor analysis.

EdFd 503  Evaluation and Measurement
A.S. 3 cr. Rec-Disc.
PREREQUISITE: EdFd 501.
Evaluation as an ongoing process in education; con-
struction, selection and use of criterion-referenced
and norm-referenced instruments.

EdFd 506  Research Design
W,Su. 3 cr. Rec-Disc.
PREREQUISITE: EdFd 501.
Emphasis on basic educational research methods
and procedures for research studies.

EdFd 512  Advanced Educational Psychology
W,Su. 3 cr. Rec-Disc.
PREREQUISITES: EdFd 208 or EdFd 350, graduate
standing.
Principles of advanced educational psychology; for
those who have had little training or training a num-
er of years ago. Major emphasis on advanced
theories and how they apply to present teaching
methods.

EdFd 515  Classroom Behavior Modification
S,Su. 4 cr. Rec-Disc.
PREREQUISITE: Graduate standing.
Classroom application of the principles of behavior
modification as a means to a better solution of com-
on teaching problems.

EdFd 521  Learning Disabilities, Identification
and Assessment for the Regular Classroom
Teacher
Su on demand. 3 cr. Rec-Disc.
PREREQUISITES: EdFd 208, graduate standing.
Procedures for diagnosing students with neurolog-
ic impairment causing perceptual, language, activi-
ty, motor, attention and academic learning disabilities.
Diagnosis of minor retardation will also be covered.

EdFd 522  Precision Teaching
S. 3 cr. Rec-Disc.
PREREQUISITES: EdFd 208 and graduate standing.
Provides the regular or special teacher a set of
measurement procedures based on direct and daily
measurement from the current curriculum with built-
in formative evaluations to provide continuous
measurement of performance.

EdFd 532  General School Curriculum
A,S, Su. 3 cr. Rec-Disc.
PREREQUISITE: Graduate standing.
Mastery learning instructional strategies, systems,
middle schools and current curriculum topics.

EdFd 553  Junior High/Middle Schools
S. 3 cr. Lect. 2; Rec-Disc. 1.
PREREQUISITES: Graduate standing and teacher cer-
tification.
History, philosophy, and functions of the junior
high and middle schools emphasizing curriculum and
instruction based on the characteristics and needs of
transient youth.
EdFd 534 Construction of Curriculum
W,Su on demand. 3 cr. Rec.-Dis.
PREREQUISITES: Teaching experience, EdFd 552.
Implementation of a systems model of curriculum development; change theory; management styles and curriculum evaluation.

EdFd 535 Involving the Community
In Curriculum Development
S,Su on demand. 3 cr. Rec.-Dis.
PREREQUISITES: EdFd 534, graduate standing.
Development of strategies and techniques for community educational needs, assessments, and development of plans for disseminating and utilizing the data for curriculum development.

EdFd 536 Planned Change—Theory and Process
S,Su. 3 cr. Lect.
PREREQUISITES: Graduate standing, teacher certification.
Study of the dynamics of planned change in the helping professions. Includes the process of change, roles in the change process, and the interdisciplinary research that supports change theory and practice.

EdFd 538 School Activity Program
Su on demand. 2 cr. Rec.-Dis.
PREREQUISITES: Graduate standing, teacher certification.
Development of co-curricular activity programs of junior and senior high schools.

EdFd 541 History of Education
A,Su. 3 cr. Rec.-Dis.
PREREQUISITE: Graduate standing.
Historical development of educational theory and practice.

EdFd 544 Philosophies of Education
W,Su. 3 cr. Rec.-Dis.
PREREQUISITE: Graduate standing.
Major philosophies, their relationship to education and their application in an educational setting.

EdFd 548 Education for the Multicultural School
W alternate years, will be offered W 1988,Su. 3 cr. Rec.-Dis.
PREREQUISITES: EdFd 440 and teacher certification.
Develop the in-service educator's knowledge of cultures and how cultures present special problems in educating students in K-12 schools.

EdFd 550 Overview of Advanced Teaching Strategies
Su on demand. 3 cr. Rec.-Dis.
Teaching techniques and questioning strategies for experienced teachers.

EdFd 551 Advanced Teaching Strategies: Tabata
Su on demand. 3 cr. Rec.-Dis.
PREREQUISITE: Graduate standing.
Teaching strategies that increase the ability of students to solve problems by categorizing facts, drawing generalizations, and applying them to unknown situations.

EdFd 570 Individual Problems
A,W,Su. 1-5 cr. Ind. St. Maximum 9 cr.
PREREQUISITES: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies.
Directed research and study on an individual basis.

EdFd 576 Internship
PREREQUISITES: Graduate standing, consent of instructor and approval of department head.
An individualized program of field experience in an educational institution, organization or agency.

EdFd 580 Special Topics
On demand. 1-5 cr. Maximum 15 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

EdFd 606 Doctoral Research
S,Su. 3 cr. Rec.-Dis.
PREREQUISITES: Doctoral standing, EdFd 502 and 506.
Basic concepts of research design for doctoral students who are in the process of planning their research.

Educational Services

Head of Departments: Dr. Donald Robson
Associate Professors: G.A. Gregg, S.R. Hample (Adjunct), R.K. Horwill, J.J. O'Connell, D.L. Robson
Assistant Professors: R.G. Brockett, E.L. Bryan, C.N. Casey (Adjunct), A.S. Clarke, P.M. Donahoe, R.S. Groseth (Adjunct), K.A. O'Malley (Adjunct), W.D. Porterfield (Adjunct), T.B. Robinson (Adjunct), M.H. Wessell (Adjunct)
Instructors: W.C. Fleming
Courses offered through this department may be found under Adult and Higher Education, Educational Administration and Counseling.

Education
Elementary Education

Head of Departments: Dr. D. Melling (acting)
Professors: D. Melling, G. Sullivan.

EdEl 201 Teacher as Learner
S. 1 cr. Rec.-Dis.
Acquisition and refinement of skills related to observation of children, characteristics of effective teachers and professional responsibilities of teachers. Assessment of requisite knowledge and skills for entry into the teaching profession will also be involved.

EdEl 202 In-school Observation Experience
A. 1 cr. .5 Lab. .5 Rec.-Dis.
PREREQUISITES: EdEl 201.
Observation in an elementary school during the first week of the elementary school's academic year and follow-up sessions which focus on review and refinement of specific observational targets and child observation skills.

EdEl 280 Special Topics
Courses required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

EdEl 300 Paraprofessional Experience
A,W,Su. 1-3 cr. Ind. St. Maximum 9 cr.
PREREQUISITES: EdEl 208, and good standing in Teacher Education Program.
Students will observe children, observe teaching strategies and serve as teacher aides under the direct supervision of the classroom teacher and the University supervisor. Students will teach lessons in each of the subject areas corresponding to the methods classes in which they are currently enrolled.

EdEl 305 Fundamentals of Teaching Reading
A,W,Su alternate summers, will be offered Su 1986. 4 cr. Lect. 3; Ind. St. 1.
PREREQUISITES: EdEl 208, and good standing in Teacher Education Program.
Current theory and techniques in the teaching of reading with emphasis on beginning reading instruction, reading readiness, developmental needs of young children, phonics, basal reader and language experience approaches. Concurrent paraprofessional lab experience included during the academic year.

EdEl 307 Teaching the Multicultural Child
A,Su alternate summers, will be offered Su 1986. 3 cr. Lect.
PREREQUISITE: EdEl 208.
Current theory and techniques in teaching children with bilingual backgrounds. Major topics will include aspects of child development in culture matrix, language acquisition and development. English as a second language, improved methodology in teaching elementary education subjects to the bilingual child.

EdEl 312 Teaching Language Arts
A,W,Su alternate summers, will be offered Su 1986. 4 cr. Lect. 3; Ind. St. 1.
PREREQUISITES: Engl 236, SpCm 216, EdEl 208, and good standing in Teacher Education Program.
Current theory and techniques in teaching language arts (oral and written communication). Child development in the language arts, the integration and use of the language arts in the rest of the curriculum, the relationship of language and thought development in children and creative aspects of the language arts. Concurrent paraprofessional lab experience included during the academic year.

EdEl 313 Teaching Social Studies
A,W,Su alternate summers, will be offered Su 1987. 4 cr. Lect. 3; Ind. St. 1.
Teacher-pupil planning of objectives, selection of course content and application of appropriate learning experiences to achieve the objectives. Concurrent paraprofessional lab experience included during the academic year.

EdEl 325 Teaching Science
A,W,Su. 5 cr. Lab. 4; Ind. St. 1.
PREREQUISITES: Restricted Elective Life Science with lab, Geog 101, Phys 103, 105, EdEl 208, and good standing in Teacher Education Program.
Activity-centered science integrating basic cognitive background acquired in science content courses with programs in elementary school science field trips included. Concurrent paraprofessional lab experience included during academic year.

EdEl 332 Teaching Art
A,W,Su. 5 cr. Ind. St. 1.
PREREQUISITES: Art 114, EdFd 208.
The principles of teaching art from kindergarden through sixth grade. Discussion of developmental stages, construction of curriculum and lesson resources for art along with a creative studio investigation of materials.
EdEl 333 Teaching Mathematics  
A,W,S,Su alternate summers, will be offered Su 1986.  
4 cr. Lect. 3; Ind. St. 1.  
PREREQUISITES: Math 107 and 109, EdFd 208, and  
good standing in Teacher Education Program.  
Math methods and materials for the prospective ele-
mentary teacher. Classroom organization, operation,  
management, and current theory. Concurrent para-
professional lab experience included during the  
academic year.

EdEl 335 Teaching Physical Education  
A,W,S,Su. 3-4 cr. for EdEl majors. Lect. 2; Lab.  
1; Ind. St. 1; 5 cr. for all others. Lect. 2; Lab. 1.  
PREREQUISITES: PE 310 and good standing in  
Teacher Education Program.  
Planning, organization and teaching methods of  
elementary school physical education. Practice in  
physical skills and teaching techniques.

EdEl 336 Teaching Music  
A,W,S,Su. 3 cr. Lect. 1; Rec.-Dis. 2.  
PREREQUISITES: Mus 242, EdFd 208, and good  
standing in Teacher Education Program.  
Orff, Kodaly, TTM, creative activities for youth,  
philosophy of music teaching, song leading, guiding  
listening, current music series and supplementary  
music. rhythm/harmony bands, classroom level  
ability on guitar and piano.

EdEl 337 Methods in Music K-6  
A,Su on demand. 3 cr. Lect. 1; Rec.-Dis. 2.  
PREREQUISITES: Mus 133, and good standing in  
Teacher Education Program. EdFd 208 or concurrent  
registration in EdSd 350.  
Singing, rhythmic activities, creative activities,  
classroom instruments, listening to music and teach-
ing reading of music.

EdEl 400 Seminar  
A,W,S,Su. 1-3 cr. Maximum 6 cr.  
Discussion of current topics in elementary educa-
tion. Topics vary with each offering.

EdEl 401 Educational Issues and Practices I  
PREREQUISITES: EdFd 208 and good standing in  
Teacher Education Program.  
Discussion of general teaching problems and  
strategies. The course is related to the concurrent  
paraprofessional experience. Students should register  
for EdEl 401 during the first quarter of paraprofes-
sional work and EdEl 402 during the second quarter  
of paraprofessional work.

EdEl 402 Educational Issues and Practices II  
PREREQUISITES: EdFd 208 and good standing in  
Teacher Education Program.  
Discussion of general teaching problems and  
strategies. The course is related to the concurrent  
paraprofessional experience. Students should register  
for EdEl 401 during the first quarter of paraprofes-
sional work and EdEl 402 during the second quarter  
of paraprofessional work.

EdEl 405 Methods and Materials of Teaching Reading  
A,W,S,Su alternate summers, will be offered Su 1987.  
3 cr. Lect.  
PREREQUISITE: EdFd 208.  
Current psycholinguistic theory and implications  
for teaching reading. Development of personal theory  
of the reading process. Emphasis on reading as a  
language-based process and comprehension as a part  
of rather than a product of that process. Practice and  
application of methods learned in class required.  
Concurrent paraprofessional lab experience included during the  
aacademic year.

EdEl 406 Early Childhood Education  
W,S,Su alternate summers, will be offered Su 1987.  
3 cr. Lect.  
PREREQUISITES: EdFd 208.  
Preparing teachers to teach kindergarten and the  
primary grades one through three. Understanding the  
characteristics of the age-level child; establishing  
curriculum methods, materials, learning environ-
ments, and activities for teaching, and investigation  
of the relevant subject area.

EdEl 408 Instructional Application of Children's Books  
On demand. 3 cr. Rec.-Dis.  
PREREQUISITE: Engl 236.  
Investigation of current issues, resources and  
references, children's books, and comprehension-
based models of reading instruction. Emphasis will  
be placed on reading a variety of children's books and  
learning about and practicing lessons that facilitate  
comprehension.

EdEl 410 Student Teaching  
A,W,S,4-6 cr. Ind. St.  
PREREQUISITE: Standalone third quarter, all EdEl methods  
courses in curriculum or consent of Director of Stud-
ent Teaching and Certification, and good standing in  
Teacher Education Program.  
Observation of classroom teaching, preparation of  
lesson plans; supervised experience in teaching under  
experienced teachers and MSU staff supervisors.

EdEl 411 Student Teaching  
A,W,S,4-6 cr. Ind. St.  
PREREQUISITES: Senior standing, all EdEl methods  
courses in curriculum or consent of Director of Stud-
ent Teaching and Certification, and good standing in  
Teacher Education Program.  
Observation of classroom teaching, preparation of  
lesson plans; supervised experience in teaching under  
experienced teachers and MSU staff supervisors.

EdEl 412 Student Teaching  
A,W,S,3-6 cr. Ind. St.  
PREREQUISITES: Senior standing, all EdEl methods  
courses in curriculum or consent of Director of Stud-
ent Teaching and Certification, and good standing in  
Teacher Education Program.  
Observation of classroom teaching, preparation of  
lesson plans; supervised experience in teaching under  
experienced teachers and MSU staff supervisors.

EdEl 414 Student Teaching Issues  
A,W,S,4 cr. Lect. 2; Rec.-Dis. 2.  
PREREQUISITES: Student teaching, and good stand-
ing in Teacher Education Program.  
Review of role of teachers and elementary school;  
school law, teacher contracts, certification, profes-
sional organizations; ethics; job seeking; job success;  
and other critical issues for elementary education  
majors.

EdEl 434 Reading Diagnosis Procedures  
S, 3 cr. Lect. 2; Lab. 1.  
PREREQUISITE: EdEl 305 or 405.  
Emphasis is on correlating an understanding of how  
reading occurs with assessment of reading difficulties.  
Test language, how tests are developed, and a survey  
of currently used instruments.

EdEl 451 Educational Software Design  
A,W,S,Su alternate summers, will be offered Su 1987.  
3 cr. Lect.  
PREREQUISITES: EdIM 251 and CS 170 or CS 172 or  
CS 174 and senior standing.  
Techniques for developing, evaluating, and using  
educational software as it relates to the use of com-
puters in education. Students will design and imple-
ment programs using microcomputers.

EdEl 470 Individual Problems  
A,W,S,Su. 1-5 cr. Ind. St. Maximum 6 cr.  
PREREQUISITES: Consent of instructor and approval of  
department head.  
Directed research and study on an individual basis.

EdEl 480 Special Topics  
On demand. 2-5 cr. Maximum 16 cr.  
Courses not required in any curriculum for which  
there is a particular need, or given on a trial basis to  
determine demand.

Graduate Courses in Elementary Education  
There are certain implicit prerequisites for 500- and  
600-level courses. See Graduate Course Prerequisites,  
page 126, for details.

EdEl 500 Seminar  
On demand. 1 cr. Maximum 6 cr.  

EdEl 504 Organization and Supervision of Elementary School Reading  
A,W,S,4 cr. Lect.  
PREREQUISITE: EdEl 305 or 405.  
The role of the supervisor or administrator in im-
proving reading instruction; different reading ap-
proaches in published material; the purpose and place  
of basal readers; what research indicates; under what  
conditions reading instruction is good.

EdEl 505 Improvement of Instruction in Teaching Reading  
A,W,S,4-6 cr. Ind. St.  
PREREQUISITE: EdEl 305 or 405.  
Designing and improving instruction in reading  
fundamentals, children's literature, reading study skills  
and reading in other school subjects. Emphasis on  
historical development, research, and controversy  
in the teaching of reading.

EdEl 510 Elementary School Curriculum  
A,Su. 3 cr. Lect.  
PREREQUISITES: EdEl 410, 411 and graduate stand-
ing.  
Understanding attitudes and skills for in-service  
teachers and administrators to be used in selecting and  
implementing learning experiences for children.

EdEl 512 Improvement of Instruction in Language Arts  
A,Su. 3 cr. Lect.  
PREREQUISITE: EdEl 312.  
Trends in teaching communication skills in the  
elementary school with emphasis on research and  
modern approaches to teaching the language arts.

EdEl 513 Improvement of Instruction in Social Studies  
A,Su. 3 cr. Lect.  
PREREQUISITES: EdEl 305, 313 and teaching experi-
cence.  
Issues and trends in teaching and supervision of  
elementary social studies.

EdEl 514 The Exceptional Learner  
Su. 3 cr. Lect.  
PREREQUISITES: EdEl 410 and 411.  
Nature, needs and provisions for curriculum devel-
opment of teaching slow and gifted learners. Primarily  
for experienced elementary and secondary teachers.

EdEl 525 Improvement of Instruction in Science  
S,Su. 4 cr. Lect.  
PREREQUISITES: Graduate standing and teaching  
experience.  
Format, costs, and instructional strategies of con-
temporary science programs derived from various  
learning theories. Use of science facilities, science  
resource centers and outdoor instructional environ-
ments.
EdEl 551 Improvement of Instruction in Art
A,Su. 3 cr. Lect. 1; St. 2.
PREREQUISITES: EdEl 352, teaching experience.
Presentation of a variety of art methods for the elementary classroom. Current trends, interrelationships with other classroom disciplines and in-depth experience with materials.

EdEl 553 Improvement of Instruction in Mathematics
W,Su. 4 cr. Lect.
PREREQUISITES: EdEl 353 and teaching experience.
Stresses use of appropriate knowledge from mathematics education, learning theory, developmental psychology, readiness, evaluation and individual differences in selecting, organizing and presenting mathematical content for elementary school children.

EdEl 554 Corrective and Remedial Reading
Su. 4 cr. Lect. 2; Lab. 2.
PREREQUISITES: EdEl 305, 405 and teaching experience.
Assessment, prescription and correction of reading difficulties with emphasis on specific techniques for use either in the classroom or with small groups outside the classroom.

EdEl 555 Improvement of Instruction in Physical Education
On demand. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: EdEl 355.
Curriculum content, methods, and ideas on how to build inexpensive equipment for an elementary physical education movement program. Movement education will be presented along with a concept known as games analysis.

EdEl 542 Creative Processes
Su. 3 cr. Rec.-Dis. 2; Lab. 1.
PREREQUISITES: Graduate standing and teaching experience.
Survey of research in creativity. Opportunity to investigate materials, explore processes and experience field trips. Designed to help classroom conditions which promote the creative development of children.

EdEl 543 Math Labs in the Self-Contained Classroom
Su. alternate years, will be offered Su 1987. 3 cr. Lect. 2; Rec.-Dis. 1.
PREREQUISITES: Graduate standing and teaching experience.
Establishment, management and operation of an active mathematics program. Emphasis on learning how to teach using concrete learning aids with appropriate classroom activities, projects and games examined, practiced and learned. Students will develop practical learning materials for use in the mathematics program.

EdEl 556 Improvement of Instruction in Physical Education
On demand. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: EdEl 356.
Curriculum content, methods, and ideas on how to build inexpensive equipment for an elementary physical education movement program. Movement education will be presented along with a concept known as games analysis.

EdEl 575 Professional Project
A,W,Su. 1-6 cr. Ind. St. Maximum 6 cr.
PREREQUISITES: EdEl 506 and graduate standing.
A professional paper written on an educational topic mutually agreed upon by the student and his or her major advisor.

EdEl 576 Internship
PREREQUISITES: Graduate standing and approval of the head of the elementary education department.
A supervised individual program of field experiences in elementary school curriculum and instruction, or elementary school administration.

EdEl 580 Special Topics
On demand. 1-5 cr. Maximum 15 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

EdEl 589 Graduate Consultation
A,W,Su. 3-5 cr. Tut.
PREREQUISITES: Master's standing and approval of the Dean of Graduate Studies.
This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) for master's degree but who need additional faculty help or time.

EdEl 590 Master's Thesis
A,W,Su. 3-12 cr. Ind. St. May be repeated.
PREREQUISITE: Master's standing.

EdEl 610 Readings in Current Research in Elementary Education
Su. On demand. 3 cr. Lect. 1; Rec.-Dis. 2.
PREREQUISITES: EdEl 506 and doctoral standing.
Readings in current research related to elementary education and examination of application and implications for curriculum.

EdEl 690 Doctoral Thesis
A,W,Su. 3-12 cr. Ind. St. May be repeated.
PREREQUISITE: Doctoral standing.

Education—Instructional Media

Department of Secondary Education and Foundations
994-4752
See Secondary Education for faculty list.

EdIM 251 Foundations of Instructional Computing
A,W,Su. 3 cr. Lect. 2; Rec.-Dis. 1.
PREREQUISITE: EdEd 208.
Basic competencies and knowledge for pre-service teachers in the use of computers in an educational context. Emphasis on issues related to computers and education.

EdIM 280 Special Topics
On demand. 1-5 cr. Maximum 8 cr. of EdIM 280 plus EdIM 480, 16 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

EdIM 307 Basic Research Sources
A,Su alternate summers, will be offered Su 1987. 3 cr.
PREREQUISITE: Junior standing.
Selection and use of basic research material for personal use. Some subject research materials are also included. Intended for anyone who wants to fully utilize a library's resources.

EdIM 323 Basic Media Production and Equipment
A,W,Su. 2 cr. Lab.
PREREQUISITE: Junior standing.
Audiovisual equipment operation and material production. Course is self-scheduled and is self-instructional.

EdIM 351 Teaching with Instructional Media Materials
PREREQUISITE: Junior standing.
Insight into the selection and use of library-media materials for personal use as well as subject enrichment. Intended for education majors.

EdIM 352 Organization of Instructional Media Materials
W,Su alternate summers, will be offered Su 1986. 4 cr.
PREREQUISITE: EdIM 351.
Library media specialists will learn classification and cataloging techniques for print and non-print media.

EdIM 354 Selection of Instructional Media Materials
W,Su alternate summers, will be offered Su 1987. 5 cr.
Evaluation, selection and acquisition of library-media materials.

EdIM 406 Literature for Young Adults
W,Su alternate summers, will be offered Su 1987. 3 cr.
PREREQUISITE: EdIM 354.
Junior standing.
Reading and appraising literature appropriate to the needs, interests and abilities of young people (approximately ages 11-18). Examination of tools and review media for selection and reviewing.

EdIM 411 Multi-Media Storytelling
A,Su alternate summers, will be offered Su 1986. 5 cr.
PREREQUISITE: Engl 303.
Principles of the art of storytelling; learning the techniques of preparing and presenting a story; planning a story hour and locating suitable materials; creation of materials to use in oral presentations of literature.

EdIM 412 Administration of Instructional Media Services
W,Su alternate summers, will be offered Su 1987. 4 cr.
PREREQUISITES: EdIM 351, 352, 354.
Functions, services, requirements and problems for a school library-media center. For prospective K-12 school library-media personnel.

EdIM 424 Classroom Videotape Production
On demand. 3 cr. Lect. 1; Lab. 2.
PREREQUISITE: EdIM 323.
Operation and design of classroom television videotape techniques and problems.

EdIM 425 Teaching with Media
W,S. 5 cr. Lect. 2; Lab. 1.
PREREQUISITE: EdIM 323.
Various means by which instructional media can be utilized in the classroom. Focus on how to teach with media.
EdIM 427 Graphics in Education
A,W,S; 3 cr. Lect. 2; Lab. 1.
PREREQUISITE: EdIM 323.
Techniques, processes and methods by which visual materials may be prepared. Creative projects for students in teaching, public relations, marketing, engineering, extension and other areas requiring professional presentations.

EdIM 429 Educational Photography
On demand. 3 cr. Lect. 2; Rec.-Dis. 1.
PREREQUISITE: EdIM 323.
Techniques, production and use of photography in the educational process. Basic skill in 8mm movie film, black and white prints, and 35mm slides. Students provide own camera equipment.

EdIM 450 Educational Computing Laboratory
A,W,S,Su; 1-5 cr. Lab.
Flexible format which allows a student to select one or more specialized educational application modules related to computers or contract for a project if a module does not exist for that project.

EdIM 452 Advanced Educational Software Design
A,Su; 3 cr. Lect. 2; Rec.-Dis. 1.
Advanced techniques in designing educational software, application of these techniques in designing sophisticated micro-computer software for education and their use in education.

EdIM 460 Non-Programming Computer Applications to Education
A,W,Su; 3 cr. Lect. 2; Lab. 1.
PREREQUISITE: EdEI 410 or EdSD 410.
Develop skill in using word processing, spreadsheets, and data base management programs. Apply these programs to education.

EdIM 470 Individual Problems
A,W,Su; 1-5 cr. Ind. St. Maximum 6 cr.
PREREQUISITES: EdIM 323, 352, 354, 412, consent of instructor and department head.
Directed research and study on an individual basis.

EdIM 476 Internship
A,W; 4 cr. Ind. St.
PREREQUISITES: Senior standing, EdIM 307, 323, 352, 354, 412, consent of instructor and department head.
A supervised practicum in performing routines of the library-media specialist.

EdIM 480 Special Topics
On demand. 2-5 cr. Maximum 15 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Graduate Courses in Educational Instructional Media

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

EdM 570 Individual Problems
A,W,Su; 1-5 cr. Ind. St. Maximum 9 cr.
PREREQUISITES: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies.
Directed research and study on an individual basis.

EdM 580 Special Topics
On demand. 1-5 cr. Maximum 15 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Education—Secondary Education

Department of Secondary Education and Foundations
994-4752

Acting Head of Department: Dr. L. Casagrande.
Professors: D. Bisbri (Agricultural/Industrial Education), G. Evans (Physical Education), D. Berthauser, L. J. B. Strohmeyer, A. Swaid (Testing), M. Markowsits (Elementary Education), B. F. Miles (Counseling), A. Parsons (Home Economics), W. Serdabey (Health).
Assistant Professors: F. Abel, D. B. Barbolomew (Music), N. Colton (Physical Education), F. Frost (Business).

EdSD 280 Special Topics
On demand. 1-4 cr. Maximum 6 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

EdSD 348 Field Experience
A,W; 1 cr. Lab. Maximum 5 cr.
PREREQUISITE: EdFD 208.
Opportunities to interact with real learners in an actual school situation (may be taken in conjunction with courses in methods of teaching).

EdSD 350 Strategies and Tactics in Teaching
A,W,S; 3 cr. Lect. 2; Rec.-Dis. 1.
PREREQUISITE: HEC 268 or PSY 103, EdFD 208.
Good teaching in the Teacher Education Program. For students not seeking certification: consent of instructor and cumulative grade point average of 2.0 or better.
An introduction to instructional planning, methods, and professional concerns for those preparing for secondary certification. Includes practical experience in the classroom and a practicum in a secondary school.

EdSD 351 Methods of Teaching Typewriting and Business Machines
W; 2 cr. Lect. 1; Lab. 1.
PREREQUISITE: EdSD 350, 20 or more credits in the subject area, good standing in the Teacher Education Program and cumulative grade point average of 2.0 or better.
Objectives, methodologies and materials used in teaching typewriting and business machine subjects.

EdSD 352 Methods of Teaching Vocational Agriculture and Industrial Education
A,W; 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: EdIM 325 to be taken concurrently, EdSD 350, 20 or more credits in the subject area, good standing in the Teacher Education Program and cumulative grade point average of 2.0 or better.
Objectives, methodologies and materials utilized in teaching vocational agriculture and industrial education at the junior high and secondary levels.

EdSD 353 Methods of Teaching Art
W; 3 cr. Lab.
PREREQUISITE: EdSD 350, 20 or more credits in the subject area, good standing in the Teacher Education Program and cumulative grade point average of 2.0 or better.
Objectives, methodologies and materials utilized in teaching art.

EdSD 355 Methods of Teaching Shorthand and Transcription
A; 2 cr. Lect. 1; Lab. 1.
PREREQUISITES: EdSD 350, 0 S 112, 20 or more credits in the subject area, good standing in the Teacher Education Program and cumulative grade point average of 2.0 or better.
Objectives, methodologies and materials utilized in teaching shorthand and transcription.

EdSD 356 Methods of Teaching Accounting and Basic Business
W; 2 cr. Lect. 1; Lab. 1.
PREREQUISITE: EdSD 350, 20 or more credits in the subject area, good standing in the Teacher Education Program and cumulative grade point average of 2.0 or better.
Objectives, methodologies and materials utilized in teaching accounting and basic business.

EdSD 357 Methods of Teaching English
S; 3 cr. Rec.-Dis. 2; Lab. 1.
PREREQUISITE: EdSD 350, 20 or more credits in the subject area, good standing in the Teacher Education Program and cumulative grade point average of 2.0 or better.
Teaching strategies, methods and materials for planning, implementing and evaluating language arts instruction.

EdSD 358 Methods of Teaching Social Studies
A; 3 cr. Lect.
PREREQUISITE: EdSD 350, 20 or more credits in the subject area, good standing in the Teacher Education Program and cumulative grade point average of 2.0 or better.
Curriculum materials and procedures for teaching social studies in secondary schools.

EdSD 359 Methods of Teaching Home Economics
W; 3 cr. Lect. 2; Lab. 1.
PREREQUISITE: EdSD 350, 20 or more credits in the subject area, good standing in the Teacher Education Program and cumulative grade point average of 2.0 or better.
Teaching strategies, methods and materials for planning, implementing and evaluating home economics programs.

EdSD 361 Methods of Teaching Mathematics
W; 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: EdSD 350, Math 358 (may be taken concurrently), good standing in the Teacher Education Program and cumulative grade point average of 2.0 or better.
Effective techniques in presenting materials, planning class activities and creating good learning experiences. Methods of teaching algebra, geometry, trigonometry, probability and statistics, applications of current mathematics education research.

EdSD 362 Methods of Teaching Modern Languages
W; 3 cr. Rec.-Dis. 2; Lab. 1.
PREREQUISITE: EdSD 350, 20 or more credits in the subject area, good standing in the Teacher Education Program and cumulative grade point average of 2.0 or better.
Secondary principles, methodologies and materials utilized in teaching modern languages.

EdSD 363 Methods of Teaching Marketing Education
W,S; 3 cr. Lect. 2; Lab. 1.
PREREQUISITE: EdSD 350, 20 or more credits in the subject area, good standing in the Teacher Education Program and cumulative grade point average of 2.0 or better.
Objectives, methodologies and materials utilized in teaching marketing education. Review of Montana Curriculum Guidelines for Marketing Education.
EdSd 364 Methods of Teaching Health
S. 3 cr. Lect. 2; Lab. 1.
PREREQUISITES: EdSd 350, 20 or more credits in the subject area, good standing in the Teacher Education Program and cumulative grade point average of 2.0 or better.
Organization and administration of health instruction and health programs centered around the elementary and secondary schools. Emphasis on teacher preparation.

EdSd 365 Methods of Teaching Physical Education
A.S. 3 cr. Lect. 1; Lab. 2.
PREREQUISITES: EdSd 350, 20 or more credits in the subject area, good standing in the Teacher Education Program and cumulative grade point average of 2.0 or better.
Practical application of writing objectives and designing lesson and unit plans for various teaching styles in order to present appropriate movement activities. Concurrent registration in PE 366 is highly recommended.

EdSd 366 Methods of Teaching Science
W. 3 cr. Lect. 2; Rec.-Dis. 1.
PREREQUISITES: EdSd 350, 20 or more credits in the subject area, good standing in the Teacher Education Program and cumulative grade point average of 2.0 or better.
Learning theory application, organization and techniques for individualization, general methodologies for junior and senior high biology, earth science, chemistry and physics.

EdSd 368 Methods of Teaching Junior High School Music
W. 3 cr. Lect. 1; Rec.-Dis. 1.
PREREQUISITES: Piano proficiency; EdSd 350, 20 or more credits in the subject area, good standing in the Teacher Education Program and cumulative grade point average of 2.0 or better.
Recent trends and technologies in music education, the computer for music instruction, characteristics of the adolescent, Manhattanville, literature for general music, philosophy of aesthetic education, individualized instruction, movement to music.

EdSd 369 Methods of Teaching Secondary School Music
S. 3 cr. Lect. 1; Rec.-Dis. 2.
PREREQUISITES: EdSd 350, 20 or more credits in the subject area, good standing in the Teacher Education Program and cumulative grade point average of 2.0 or better.
Comprehensive music curriculum design, administration of music programs, promoting music programs, career information, program planning, rehearsal motivation techniques, standardized music testing.

EdSd 371 Methods of Teaching Junior High Mathematics
S. 4 cr. Lect. 3; Lab. 1.
PREREQUISITES: EdSd 350 or EdEl 333, 20 or more credits in the subject area, good standing in the Teacher Education Program and cumulative grade point average of 2.0 or better.
Effective techniques in presenting materials, planning class activities and creating good learning experiences. Methods of teaching arithmetic, remedial mathematics, basic geometry, introductory algebra, reading/writing mathematics.

EdSd 374 Methods of Teaching Theatre Arts
W alternate years, will be offered W 1987, 3 cr.
Rec.-Dis.
PREREQUISITES: EdSd 350, 20 or more credits in the subject area, good standing in the Teacher Education Program and cumulative grade point average of 2.0 or better.
Solutions to the problems inherent in high school drama teaching and directing, philosophy of educational theatre and relationships between the high school program and the community.

EdSd 400 Seminar
A.W.S. 1 cr. Sem.
PREREQUISITE: EdFd 208 and EdSd 350.
The multicultural child in the school setting will be discussed. Methods for integrating the child with special needs into the activities of the regular classroom will be studied. Each quarter these two topics will be addressed in separate sections.

EdSd 410 Student Teaching
A.W.S. 6.8 cr. Lab. Maximum 8 cr.
PREREQUISITE: Senior standing. Good standing in the Teacher Education Program, EdSd 350 and special methods or consent of the Director of Student Teaching and Certification.
Observation of classroom teaching; preparation of work and lesson plans; supervised experience in teaching under experienced teachers and MSU staff members; conferences with supervisors.

EdSd 411 Student Teaching Seminar
A.W.S. 1 cr. Lab. Maximum 8 cr.
PREREQUISITE: Senior standing. Good standing in the Teacher Education Program, EdSd 350 and special methods or consent of the Director of Student Teaching and Certification.
Observation of classroom teaching; preparation of work and lesson plans; supervised experience in teaching under experienced teachers and MSU staff members; conferences with supervisors.

EdSd 413 Student Teaching Seminar
A.W.S. 1-4 cr. Rec.-Dis. Maximum 4 cr.
PREREQUISITE: Good standing in the Teacher Education Program. To be taken concurrently with EdSd 410 and 411.
The role of secondary school teacher and secondary education; school support and school law; teacher contracts; certification; professional organizations; ethics; job seeking and job success; and critical issues. Required course for certification for secondary teaching.

EdSd 450 Reading in the Content Field
A.Su. 4 cr. Rec.-Dis.
PREREQUISITE: EdSd 350 or EdEl 305.
Techniques, materials, organization and theory in reading instruction; junior and senior high schools. Reading effectively in all content fields, diagnosis of reading level, materials and methods for teaching specific skills.

EdSd 470 Individual Problems
A.W.Su. 1-5 cr. Ind. St. Maximum 6 cr.
PREREQUISITE: Consent of instructor and department head.
Directed research and study on an individual basis.

EdSd 480 Special Topics
On demand. 1-5 cr. Maximum 15 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Graduate Courses in Secondary Education
There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

EdSd 570 Individual Problems
A.W.Su. 1-5 cr. Ind. St. Maximum 9 cr.
PREREQUISITE: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies.
Directed research and study on an individual basis.

EdSd 571 In-Service Education
On demand. 2-5 cr. Rec.-Dis., Lab. Maximum 15 cr.
PREREQUISITE: Graduate standing and employment by sponsoring school organization.

An approved supervised group study of an educational problem within a local school supervised by an MSU faculty member which culminates in a special report to be filed with the local district and the Department of Secondary Education and Foundations.

EdSd 575 Professional Project
A.W.S Su. 1-6 cr. Ind. St. Maximum 6 cr.
PREREQUISITES: EdFd 506 and graduate standing.
A professional project written on an educational topic mutually agreed upon by the student and the major advisor.

EdSd 580 Special Topics
On demand. 1-5 cr. Maximum 15 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

EdSd 589 Graduate Consultation
A.W.Su. 3 cr. Tut.
PREREQUISITES: Master's standing and approval of the Dean of Graduate Studies.
This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) for a master's degree but who need additional faculty help or time.

EdSd 590 Master's Thesis
A.W.Su. 3-12 cr. Ind. St. May be repeated.
PREREQUISITE: Master's standing.

EdSd 690 Doctoral Thesis
A.W.Su. 3-12 cr. Ind. St. May be repeated.
PREREQUISITE: Doctoral standing.

Electrical and Electronic Engineering Technology
Department of Electrical Engineering
994-2505
See Electrical Engineering for faculty listing.

EEET 201 Electric Circuits and Fundamentals I
A. 3 cr. Lect.
PREREQUISITE: Math 175.
Basic concepts of voltage, current, work and power. Analysis of resistors, capacitors and inductors in steady state and transient DC circuits.

EEET 202 Electric Circuits and Fundamentals II
W. 3 cr. Lect.
PREREQUISITES: EEET 201, CS 154, CS 172, Math 176, Phys 205.
Natural and forced RLC response; alternating currents and voltages and the use of impedance concepts for steady state AC circuit analysis.

EEET 203 Electric Circuits and Fundamentals III
S. 3 cr. Lect.
Polyphase circuits, magnetic circuits, mutual inductance and resonance.

EEET 208 Electrical Laboratory I
W. 2 cr. Lab.
PREREQUISITE: Concurrent enrollment in EEET 202.
The use of computers in circuit analysis. Basic measuring instruments and their application in measurements of voltages, currents and powers of DC and AC circuits as well as individual circuit elements. Laboratory verification of network theorems.
EEET 209 Electrical Laboratory II  
S. 2 cr. Lab.  
PREREQUISITE: Concurrent enrollment in EEET 203.  
Continuation of EEET 208 but stressing AC circuits.

EEET 280 Special Topics  
On demand. 1.5 cr. Maximum 8 cr. Maximum of EEET 280 plus EEET 480, 16 cr.  
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

EEET 301 Electronics I  
A. 3 cr. Lect.  
PREREQUISITES: EEET 301 or EEET 302 or EEET 303.  
Introductory course in electronics for EEET majors. Principles and characteristics of diodes, bipolar and field-effect transistors. Biasing circuits, small-signal AC models, small signal amplifier characteristics. Introduction to operational amplifiers.

EEET 302 Electronics II  
W. 3 cr. Lect.  
PREREQUISITE: EEET 301.  
Continuation of EEET 301. Amplifier frequency response, large signal amplifiers, negative feedback, oscillators.

EEET 303 Electronics III  
S. 3 cr. Lect.  
PREREQUISITE: EEET 302.  
Power supply regulation, introduction to logic circuits and logic families. Introduction to communications, rf amplifiers, receivers, modulation techniques, noise.

EEET 305 Analysis of Linear Systems  
A. 3 cr. Lect.  
PREREQUISITE: EEET 303.  
Laplace transforms in circuit analysis, Fourier series, and two port networks.

EEET 307 Electronics Laboratory I  
A. 2 cr. Lab.  
PREREQUISITE: Concurrent enrollment in EEET 301 and 305.  
An introduction to laboratory instruments and measuring techniques applied to electrical and electronic circuits. Measurement of diode and transistor characteristics, discrete and I.C. amplifier characteristics. Use of computer programs such as SPICE for analysis of circuits.

EEET 308 Electronics Laboratory II  
W. 2 cr. Lab.  
PREREQUISITE: Concurrent enrollment in EEET 307.  
Design, breadboarding and evaluation of transistor circuits. Amplifier frequency response, multi-stage amplifiers, power amplifiers, feedback amplifiers and oscillators. Use of computer programs such as SPICE for analysis of electronic circuits.

EEET 309 Electronics Laboratory III  
S. 2 cr. Lab.  
PREREQUISITE: Concurrent enrollment in EEET 308.  
Breadboarding and evaluation of voltage regulators, digital circuits, tuned amplifiers. Laboratory introduction to AM and FM modulation, spectrum analysis.

EEET 311 Instrumentation  
W. 4 cr. Lect. 3; Lab. 1.  
PREREQUISITE: Concurrent enrollment in EEET 311.  
Principles of AC and DC meters, bridges, recorders and oscilloscopes. Applications of instruments in lab environment. Introduction to transducers.

EEET 321 Industrial Processes Laboratory I  
A. 1 cr. Lab.  
PREREQUISITES: ME 311 and concurrent enrollment in EEET 301.  
Basic processes involved in manufacturing of electrical and electronic products. Electronic drafting.

EEET 322 Industrial Processes Laboratory II  
W. 1 cr. Lab.  
PREREQUISITE: EEET 321.  
Printed circuit board design and manufacturing.

EEET 323 Industrial Processes Laboratory III  
S. 1 cr. Lab.  
PREREQUISITE: EEET 322.  
Sheet metal design and construction, anodizing and silk screening.

EEET 330 Logic Design  
W. 4 cr. Lect. 2; Lab. 2.  
PREREQUISITES: EEET 226, EEET 301 and 307.  
Combinational and sequential digital logic design techniques. Application of programmable logic devices to logic design, including: PLEs, PALs, FPGA, FPLLs and PLLs.

EEET 341 Electrical Engineering Fundamentals—Circuits  
A. 4 cr. Lect. 3; Lab. 1.  
PREREQUISITE: Math 176 and Phys 207.  
Electrical components, circuits, DC and AC circuit theorems, and applications.

EEET 342 Electrical Engineering Fundamentals—Electronics  
W. 4 cr. Lect. 3; Lab. 1.  
PREREQUISITE: EEET 341.  
Electronic components and their application to electronic circuits.

EEET 343 Electrical Engineering Fundamentals—Machines  
S. 4 cr. Lect. 3; Lab. 1.  
PREREQUISITE: EEET 341.  
Transformers and DC and AC rotating machines.

EEET 400 Seminar  
On demand. 1 cr. Sem. Maximum 6 cr.  
PREREQUISITE: Junior standing.  
Subjects of current interest in electrical engineering and engineering technology.

EEET 401 Machines and Power Systems  
A. 3 cr. Lect.  
PREREQUISITE: EEET 203 and senior standing.  
Power transformer connections and models; DC and AC machine theory including models and characteristics applications.

EEET 402 Normal Electrical Power Systems  
W. 3 cr. Lect.  
PREREQUISITE: EEET 401.  
Transmission and distribution system components and operation. Per unit analysis, models, and computer load flow study.

EEET 403 Faulted Electrical Power Systems  
S. 3 cr. Lect.  
PREREQUISITE: EEET 402.  

EEET 407 Electrical Power Laboratory  
W. 2 cr. Lab.  
PREREQUISITE: EEET 401.  
Characteristics of various machines obtained from physical measurements and results of equivalent circuit analysis are compared to measured characteristics.

EEET 420 Microcomputer Software Techniques  
W. 1 cr. Lect.  
PREREQUISITE: EE 361.  
Examination of an entire microprocessor instruction set and application to software tasks.

EEET 422 Feedback Control Systems  
W. 4 cr. Lect.; Lab. 1.  
PREREQUISITES: EEET 305 and 401.  
Mathematical characterization of physical components and systems; analysis of linear feedback systems using differential equations and Laplace transforms; analog and digital simulation; stability theory.

EEET 424 Digital Systems and Control  
S. 4 cr. Lect.; Lab. 2.  
PREREQUISITES: EEET 420 and 422.  
Analysis and construction of digital control systems, including: sensors, stepping motors and microprocessors.

EEET 431 Advanced Electronics  
A. 3 cr. Lect.; Lab. 1.  
PREREQUISITE: EEET 303.  
Advanced topical coverage of electronic devices and digital and analog integrated circuits. Emphasis on linear IC applications including active filters, A/D, D/A conversion. Use of circuit analysis programs such as SPICE as analysis and design aids.

EEET 435 Electronic Communications  
S. 3 cr. Lect.; Lab. 1.  
PREREQUISITES: EEET 303 and 309.  
An introduction to electronic communications systems; transmission line, antennas, r.f. and microwave components.

EEET 470 Individual Problems  
A.W.S.S. 1-5 cr. Ind. St. Maximum 6 cr.  
PREREQUISITES: Consent of instructor and department head.  
Directed research and study on an individual basis.

EEET 480 Special Topics  
On demand. 1.5 cr. Maximum 15 cr. Maximum of EEET 280 plus 480, 16 cr.  
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Electrical Engineering  
994-2505

Head of Department: Dr. V. Gerez.  
Assistant Professors: M. Kejarivich, S. E. Stanton.  
Lecturer: H. A. Leach.  

EE 101 Introduction to Electrical Fundamentals I  
W. 1 cr. Lab.  
PREREQUISITES: Math 165 or 181.  

EE 102 Introduction to Electrical Fundamentals II  
A.S. 1 cr. Lab.  
PREREQUISITES: EE 101.  
EE 201 Introduction to Logic Circuits  
A. 3 cr. Lect.  
PREREQUISITE: Sophomore standing.  
An introductory course on logic circuits and digital systems. Course covers combinational logic circuits, synchronous sequential circuits and information storage circuits. Binary codes, binary arithmetic, typical computer operations on binary data.

EE 212 Linear System Analysis I  
W. 3 cr. Lect.  
PREREQUISITES: EE 102 or EE 225, concurrent enrollment in Math 224.  
Basic concepts of voltage, current, electric power and energy. Characteristics of circuit elements. Kirchhoff’s laws, nodal and loop analysis, network theorems. Natural and forced response of basic circuits.

EE 232 Introduction to Digital Computers  
W. 3 cr. Lect.  
PREREQUISITE: EE 201.  
Application of digital circuit theory and logic circuit design.

EE 226 Logic Circuits Laboratory  
A. 1 cr. Lab.  
PREREQUISITE: Math 182.  
Basic electrical measurement instruments and techniques for students who have not taken the freshman EE classes.

EE 227 Linear Systems Laboratory  
S. 1 cr. Lab.  
PREREQUISITES: EE 102 or 225, concurrent enrollment in EE 213.  
Electrical measuring instruments and techniques applied to verify basic circuit laws, steady-state and transient response in RLC circuits, and three-phase power measurements.

EE 228 Special Topics  
On demand. 1-5 cr. Maximum 8 cr. Maximum of EE 280 plus EE 480, 16 cr. Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

EE 304 Principles of Electronics  
W. 3 cr. Lect.  
PREREQUISITE: EE 303.  

EE 305 Principles of Electrical Machinery  
S. 3 cr. Lect.  
PREREQUISITE: EE 503.  
A service course for non-EE/EEET majors. Three phase circuits and transformers. DC generators and motors. Applications of electric motors. Induction and synchronous motors.

EE 306 Electrical Circuits Laboratory  
A. 1 cr. Lab.  
COREQUISITE: EE 303.  
For those who desire or are required to have laboratory exposure to topics covered in EE 303.

EE 307 Electronics Laboratory  
W. 1 cr. Lab.  
COREQUISITE: EE 304.  
For those who desire or are required to have laboratory exposure to topics covered in EE 304.

EE 308 Electrical Machinery Laboratory  
S. 1 cr. Lab.  
COREQUISITE: EE 305.  
For those who desire or are required to have laboratory exposure to topics covered in EE 305.

EE 309 Electromagnetic Theory I  
A. 3 cr. Lect.  
PREREQUISITES: EE 213, EM 251, Phys 229 and concurrent enrollment in Math 226.  
Electrostatic and magnetostatic fields with emphasis on physical concepts and analysis techniques. Basic vector concepts, Coulomb’s law, non-time varying Maxwell’s equations.

EE 310 Electromagnetic Theory II  
W. 3 cr. Lect.  
PREREQUISITE: EE 309.  
A continuation of EE 309 with emphasis on time varying electromagnetic fields. Maxwell’s equations are used to introduce and study concepts such as propagation, skin effect, electromagnetic field behavior at metal and dielectric boundaries and the behavior of various transmission systems.

EE 311 Linear System Analysis  
A. 3 cr. Lect.  
PREREQUISITES: EE 213 and concurrent enrollment in Math 226.  
Magnetically coupled circuits. Fourier series and transform. Laplace transform theory and electrical system applications.

EE 313 Materials Science  
W. 3 cr. Lect.  
PREREQUISITES: EE 309 and 337.  
Basic material properties of dielectrics, magnetic materials, conductors, semiconductors. Practical applications of materials to circuit devices.

EE 317 Electrical Machines and Transformers  
S. 4 cr. Lect. 3; Lab. 1.  
PREREQUISITES: EE 311 and 313.  
Energy conversion concepts. Electromagnetic conversion, electrical machinery, including direct current, synchronous, induction and special purpose machines characteristics and applications.

EE 321 Logic Design  
S. 3 cr. Lect.  
PREREQUISITES: EE 201, 226 and 252.  
Number system and combinational logic review; CAD for combinational logic; flip flop and clocked logic circuits; synchronous and asynchronous sequential logic systems; CAD for sequential logic.

EE 325 Electrical Engineering Laboratory I  
A. 2 cr. Lab.  
PREREQUISITES: EE 227, concurrent enrollment in EE 311 and 337.  
Experiments to provide a knowledge of test equipment, measurement techniques and verification of theoretical concepts of circuits and electronic devices.

EE 326 Electrical Engineering Laboratory II  
W. 2 cr. Lab.  
PREREQUISITES: EE 325 and concurrent enrollment in EE 338.  
Experiments to provide a knowledge of test equipment, measurement techniques and verification of theoretical concepts of circuits and electronic devices.

EE 327 Electrical Engineering Laboratory III  
S. 1 cr. Lab.  
PREREQUISITES: EE 326 and concurrent enrollment in EE 339.  
Experiments to provide a knowledge of test equipment, measurement techniques and verification of theoretical concepts of circuits and electronic devices.

EE 337 Electronics I  
A. 3 cr. Lect.  
PREREQUISITE: EE 213.  
Fundamentals of physical electronics as related to solid-state devices. Includes the study of diodes, some transistor types and their circuit models. The concept of gain calculation through the use of small signal equivalent circuits is introduced.

EE 338 Electronics II  
W. 3 cr. Lect.  
PREREQUISITES: EE 311 and 337.  
This is a continuation of EE 337. Additional transistors and their models are presented. Multiple transistor amplifiers are studied. Digital electronic circuits for TTL and CMOS gates studied.

EE 339 Electronics III  
S. 3 cr. Lect.  
PREREQUISITE: EE 338.  
Amplifier frequency response and the concept of feedback are presented. Active filters, oscillators, power amplifiers, modulation and demodulation techniques are studied.

EE 344 Electrical Engineering Devices  
S. 3 cr. Lect.  
PREREQUISITE: Phys 229.  
Theory and application of devices such as LEDs, LCDs, lasers, transport devices, microwave devices, charge coupled devices and magnetic devices.

EE 361 Microcomputer Software Engineering  
S. 4 cr. Lect. 3; Rec-Disc. 1.  
PREREQUISITES: EE 232 and 233.  
Description, operation and use of small digital computer (mini and micro) systems. Hands-on use of typical machines is emphasized. Machine and assembler languages are utilized.

EE 400 Seminar  
A. 1 cr. Sem.  
May be repeated for credit.  
PREREQUISITE: Junior standing.  
Subjects of current interest in electrical engineering.

EE 405 Methods in Continuous and Discrete Systems  
W. 3 cr. Lect.  
PREREQUISITE: EE 311 or Math 548.  
Effects of sampling on continuous dynamic systems. Z-transform and modified z-transform analysis. Applications to switched electronic circuits and to computers used in control. State variable methods and discrete Fourier transform methods.

EE 415 Power Systems I  
A. 4 cr. Lect. 3; Lab. 1.  
PREREQUISITE: EE 317.  
Normal power system: system components, electric energy transport, load flow studies.
EE 416 Power Systems II
W. 4 cr. Lect.; 3 cr. Lab. 1.
PREREQUISITE: EE 415.
System operation and control. Systems transients: surge phenomena, fault analysis, system protection and transient stability analysis.

EE 418 Control Systems I
A. 4 cr. Lect.
PREREQUISITES: EE 311, EM 251 and Math 226.
Analysis and design of continuous-time linear feedback systems; mathematical characterization of physical components and systems; stability theory and signal flow analysis; computer-aided design with root locus and frequency response techniques; compensator and controller types; state variable description of systems.

EE 419 Control Systems II
W. 4 cr. Lect.
PREREQUISITE: EE 418.
Analysis and design of discrete-time and computer-controlled linear feedback systems; z-transforms; sampling analog components; digital control derived from analog design techniques; digital control using z-transforms and state-space methods; mechanization of control algorithms and digital filters on computers; computer simulation of discrete-time systems.

EE 426 Energy Conversion Laboratory
W. 2 cr. Lab.
PREREQUISITE: EE 317.
Experiments to determine steady state and transient requirements and characteristics of electromechanical energy conversion devices.

EE 428 Control Systems Laboratory
S. 2 cr. Lab.
PREREQUISITE: EE 418.
Identification of characteristics and parameters of physical systems; implementation of various aspects of feedback control on physical systems; simulation and control application to large systems; real-time simulation using a high-speed digital dynamic simulator; simulation and control of nonlinear systems.

EE 435 Filter Design
A. 3 cr. Lect.
PREREQUISITES: EE 310 and 311.
Introduction to filter circuit theory and design techniques. Transmission line equations with applications to wave propagation and current distribution, signal propagation, reflection, line impedance and stub matching. Applications cover the power through radiofrequency range.

EE 436 Microwave Principles
S. 4 cr. Lect.; 3 cr. Lab. 1.
PREREQUISITE: EE 310.
Microwave components and systems. Experimental measurements, use of the Smith Chart, single and double stub matching. Considerable emphasis on the use of the scattering matrix as a means of analysis.

EE 440 Electronic Circuits
A. 3 cr. Lect.
PREREQUISITE: EE 339.
Class-B and class-C amplifiers, impedance matching networks, noise and noise figure, power supply filters and regulators, IC applications, wave shaping sweep and timing circuits, logic gates, flip-flop circuits and transducers.

EE 441 Electronic Instrumentation Design
A. 3 cr. Lect.
PREREQUISITE: EE 338.
Electrical transducers, instrumentation and isolation amplifiers, analog and digital signal processing, signal conditioning and filtering operations, A-D and D-A conversion systems, passive elements and groundloop considerations.

EE 444 Applications of Linear ICs
W. 3 cr. Lect.
PREREQUISITE: EE 338.
Properties and applications of integrated voltage regulators, operational amplifiers, instrumentation and isolation amplifiers, comparators, sample and hold devices, analog switches, A-D and D-A converters.

EE 446 MOS Devices
W. 3 cr. Lect.
PREREQUISITE: EE 339.
Theory and models of metal-oxide-semiconductor devices, applications to both linear and digital circuits.

EE 447 Junction Devices
S. 3 cr. Lect.
PREREQUISITE: EE 338.
Junction devices and their relationship to the basic properties of semiconductors. Device models and their relation to materials and operating conditions.

EE 466 Communication Systems
W. 3 cr. Lect.
PREREQUISITE: EE 311.
Digital and analog modulation techniques, sampling, quantization, waveshaping and bandwidth considerations, time and frequency division multiplexing, system design, power budgets, and system comparisons.

EE 467 Statistical Communications
S. 3 cr. Lect.
PREREQUISITE: EE 466.
Basic probability theory, statistical representation of noise, analog and digital communication system performance in noise environment, signal-to-noise ratios, matched filter detection, Shannon's capacity theorem, error-correcting codes.

EE 470 Individual Problems
A,W,Su. 1-5 cr. Ind. St. Maximum 6 cr.
PREREQUISITES: Consent of instructor and department head.
Directed research and study on an individual basis.

EE 480 Special Topics
On demand. 1-5 cr. Lect. Maximum 15 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

EE 486 Computer Systems
A. 4 cr. Lect.; 2, Lab. 2.
PREREQUISITES: EE 321 and 361.
Lecture laboratory exposure to computer hardware and software in control applications; serial and parallel I/O; timing generation; interrupts; in-circuit emulation; logic analyzers; project realizing a real time control problem.

EE 488 Computer Architecture and System Organization
W. 3 cr. Lect.
PREREQUISITES: EE 361 and senior standing.
Computers as interconnected systems of data transferral, conversion, storage and modification subunits; and relevant programming. Relations and tradeoffs between hardware and software at various levels of machine description. Control and the instruction sets of computers, including microprogramming and conventional instruction interpretation.

Graduate Courses in Electrical Engineering
There are certain implicit prerequisites for 500- and 600-level courses: see Graduate Course Prerequisites, page 120, for details.

EE 500 Seminar
A,W,S. 1 cr. Sem. May be repeated for credit. Maximum 4 cr.
Subjects of current interest in electrical engineering.

EE 501 VLSI Theory and Logic Design I
A alternate years, will be offered A 1987. 3 cr. Lect.
PREREQUISITES: EE 321 and 337.
Integrated logic system fabrication using VLSI techniques; component implementation, cost analysis, logic and mask designs for bipolar and MOS logic families; CAD circuit simulation, analysis and layout.

EE 502 VLSI Theory and Logic Design II
W alternate years, will be offered W 1988. 3 cr. Lect.
PREREQUISITE: EE 501.
A continuation of EE 501; design of controllers; highly concurrent systems; constraints of computational systems; algorithms for automated logic design, partitioning, and routing; full and semi-custom design approaches; CAD circuit simulation, analysis and layout.

EE 504 Parallel and Associative Processors
S alternate years, will be offered S 1988. 3 cr. Lect.
PREREQUISITE: EE 361 or CS 305.
Architecture and applications of parallel processors, major design issues, fault tolerant computing, associative processors, performance measures of parallel and associative processors.

EE 507 Passive Filters
A alternate years, will be offered A 1986. 3 cr. Lect.
PREREQUISITE: EE 311.
Modern passive network synthesis and realization, approximation of magnitude and phase requirements.

EE 508 Active Filters
W alternate years, will be offered W 1987. 3 cr. Lect.
PREREQUISITE: EE 507.
Networks and filters involving amplifiers and other nonreciprocal devices. Design procedures and sensitivity analysis.

EE 509 Digital Filters
S alternate years, will be offered S 1987. 3 cr. Lect.
PREREQUISITE: EE 507.

EE 514 Remote Sensing and Image Processing
W alternate years, will be offered W 1988. 3 cr. Lect.
PREREQUISITE: EE 311 or Math 348.
Remote sensing and image processing from the physical optics point of view. An introduction to various types of image processing, including optical and digital processing.

EE 516 Introduction to Statistical Communication Theory
A alternate years, will be offered A 1986. 3 cr. Lect.
PREREQUISITE: EE 466.
Signal analysis and transmission, spectra analysis and the representation of random processes, correlation functions, the Gaussian random process, functional transformations of random variables, probability of error.

EE 517 Detection and Estimation Theory
W alternate years, will be offered W 1987. 3 cr. Lect.
PREREQUISITE: EE 516.
Optimal linear filtering and estimation, statistical analysis of analog modulation systems; optimal receiver design, orthogonal and related signals; time, bandwidth, and dimensionality; channel description; optical communication systems, satellite communication systems.

EE 518 Information Theory and Coding
S alternate years, will be offered S 1987. 3 cr. Lect.
PREREQUISITE: EE 516.
Information, entropy, mutual information, source encoding, channel capacity and the coding theorem, bounds on system performance, error-control using codes, linear block codes, cyclic codes.
EE 519 High Voltage Energy Transmission
S alternate years, will be offered S 1988. 3 cr. Lect.
PREREQUISITE: EE 415.
Characteristics of electric EHV-UHV AC and DC transmission lines, corona, radio and audible line noise, overvoltage effects, lightning surges, switching surges, insulator properties and performance characteristics.

EE 521 Power System Operation and Control I
A alternate years, will be offered A 1987. 3 cr. Lect.
PREREQUISITE: EE 416.
Characteristics of power generating plants, methods of economic dispatch, transmission losses, unit commitment, generation with limited supply, and hydro-thermal coordination.

EE 522 Power System Operation and Control II
W alternate years, will be offered W 1988. 3 cr. Lect.
PREREQUISITE: EE 521.
Energy production cost models, control of generation, interchange evaluation and power pools, power system security, state estimation in power systems, and operation of energy dispatch centers.

EE 523 Advanced Power Systems Analysis
A alternate years, will be offered A 1986. 3 cr. Lect.
PREREQUISITE: EE 415 or concurrent enrollment in EE 416.
Symmetrical faults, symmetrical components and unsymmetrical faults, active and reactive power flow, loadflow study, grounding, designing power distribution systems.

EE 527 Power System Protection
S alternate years, will be offered S 1987. 3 cr. Lect.
PREREQUISITE: EE 529.
Protection of electrical equipment, design philosophy, design criteria. Protection of transformers, generators, motors, transmission lines, feeders, and distributors.

EE 529 Transient Power Systems Analysis
W alternate years, will be offered W 1987. 3 cr. Lect.
PREREQUISITE: EE 527.
The course provides the needed background to handle power system stability problems. Typical models and problems will be covered.

EE 533 Advanced Electromagnetic Theory I
A alternate years, will be offered A 1986. 3 cr. Lect.
PREREQUISITE: EE 410.
Mathematical and computational treatment of electromagnetic theory including methods of solution for Laplace, Poisson and general boundary value problems. Emphasis is on static domain solutions.

EE 534 Advanced Electromagnetic Theory II
W alternate years, will be offered W 1987. 3 cr. Lect.
PREREQUISITE: EE 533.
Dynamic solution to the Maxwell field equations by classical and numerical methods. General wave solutions for isotropic and anisotropic media, including rectangular, cylindrical, spherical, and helical systems.

EE 535 Applied Electromagnetic Theory
S alternate years, will be offered S 1987. 3 cr. Lect.
PREREQUISITE: EE 534.
Applications to Maxwell’s equations for propagating or radiation regions. Topics include: mode theory of LF propagation, dielectric antennas, ferrite antennas, magneto-hydrodynamic plasma waves, the Dirichlet problem, diffraction theory.

EE 536 Advanced Electronics I
A alternate years, will be offered A 1987. 3 cr. Lect.
PREREQUISITE: EE 535.
Solid state device models, computer simulations, circuit applications and electrical noise.

EE 537 Advanced Electronics II
W alternate years, will be offered W 1988. 3 cr. Lect.
PREREQUISITE: EE 536.
RF circuits, s parameters, operational and feedback amplifiers and circuit applications.

EE 538 Advanced Electronics III
S alternate years, will be offered S 1988. 3 cr. Lect.
PREREQUISITE: EE 537.
Filters, oscillators, new solid state devices, and circuit applications.

EE 542 Solid State Device Principles
A alternate years, will be offered A 1987. 3 cr. Lect.
PREREQUISITE: EE 447.
Introduction to physical principles and operational characteristics of semiconductor devices including junction, MOS, optoelectric and bulk devices.

EE 549 Advanced Computer Architecture System Design
S alternate years, will be offered S 1988. 3 cr. Lect.
PREREQUISITE: EE 488.
Advanced design considerations in modern computers including: IO processors, floating point and array processing units, queing theory, control section design and tradeoffs, network architecture and memory organization.

EE 556 Optimal Design of Systems
A alternate years, will be offered A 1986. 3 cr. Lect.
PREREQUISITE: EE 331 or Math 348.
Principles of optimization as applied to system design and operation. Nonlinear programming and Lagrangian methods of constrained optimization. Calculus of variations and Pontryagin’s maximum principle Dynamic programming.

EE 561 Advanced Control Systems I
A alternate years, will be offered A 1987. 3 cr. Lect.
PREREQUISITE: EE 560.
Nonlinear feedback systems, linearization techniques; harmonic balance and describing functions; state-space methods, Lyapunov and Popov stability methods.

EE 562 Advanced Control Systems II
W alternate years, will be offered W 1988. 3 cr. Lect.
PREREQUISITE: EE 561.
Corequisite: EE 419 or 405.
Analysis and design of digital control systems; z-transform and time-domain methods; advanced z-transform method; finite settling time control; optimal linear-quadratic controllers; state observer design.

EE 563 Advanced Control Systems III
S alternate years, will be offered S 1988. 3 cr. Lect.
PREREQUISITE: EE 562.
Optimal control, model reference adaptive control; self-tuning adaptive control, advanced topics in control.

EE 568 Stochastic Processes in Automatic Control
W alternate years, will be offered W 1987. 3 cr. Lect.
PREREQUISITE: EE 418.
Linear dynamic processes and sequences, basic probability theory; optimal prediction, filtering and smoothing for discrete and continuous linear systems. Selected optimal control and identification problems in stochastic systems.

EE 570 Individual Problems
A,W,Su. 1-5 cr. Ind. St. Maximum 9 cr.
PREREQUISITES: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies.
Directed research and study on an individual basis.

EE 571 Research Experience
A,W,S,Su. 1 cr. Ind. St. Maximum 6 cr.
PREREQUISITE: Graduate standing.
Research experience, required of all M.S.E.E. students in option B program, is normally obtained through participation in a supervised research project acceptable to the department graduate committee.

EE 580 Special Topics
On demand. 1-8 cr. Maximum 15 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

EE 589 Graduate Consultation
A,W,S,Su. 3 cr. Tut.
PREREQUISITES: Master’s standing and approval of the Dean of Graduate Studies.
This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) for a master’s degree but who need additional faculty help or time.

EE 590 Master’s Thesis
A,W,S. 3-12 cr. Ind. St. May be repeated.
PREREQUISITE: Master’s standing.
Research for graduate students pursuing the Master of Science degree, option A, in electrical engineering.

EE 690 Doctoral Thesis
A,W,S,Su. 3-12 cr. Ind. St. May be repeated.
PREREQUISITE: Doctoral standing.

Engineering
994-2272
Engr 101 Freshman Engineering Lectures I
A. 1 cr. Lect.
Introduction to career opportunities in engineering, guidance in meeting academic requirements, setting personal and professional goals, improving study skills and an introduction to professionalism and ethics.

Engr 102 Freshman Engineering Lectures II
W. 1 cr. Lect.
Introduction to current engineering research, industry and emerging technologies; improvement of study skills and scholastic behavior; identification of career interests and abilities; exploration of opportunities for financial assistance through various employment programs, scholarships and financial aid; guidance in meeting academic requirements.

Engr 236T Energy Conservation for the Individual
S. 4 cr. Lect.
Personal energy consumption and conservation are analyzed from an engineering point of view. Decision making processes in engineering and their effects on society.

Engr 308T Technological Decision Making
S. 4 cr. Lect. 2; Rec-Dis. 2.
A study of how economic, technical, political and social factors affect the selection of a particular technology to perform a social function. The impacts of different potential technologies are assessed. Topics vary each year: 1987—Energy Production.

Engr 328T The Technology of Energy Conversion
W. 4 cr. Lect.
PREREQUISITE: Phbs 207 or 229.
Energy conversion, stressing the new technology including thermal, solar and chemical that are being developed to generate electrical energy. Comparisons of traditional and non-traditional generation methods and their impacts on power systems, society and the environment.
EM 406 Advanced Dynamics
W. 4 cr. Lect.
PREREQUISITES: EM 252 and Math 226.
Advanced topics in dynamics of particles, systems of particles and systems with constraints, central force motion, generalized coordinates, Lagrange's and Hamilton's equations.

EM 415 Advanced Mechanics of Solids
A. 4 cr. Lect.
PREREQUISITES: EM 253 and Math 226.
Field equations of elasticity, yield and failure theories, plastic deformation, ultimate load analysis, stress and deformation analysis of straight and curved beams, beams on elastic foundation, thick-walled cylinders, thermal stresses and torsion theory.

EM 420 Experimental Mechanics
S. 4 cr. Lect. 2; Lab. 2.
PREREQUISITES: EM 253 and EE 303.
Principles of experimental measurement; experimental apparatus and techniques; applications in solid mechanics.

EM 435 Fluid Dynamics
W alternate years with ME 442, will be offered W 1987. 4 cr. Lect.
PREREQUISITES: EM 253 and Math 226.
Equations governing steady and unsteady fluid flow; applications to contemporary engineering problems.

EM 470 Individual Problems
A,W,Su. 1-5 cr. Ind. St. Maximum 6 cr.
PREREQUISITES: Consent of instructor and department head.
Directed research and study on an individual basis.

EM 480 Special Topics
On demand. 1-5 cr. Maximum 16 cr. Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

EM 500 Seminar
A,S. 1 cr. Sem. May be repeated. Maximum 4 cr.
PREREQUISITE: Graduate standing.
Presentation and discussion of items of technical interest.

EM 510 Theory of Elasticity I
A alternate years, will be offered A 1987. 3 cr. Lect.
PREREQUISITE: EM 415.
Fundamentals of elasticity; general principles of stress, strain, energy and stress-strain relationships for elastic materials and plane elasticity with applications.

EM 511 Theory of Elasticity II
W alternate years, will be offered W 1988. 5 cr. Lect.
PREREQUISITE: EM 510.
Tensorial development of three-dimensional elasticity and non-linear elasticity, large elastic deformations.

EM 518 Theory of Plates
W. 3 cr. Lect.
PREREQUISITE: EM 415.
Theory of small and large plate deformations, coverage of analytical and numerical solution techniques.

EM 519 Theory of Shells
S. 3 cr. Lect.
PREREQUISITE: EM 518.
General thin-shell equations in curvilinear coordinates. Specialization to membrane, shallow shell and nonshallow shell geometries with applications.

EM 525 Continuum Mechanics
W. 3 cr. Lect.
PREREQUISITE: EM 415.
Solid and fluid mechanics, laws of vector and tensor transformations, vector and tensor calculus; theory of deformation, principles of thermodynamics, fluid mechanics and viscoelasticity.

EM 526 Variational Principles of Mechanics
S. 3 cr. Lect.
PREREQUISITE: EM 415.
Calculus of variations; energy principles; applications to static, dynamic and stability analysis of beam-columns, plates, torsion.

EM 527 Viscoelasticity and Plasticity
W alternate years, will be offered W 1987. 3 cr. Lect.
PREREQUISITE: EM 525.
Plastic stress-strain laws and their relationship to yield conditions and load functions, linear and nonlinear viscoelasticity; Application to bending, torsion and thick-walled cylinders. Introduction to variational plasticity.

EM 535 Fluid Flow Analysis
W alternate years, will be offered W 1987. 4 cr.
PREREQUISITE: EM 415.
Analysis of selected flow topics; fluid transients, cavitation, hydraulic machinery, transport of solids, energy dissipation, diffusion.

EM 560 Finite Element Mechanics
A. 3 cr. Lect.
PREREQUISITES: EM 253 and graduate standing or EM 415.
Basic concepts of finite element analysis; derivation of elements in solid, fluid and thermal mechanics; linear and nonlinear applications.

EM 570 Individual Problems
A,W,Su. 1-5 cr. Ind. St. Maximum 9 cr.
PREREQUISITES: Graduate standing, consent of instructor, approval of department head and Graduate Dean.
Directed research and study on an individual basis.

EM 580 Special Topics
On demand. 1-5 cr. Maximum 12 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

English

Head of Department: Dr. R.H. Figgins


Engl 001 Basic Writing
A,W,S. 4 cr. Rec-Drs. No university credit.

Instruction and practice in basic writing skills, with emphasis upon gaining confidence and fluency with sentence structure and sequence of ideas. All basic writing students enroll initially in Engl 001; Engl 002 and 003 are for second and third quarters of registration, if needed, before Engl 121. Engl 001 is available only to students who qualify for the Advance By Choice program, although the course might also be offered under Continuing Education, if there is sufficient demand.
Engl 002 Basic Writing
A.W.S. 1-4 cr. Rec.-Dis. No university credit.
Instruction and practice in basic writing skills for students who need a second quarter of basic writing before enrolling in Engl 121, or for students who need supporting instruction while taking Engl 121. Engl 002 is available only to students in the Advance By Choice program.

Engl 003 Basic Writing
A.W.S. 1-4 cr. Rec.-Dis. No university credit.
Instruction and practice in basic writing skills for students who need a third quarter of basic writing before enrolling in Engl 121, or for students who need supporting instruction while taking Engl 121. Engl 003 is available only to students in the Advance By Choice program.

Engl 121C College Writing I
A.W.S. 4 cr. Rec.-Dis. Maximum 8 cr.
Experience in the discovery of ideas and their effective expression in writing, with attention to awareness of audience, organization, development and clarity. The course is taught on a collaborative learning model. Instruction in punctuation, grammar and usage conducted on a referral basis through the Writing Center. Note that there is a CLEP exam, which, if passed, will yield four credits of Engl 121 in lieu of taking this course.

Engl 123F Critical Approaches to Literature
A.W.S. 4 cr. Rec.-Dis.
Reading and understanding of imaginative literature. Critical analysis and interpretation of selected literary works. Includes composition practice. Special sections for English majors will be indicated in time schedules.

Engl 209F Mythological Backgrounds
A.W.S. 4 cr. Lect.
Selected readings in mythology which have significant value and interest for the modern world.

Engl 211F World Literature
W. 4 cr. Lect. Maximum 12 cr.
PREREQUISITE: Engl 123.
Selected major works from non-English cultures, e.g. French, German, Russian, Asian, Latin American, and Native American.

Engl 214 Literature of the American West
On demand. 4 cr. Lect.
A study of writing about the frontier with emphasis on its sources, problems and significance.

Engl 215 Studies in Popular Literature
On demand. 4 cr. Rec.-Dis. Maximum 12 cr.
Theory and practical literary criticism to study the literature of popular forms of writing. Students will develop a general theory about a specific literary formula.

Engl 221 College Writing II
A.W.S. 4 cr. Rec.-Dis.
PREREQUISITE: Engl 121.
Study and practice of strategies and devices of expository prose, both academic and general. Emphasis upon mastery of basic skills practiced in Engl 121, related thinking and composing processes, and effective work with source materials and other evidence.

Engl 236 Introduction to Language
A.W.S. 4 cr. Lect.
The nature and function of language systems, the psychology of language, the relationship between language and culture, language variety, language change, the languages of the world, the levels of linguistic analysis-phonology, morphology, syntax.

Engl 238 Traditional English Grammar
On demand. 4 cr. Rec.-Dis.
Study of the traditional approach to English grammar: exploration of the rationales for prescriptive grammar, including the history of the doctrine of correctness. This course does not include treatment of modern grammars; no composition beyond sentence length is required.

Engl 240F Classicism: The Desire for Harmony
A. 4 cr. Rec.-Dis.
PREREQUISITE: Engl 123.
The concept of "classicism" as both a literary term and an enduring perspective on human experience. Classicism will be viewed as an expression of humanity's need for "harmony"—order within diversity. The course will identify the essential components of the classical perspective through secondary works and through texts from many ages and different countries.

Engl 241 Romanticism: Imagination and Impulse
W. 4 cr. Rec.-Dis.
PREREQUISITE: Engl 123.
The concept of "romanticism" as both a literary term and an enduring perspective on human experience. Romanticism will be viewed as a tendency to place the individual at the center of art, making literature an expression of an individual's unique feelings and impulses, and placing a high premium upon the creative function of the imagination.

Engl 242F Modernism: The Adversarial Stance
S. 4 cr. Rec.-Dis.
PREREQUISITE: Engl 123.
The modernist perspective as expressed in literature and other forms of culture, such as music and the visual arts. The course will explore the nature of modernism and the formation of defining characteristics of modern consciousness within cultural and intellectual contexts.

Engl 280 Special Topics
On demand. 2-4 cr. Lect. Maximum of Engl 280 plus Engl 480, 16 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Engl 302 Composition and the Teaching of English
On demand. 4 cr. Rec.-Dis.
PREREQUISITES: 4 cr. of composition. Normally limited to juniors and seniors. EdED 357 recommended.
Study of the composing process of student writers, with emphasis on alternative choices of words and structures, strategies of purposeful development of ideas and specifics, techniques of revision, and such variables as motivation and choice of role. The course integrates these concerns with approaches and materials for instruction and evaluation of composition.

Engl 303 Children's Literature
On demand. 3 cr. Lect.
Development of criteria for evaluating literature for grades K-9 through reading and discussion of children's books and of appreciation of the unique contributions of writers and artists in this field.

Engl 316 Tragedy
A. 4 cr. Rec.-Dis.
PREREQUISITE: Engl 123.
This course is meant to cut across traditional academic compartments, such as Greek drama, nineteenth century British novel, or contemporary American drama. Students should understand "tragedy" in more dimensions than just the Greek or just the Renaissance British tragedy.

Engl 317 Comedy and the Comic Spirit
W. 4 cr. Rec.-Dis.
PREREQUISITE: Engl 123.
An exploration in comic theory and practice. Through primary and secondary texts, the conventions of comedy in different historical periods and countries will be identified.

Engl 319F Shakespeare: The Tragic Vision
A.S alternate years, will be offered S 1988. 4 cr. Lect.
PREREQUISITE: Engl 123.
Selected major tragedies plus other related plays. Development of Shakespeare's philosophy, poetry and dramaturgy. Includes history plays with a tragic focus.

Engl 320F Shakespeare: The Comic Vision
W.S alternate years, will be offered S 1988. 4 cr. Lect.
PREREQUISITE: Engl 123.
Selected major comedies, a late romance and other related plays. Development of Shakespeare's philosophy, poetry and dramaturgy. Includes history plays with a comic focus.

Engl 326 Research Writing
A.W.S. 4 cr. Rec.-Dis.
PREREQUISITE: Engl 221.
Refinement of skills and strategies practiced in Engl 221. Emphasis upon development of individual style, more advanced thinking and composing techniques, and more complex work with source materials and other evidence. Normally limited to juniors and seniors.

Engl 327 Self-Expressive Writing
On demand. 4 cr. Rec.-Dis.
PREREQUISITE: Engl 221.
"Self-expressive writing" means writing that is close to the writer's personal life—either writing that is based on personal experience or writing that reflects personal feelings and points of view. There are generally three kinds: 1) rapid exploratory writing, often used by professional writers at the early thinking stages of rough drafts; 2) personal experience writing, often shaped artistically; 3) reflective, often philosophical writing thatrecords the process of the mind ruminating over complex ideas.

Engl 328 Creative Writing
A.W.S. 4 cr. Rec.-Dis. Maximum 8 cr.
PREREQUISITE: Consent of instructor based upon consideration of samples of writing submitted by the student.
Current techniques and practice in creative writing.

Engl 330F Women in Literature
On demand. 4 cr. Rec.-Dis. Maximum 8 cr.
Study of women in literature and women writers. Course content will vary.

Engl 336 Survey of English Grammars
On demand. 4 cr. Rec.-Dis.
PREREQUISITE: Engl 236.
Structure and grammar of modern English, traditional, structural, and transformational models, with implications for teaching.

Engl 348 Studies in the Middle Ages
A. 4 cr. Rec.-Dis.
PREREQUISITE: Engl 123.
Significant medieval works relating to an announced literary topic. The course will emphasize the works and their backgrounds and may include continental works that bear on the issue being addressed.

Engl 349 Studies in the Renaissance
W. 4 cr. Rec.-Dis.
PREREQUISITE: Engl 123.
Significant Renaissance works relating to an announced literary topic. The course will emphasize the works and their backgrounds and may include some continental works that bear on the issue being addressed.
Engl 351 Studies in the 18th Century in England and America
A, 4 cr. Rec-Dis. Maximum 8 cr.
PREREQUISITE: Engl 123.
Significant eighteenth-century works relating to an announced literary topic. The course will emphasize the works and their backgrounds and may include some continental works that bear on the issue being addressed.

Engl 352 Studies in the Earlier 19th Century in England and America
W, 4 cr. Rec-Dis. Maximum 8 cr.
PREREQUISITE: Engl 123.
Significant early nineteenth-century works relating to an announced literary topic. The course will emphasize the works and their backgrounds and may include some continental works that bear on the issue being addressed.

Engl 353 Studies in the Later 19th Century in England and America
S, 4 cr. Rec-Dis. Maximum 8 cr.
PREREQUISITE: Engl 123.
Significant later nineteenth-century works relating to an announced literary topic. The course will emphasize the works and their backgrounds and may include some continental works that bear on the issue being addressed.

Engl 354 Studies in Modern Literature
On demand. 4 cr. Rec-Dis. Maximum 8 cr.
An intensive experience with selected modern literary works of various genres and nations written in this century before World War II.

Engl 355 Studies in Contemporary Literature
On demand. 4 cr. Rec-Dis. Maximum 8 cr.
PREREQUISITE: Engl 123.
Works of fiction, poetry and drama from British, American, Continental and South American writers. Works will be related to historical events and cultural contexts in order to demonstrate how literature reflects and contributes to cultural change.

Engl 366 History of English Language
W, 4 cr. Rec-Dis.
PREREQUISITE: Engl 236.
Development from Old English to Modern, external influences, structure, phonology, dialects, readings in Old and Middle English.

Engl 368 Language and the Teaching of English
On demand. 3 cr. Rec-Dis.
PREREQUISITE: Engl 336; EdSt 357 recommended.
Approaches to grammar and usage, as constrained by secondary school texts and materials which present confusing or inaccurate views to the secondary student; integration of secondary school language study with composition and other activities to develop linguistic awareness and competence; related study of language contexts, including applied linguistic approaches to spoken and written communication.

Engl 400 Seminar
On demand. 2-4 cr. Sem. Maximum 12 cr.
PREREQUISITE: Normally limited to junior and seniors.
Studies in depth in such areas as language, criticism, and literature. A different general area each quarter, with students working individually on related problems within the area.

Engl 401 Seminar: Literature and the Teaching of English
On demand. 4 cr. Sem.
PREREQUISITE: Normally limited to junior and seniors; EdSt 357 recommended.
Designed for prospective teachers who will share in the responsibility for class preparation, presentation, and discussion of various critical approaches to literature and the ways in which these approaches can be taught to others. The seminar will emphasize one or more genres and themes associated with the authors and works under study.

Engl 405 The British Literary Experience
On demand. 4 cr. Rec-Dis.
PREREQUISITE: Senior standing.
Selected major works which are representative of significant literary movements in England, from the early period to the present. For students who have had considerable course experience with British literature to make their own syntheses of what they have read and discussed, as a climax to their program of study.

Engl 406 The American Literary Experience
On demand. 4 cr. Rec-Dis.
PREREQUISITE: Senior standing.
American literary heritage in relation to cultural, social and political history, with emphasis upon the emergence of a distinctly American character and tradition from British antecedents. Emphasis upon students making their own syntheses of what they have read, as a climax to their program of study.

Engl 420 Principles of Literary Criticism
On demand. 4 cr. Rec-Dis.
PREREQUISITE: Normally limited to junior and seniors.
Principles, problems, and methods of literary criticism and of significant works in classical and contemporary criticism. Main theories of nature and function of literature; historical development of some major critical positions.

Engl 430 How to Write for the General Public
On demand. 4 cr. Rec-Dis.
PREREQUISITE: Engl 326.
Intended for students who already have considerable skill and experience in expository writing and who are presumably ready to adjust their styles and strategies for different purposes and audiences.

Engl 450 Tutoring Student Writers
On demand. 4 cr. Rec-Dis.
PREREQUISITE: Consent of instructor.
Combines experiential and classroom learning in writing instruction to train tutors who work with students on their writing in all disciplines across the campus.

Engl 451 Major Literary Figures
On demand. 2-4 cr. Rec-Dis. Maximum 12 cr.
PREREQUISITE: Normally limited to juniors and seniors.
In-depth analysis of one or two significant literary figures.

Engl 465 Studies in Linguistics
On demand. 4 cr. Sem.
PREREQUISITE: Engl 236 and senior standing.
Varied content, reflecting both the faculty research interests and student needs and interests.

Engl 470 Individual Problems
A,W,S,Su.
PREREQUISITES: Consent of instructor and department head.
Directed research and study on an individual basis. Student must obtain consent of instructor prior to registering and subsequently file program of study with the department.

Engl 476 Career Internship
A,W,S
PREREQUISITE: Restricted to internship recipients.
The Liberal Arts Internship Program is designed to place selected students in a professional work environment for ten weeks during their junior or senior year. The purpose of the off-campus internship is to initiate a formal career development process which will lead the student to a job and/or graduate school.

Engl 480 Special Topics
PREREQUISITE: Normally limited to juniors and seniors.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Graduate Courses in English
There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

Engl 500 Seminar
On demand. 1 cr. Sem. Maximum 6 cr.
PREREQUISITE: Graduate standing.
Intensive study of topics of interest to graduate students and staff.

Engl 570 Individual Problems
A,W,S,Su.
PREREQUISITES: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies.
Directed research and study on an individual basis. Student must obtain consent of instructor prior to registering and subsequently file a program of study with the department.

Engl 580 Special Topics
On demand. 1.5 cr. Maximum 15 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Entomology
Department of Entomology
994-3860
Head of Department: Dr. J.W. Brewer
Professors: J.W. Brewer, S.E. Knapp (Acad. V.P.), S.N. Warchner
Associate Professors: D.P. Bartell (Assoc. Dean), W.L. Morrill, G.L. Jensen (Ext.), D.P. Scholl (USDA), J.B. Henry (USDA), J.A. Omsager (USDA), M.H. Wessel (General Studies)
Assistant Professors: R.M. Nowershii, J.W. Brewer, S.E. Knapp (Acad. VP), M.H. Wessel (General Studies)
Associate Professors: P.J. Scholl (USDA), W.F. Kemp (USDA), R.H. Miller (USDA), D.S. Street (USDA)
Associate Instructors: Elaine Oma (USDA), N. Rees (USDA)

Ento 204 General Entomology
A, 4 cr. Lect. 3; Lab. 1.
General biology of insects including: principles of morphology, physiology, behavior, ecology and control. Includes identification of major orders and common families.

Ento 280 Special Topics
On demand. 1.5 cr. Maximum 8 cr. Maximum of Ento 280 plus Ento 480, 16 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Ento 301 Concepts of Pest Management
S, 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: Ento 204.
Ecological basis for the management of pest populations including: economic implications, sampling, and utilization of advanced technology in the development of an integrated pest management program.
Ento 302 Medical and Veterinary Entomology
3 on demand. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: Ento 204.
Ecology and epidemiology of major insect and arthropod vectors of disease causing organisms for livestock, big game and man.

Ento 310 Economic Entomology
W. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: Ento 204.
Identification, biology, and control of important agricultural insect pests.

Ento 400 Seminar
A,W,S. 1 cr. Max. 3 cr.
Student presentation, discussion and literature review of entomological topics.

Ento 424 Biological Control of Insects and Weeds
A alternate years, offered A 1986. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: Ento 204. Principles and application of biological control of insects and weeds.

Ento 430 Insect Anatomy
W on demand. 4 cr. Lect. 3; Lab. 1.

Ento 431 Insect Physiology
W alternate years, offered W 1987. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: Ento 204. Internal physiological components and mechanisms for insect growth, reproduction and survival.

Ento 432 Insect Identification
A alternate years, offered A 1986. 4 cr. Lect. 2; Lab. 2.
PREREQUISITE: Ento 204. The identification of adult and larval stages of major insect orders and families.

Ento 470 Individual Problems
PREREQUISITE: Consent of instructor and department head. Directed research and study on an individual basis.

Ento 480 Special Topics
On demand. 1-5 cr. Maximum 8 cr. of Ento 280 plus Ento 480, 16 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Film and Television Production
994-2484
Head of Department: Dr. P. Monaco.
Associate Professors: J.A. Hyppa, W.A. Neff, R.J. Politza (Adjunct), S. Sayed-Ahmed.
Instructors: W.R. Lewis (Adjunct), D.A. Pilote (Adjunct).

F&TV 101 Introduction to Communication
Course designed to investigate the principles, processes, techniques and variables found in interpersonal communication, mass communication and cultural communication.

F&TV 105 Fundamentals of Photography
A,W,S,Su on demand. 3 cr. Lect. 2; Lab. 1.
Practice and experience in technical and creative functions of still photography. Does not count for photography option major.

F&TV 106 Introductory Photography
A,W. 4 cr. Lect. 2; Lab. 2.
PREREQUISITE: F&TV and professional design student only.
Attention is directed toward mastering of fundamental skills of composition, exposure, processing, enlargement printing and critical evaluation of black & white film and prints with 35mm format size cameras. Seventy-five percent of openings are reserved for F&TV majors.

F&TV 107 Fundamental Cinematography
W,S. 3 cr. Lect. 2; Lab. 1.
PREREQUISITE: F&TV 101.
Technical and creative concepts in basic motion picture photography with emphasis on exterior filming.

F&TV 201 Fundamental Film Editing
W,S. 3 cr. Lect.
PREREQUISITE: F&TV 101.
Basic techniques and creative concepts of motion picture and video editing with emphasis on visual continuity and narrative structure.

F&TV 205 Intermediate Photography
A,W,Su on demand. 4 cr. Lect. 2; Lab. 2.
PREREQUISITE: F&TV 106.
Introduction to advanced B&W photography with emphasis on large-format technique. Theory combined with extensive studio and darkroom work. Problems of photographic creativity and communication are explored and discussed. Seventy-five percent of openings are reserved for F&TV majors.

F&TV 206 Fundamental Television Production
A,W. 4 cr. Lect. 2; Lab. 2.
PREREQUISITE: F&TV 101 and 201. Sophomore standing.
Operations of basic television equipment, and an examination and practice of fundamental production procedures in television, with emphasis on organized group participation.

F&TV 210 Zone System Photography
S. 4 cr. Lect. 1; Lab. 2; Rec.-Dis. 1.
PREREQUISITE: F&TV 205.
Relationship of technical and creative aspects of photography as a means of personalized expression. Practice of pre-visualization and control by exposure and processing techniques.

F&TV 212T Mass Media and the Public Interest
W. 4 cr. Lect.
An introduction to new communications technology, which investigates policy implications and explains how technologies work.

F&TV 216 History of the Silent Motion Picture
A. 3 cr. Lect. 2; Rec.-Dis. 1.
Early technical development of the motion picture and the growth of the theatrical motion picture, both American and foreign, through the 1920s up to the introduction of sound film.

F&TV 217 History of the Sound Motion Picture
W. 3 cr. Lect. 2; Rec.-Dis. 1.
The growth and development of the theatrical film, both American and foreign, from the introduction of the sound film up to contemporary trends.

F&TV 220 History of Broadcasting
W. 3 cr. Lect.
The historical development of American radio and television within the broadcasting industry, including programming and production trends up to the present time.

F&TV 221 Fundamental Script Writing
A. 3 cr. Lect.
PREREQUISITE: Sophomore standing.
Preparation of scripts and other written material for motion picture and television production.

F&TV 223 Reversal Color Photography
A. 3 cr. Lect. 2; Rec.-Dis. 1.
PREREQUISITE: F&TV 106.
Use of color reversal materials. Investigation of color design and aesthetics.

F&TV 225 Studio Lighting and Product Photography
S. 4 cr. Lect. 2; Lab. 2.
PREREQUISITES: F&TV 205, 223.
Large format, view camera technique, B&W and color in commercial and product photography. Introduction to advertising photography. Emphasis on lighting procedures. Seventy-five percent of openings are reserved for F&TV majors.

F&TV 230 History of Photography I
A. 4 cr. Lect.
A foundation in prehistory and history of photography up to the Photo Secession. The aesthetic and technological evolution of photography is explored in its relationship to culture and art.

F&TV 246 Intermediate Television Production
W,S. 4 cr. Lect. 2; Lab. 2.
PREREQUISITE: F&TV 206.
Instruction and practical experience in more complex television production situations, with emphasis on studio techniques.

F&TV 258 Fundamental Sound for Film and Television
A. 3 cr. Lect. 2; Lab. 1.
PREREQUISITE: F&TV 101.
Theory and practice in sound recording and reproduction; procedures for operating basic equipment.

F&TV 279 Cinema Production
A.S. 4 cr. Lect. 2; Lab. 2.
PREREQUISITES: F&TV 107 and 201.
Control and manipulation of imagery as it is given movement through photography and cutting, with emphasis on writing, cinematography and editing. Production of short silent films.

F&TV 280 Special Topics
On demand. 1-6 cr. Maximum of F&TV 280 plus 480, 16 cr.
PREREQUISITE: Consent of instructor.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.
F&TV 304 History of Photography II
W. 3 cr. Lect.
A comprehensive survey of photographic history from the Photo Secession through the end of WWII. The aesthetic and technological evolutions of photography are explored in their relationship to other arts and society.

F&TV 305 Photographic Expression
W. 4 cr. Lect. 1; Lab. 2
PREREQUISITES: F&TV 205 and junior standing in F&TV.
Expression of personal visual ideas through photography, with response and critique of student work.

F&TV 306 Announcing and Narration
S on demand. 2 cr. Lect. 1; Lab. 1
PREREQUISITE: F&TV 246.
Study and video editing assignments, emphasizing more complex techniques in non-dramatic television production.

F&TV 310 Darkroom Techniques
W. 4 cr. Lect. 1; Lab. 3
PREREQUISITES: F&TV 205, 223 and junior standing in F&TV.
The accomplishment of special effects through image manipulation in the darkroom. Seventy-five percent of openings are reserved for F&TV majors.

F&TV 320 Photographic Materials and Processes.
S. 4 cr. Lect. 2; Lab. 2
PREREQUISITES: F&TV 205 and junior standing in F&TV.
Evaluation of emulsion characteristics, masking controls, separation negative and color internegatives, contrast index, H and D curves and contrast index utilization.

F&TV 325 Photography for Publication
S. 4 cr. Lect. 2; Lab. 2
PREREQUISITE: F&TV 205.
An operational and practice of photography as a communications medium. The technique of producing photography for newspapers, magazines and other publications.

F&TV 330 Studio Set Design and Construction
S. 3 cr. Lect. 2; Lab. 1
PREREQUISITES: F&TV 107, 201, and 246.
Practice in the design and construction of sets for motion pictures and television. Highly specialized art with procedures and materials differing from those employed by other staged art forms.

F&TV 331 Introduction to Fiction Script Writing
W. 3 cr. Lect.
PREREQUISITE: F&TV 221.
Concentration on story ideas, dramatic structure, characterization, and research necessary to write a feature length treatment.

F&TV 333 Technical Operations
PREREQUISITE: Junior standing in F&TV.
Practical technical experience associated with production and research projects in motion pictures, television and photography.

F&TV 335 Color Negative Photography
A. 4 cr. Lect. 1; Lab. 3
PREREQUISITES: F&TV 225 and junior standing in F&TV.
Processing and printing of color negative materials. Quality control. Emphasis on portfolio development.

F&TV 337 Large Format Photography
A. 4 cr. Lect. 2; Lab. 2
PREREQUISITES: F&TV 210, 225 and junior standing in F&TV.
Advanced methods in image control, utilizing the view camera. Contrast control specialized for interior architecture with flash and incandescent lighting. Use of specific wet processes to implement the potential of the large negative.

F&TV 340 Television Programming, Sales and Management
S. 4 cr. Lect. 3; Lab. 1
PREREQUISITE: Junior standing.
Television station business procedures including operations, promotions and sales, programming standards and practices, and community relations. Emphasis on advertising practices and sales.

F&TV 360 Advanced Cinematography
A. 3 cr. Lect. 2; Lab. 1
PREREQUISITE: F&TV 279.
Emphasis upon major duties and responsibilities of the director of cinematography, including professional working conditions, personnel assignments, day-to-day shooting schedules and other vital procedures leading to the completion of a motion picture.

F&TV 365 Advanced Film Editing
W. 3 cr. Lect. 2; Lab. 1
PREREQUISITE: F&TV 279.
Primarily for motion picture majors. Advanced study in editing of picture and sound materials. Preparation of shooting material for post-production work. Video editing of visual material.

F&TV 371 Motion Picture Direction
W. 3 cr. Lect. 1
PREREQUISITE: F&TV 279.
The nature and requirements of the director and the techniques involved in the coordination of various technical and artistic functions in the creation of a motion picture.

F&TV 372 Theory of Television Production Direction
A. 3 cr. Lect.
PREREQUISITE: F&TV 246.
The nature and requirements of the producer and the directorial techniques involved in the coordination of various technical and artistic functions in the creation of a television production.

F&TV 375 Advanced Sound Recording
W. 3 cr. Lect. 2; Lab. 1
PREREQUISITES: F&TV 258 and 279.
Primarily for motion picture majors. Intended to develop working skills and creative technology necessary to prepare and execute all advanced phases of sound recording and reproduction.

F&TV 378 Television Dramatic Production Techniques
S. 4 cr. Lect. 1; Lab. 3
PREREQUISITE: F&TV 318.
Dramatic TV production techniques— including pre-planning, rehearsal procedures, lighting and set construction, personnel supervision, studio scheduling and other production control factors. Emphasis is placed on directing actors.

F&TV 380 Cinema Production II
S. 3 cr. Lect. 1; Lab. 2
PREREQUISITES: F&TV 360, 365, 371 and 375.
Final offering in cinematography prior to the Motion Picture Senior Production Workshop, emphasizing practical approach to more advanced professional techniques through the production of short sound motion pictures.

F&TV 390 Seminar
Affords students the opportunity to review many topics of special significance to their discipline.

F&TV 402 Motion Picture Criticism
S. 3 cr. Rec-Dis.
PREREQUISITE: Senior standing.
A critical approach to film in order to develop a basis for evaluation and appreciation of the motion picture as an art form and social force. Viewing of popular films produced recently as well as classics.

F&TV 405 Special Effects
W on demand. 3 cr. Lect.
PREREQUISITES: F&TV 107 and 201.
Techniques for the creation of motion picture special effects, with emphasis on optical printing and aerial image matting.

F&TV 412 FCC Regulations
W. 3 cr. Lect.
PREREQUISITE: Junior standing in F&TV.
Governmental and self-regulation of broadcasting and motion pictures including licensing, censorship, label and copyright.

F&TV 413 Motion Picture Production Management
A. 3 cr. Lect.
PREREQUISITE: Senior standing.
Concerned with practical as well as theoretical approaches to management in the motion picture industry—from initial funding through unit and fiscal management to final distribution.

F&TV 419 Non-Ferrous Processes
S. 4 cr. Lect. 2; Lab. 2
PREREQUISITES: F&TV 205 and junior standing in F&TV.
An introduction to nonferrous printing processes. Gumbichrome, platinum and palladium printing are featured, but contemporary processes will also be covered. The course will encourage extensive decision making and flexibility in photographic statements.

F&TV 420 Commercial Portrait
W. 4 cr. Lect. 2; Lab. 2
PREREQUISITE: Junior standing in F&TV.
Operational and managerial aspects of a commercial portrait studio with emphasis on modern and classic portraiture techniques.

F&TV 421 Educational Broadcasting
W on demand. 3 cr. Lect. 2; Rec-Dis. 1
PREREQUISITE: Junior standing in F&TV.
Organization and current status of U.S. public TV and radio stations and production centers. Examination of instructional television. Viewing of representative programs is emphasized.

F&TV 431 Contemporary Photography
S,Su on demand. 3 cr. Lect.
PREREQUISITES: F&TV 304 and junior standing in F&TV.
Photographic styles and aesthetic trends as observed in specific artists and groups in various fields of photography from the end of WWII to present.

F&TV 441 Advanced Scriptwriting
S. 3 cr. Lect.
PREREQUISITES: F&TV 221 and 331.
Preparation of scripts for marketability and production emphasis on professional requirements for television and motion pictures.

F&TV 461 Nonfiction Film
A. 3 cr. Lect. 2; Lab. 1
PREREQUISITE: Junior standing.
Growth and development of the nonfiction film from the early newsreels to the TV documentary.
F&TV 470 Individual Problems
A.W.Su. 1-5 cr. Ind. St. Maximum 6 cr.
PREREQUISITES: Junior standing.
Directed study and research on an individual basis.  Student presents proposal for faculty approval before proceeding with project.

F&TV 471 Motion Picture Senior Production Workshop
A.W.S. 4 cr. Lab. Maximum 12 cr.
PREREQUISITE: F&TV 380.
Practical application of advanced techniques through production of complete motion pictures by student crews under assigned supervision.

F&TV 472 Television Senior Production Workshop
A.W.S. 5 cr. Lect. 1; Lab. 4. Maximum 15 cr.
PREREQUISITES: F&TV 318, 372 and 378.
A final series of television programming and production projects produced by TV option students prior to graduation. The workshop covers all three quarters of the senior year.

F&TV 473 Photography Senior Production Workshop
A.W.S. 4 cr. Lab. Maximum 12 cr.
PREREQUISITE: Senior standing in photography option.
Senior students initiate and complete three, one-quarter photography projects, or one large project over the entire senior year.

F&TV 476 Career Internship
A.W.Su. 5-12 cr. Ind. St. Maximum 12 cr.
PREREQUISITES: Junior standing in F&TV and approval of department head.
Interns are selected by departmental faculty to work in professional production positions in governmental, public service or corporate situations during one academic quarter. Selected interns are given significant assignments at a professional level to broaden their understanding of professional expectations.

F&TV 480 Special Topics
On demand. 1-6 cr. Maximum of F&TV 280 plus F&TV 480, 16 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Graduate Courses in Film and Television Production

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

Fish and Wildlife Management
Department of Biology
984-4548
See Biology for faculty listing.

Graduate Courses in Fish and Wildlife Management

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

F&W 515 Fisheries Management
S. 3 cr. Lect.
PREREQUISITES: Biol 414 and 423.
Theory and practice of contemporary fishery management emphasizing ecology, life history, fish population sampling and manipulation, and multiple use concepts.

F&W 516 Wildlife Management—Birds
A. 5 cr. Lect.; Lab. 2.
PREREQUISITE: Biol 425.
Methods and results in the management of big game and predators.

F&W 517 Wildlife Management—Mammals
W. 5 cr. Lect.; Lab. 2.
PREREQUISITE: Biol 424.
Methods and results in the management of big game and predators.

F&W 518 Wildlife Management—Habitat
S. 5 cr. Lect.; Lab. 1.
PREREQUISITE: F&W 514 or 515.
Ecology and principles of management of wildlife habitats based on literature review, discussion and field trips.

F&W 525 Fisheries Management Laboratory
A. 2 cr. Lab.
PREREQUISITE: F&W 515.
Common methods of mensuration used in fisheries research and management surveys. Management techniques of the region as used by state and federal agencies.

F&W 526 Stream Ecology
W alternate years, will be offered W 1987. 3 cr. Lect.
PREREQUISITES: Biol 315, 324, and 414.
Overview of physical and biological interactions in streams and how these are affected by man's activities.

Geography
Department of Earth Sciences
994-3331

Head of Department: Dr. S.G. Custer.
Professors: M.J. Edie (Emeritus), R.L. Taylor.
Associate Professor: J.M. Ashley, Jr.
Assistant Professor: K.J. Hansen-Bristow.
J. Wilson.

Geog 101N Introduction to Physical Geography
A.S. 4 cr. Lect.; Lab. 1.
Weather and climate, soils, vegetation, landforms and water with emphasis on their interdependence and distribution. May serve as an overview of earth sciences for elementary education majors.

Geog 105S World Regional Geography
A.W.Su. 4 cr. Lect.
Resume of major world regions; their cultures, populations, resources, utilization of land; emphasis on regions outside Anglo-America.

Geog 201S Introduction to Human Geography
W. 4 cr. Lect.
The relationships between people, places and environment; use of human geography to analyze selected current world problems.

Geog 202T Introduction to Resource Geography
W.Su. 4 cr. Lect.
PREREQUISITE: Geog 101 or 105, or Biol 105.
Human societies in relation to the natural environment and the endowment of natural resources. Changing perceptions of and responses to the environment, especially as regards air, land, water, and ecosystems natural and modified. Impact of economic exploitation in arid, control and management of environmental change. The environmental ethic.

Geog 210 Regional Climatography
W alternate years, will be offered W 1987. 4 cr. Lect.
PREREQUISITE: ESci 106.
The climates of the continents; their classification, characteristics and interrelationships with other factors of the physical environment.

Geog 211 Principles of Cartography
A. 4 cr. Rec.-Dis.; Lab. 2.
Cartography with emphasis on graphic presentation; study and laboratory practice in presenting geographic, statistical and other data in map form.

Geog 215 Geography of the United States and Canada
A. 4 cr. Lect.
Regional geography of Anglo-America including physical, cultural and economic aspects, integrated region by region.

Geog 218 Montana Geography and Resources
S alternate years, will be offered S 1987. A Alternate years, will be offered A 1987. Su on demand. 4 cr. Lect.
Montana's natural environment and human, cultural and economic occupation.

Geog 234 Introduction to Geographical Planning
A. 4 cr. Rec.-Dis.
The application of methodology to policymaking in order to increase the validity of present and future land-use determination.

Geog 280 Special Topics
On demand. 1-5 cr. Maximum 8 cr. Maximum of Geog 280 plus Geog 480, 16 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Geog 301 Quantitative Methods in Geography
A. 4 cr. Lect.; 5; Lab. 1.
PREREQUISITE: Stat 216.
Theory and practical application of elementary quantitative techniques in geography emphasizing descriptive, inferential, and spatial analysis, probability, sampling, and spatial statistical analysis.

Geog 305 Intermediate Cartography
W alternate years, will be offered W 1987. 4 cr. Rec.-Dis.; Lab. 2.
PREREQUISITE: Geog 211.
The properties of various statistical surfaces, their cartographic portrayal, accuracy and intercorrelation.
Graduate Courses in Geography

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

Geog 401 Historical Geography of the Western United States
W alternate years, will be offered W 1988. 4 cr. Lec.
PREREQUISITE: Geog 105 and 8 additional credits of geography.
Past geographies of the Trans-Mississippi West. Methodology, techniques and concepts used by historical geographers. Includes work with original 1800s maps and documents.

Geog 405 Geography of Exploration
W alternate years, will be offered W 1988. 4 cr. Sem.
PREREQUISITE: Graduate standing.
The exploration of the world from the Classical Period through the 17th century; extensive use is made of geographic writings from the various periods and events.

Geog 407 Applied Geography
S. 4 cr. Sem.
PREREQUISITES: Geog 301 and senior standing.
The objectives, tools and methods of investigation used by geographers: archival, library, cartographic and field methods will be employed.

Geog 421 Principles of Environmental Management
S alternate years, will be offered S 1988. 4 cr. Lec. 3; Lab. 1.
PREREQUISITE: Geog 202.

Geog 422 Geographic Hazard Assessment
A alternate years, will be offered A 1986. 4 cr. Rec.-Dis.
PREREQUISITE: Geog 254.

Geog 430 Mountain Geography
A alternate years, will be offered A 1987. 4 cr. Lec. 3; Lab. 1.
PREREQUISITES: Biol 120 and ESci 106.
Local, regional, and global importance of mountains. Geomorphology, climatology, plants and animals and their relationship to human activities.

Geog 470 Individual Problems
A,W,S,Su. 1-5 cr. Ind. St. Maximum 6 cr.
PREREQUISITES: Junior standing, consent of instructor and department head.
Directed research and study on an individual basis.

Geog 480 Special Topics
On demand. 1-5 cr. Maximum 8 cr. Maximum of Geog 280 plus 480, 16 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Geog 501 Geographical Analysis
W alternate years, will be offered W 1987. 4 cr. Rec.-Dis.
PREREQUISITE: Graduate standing.
Application of remote sensing analysis, cartography, computer modeling, field and quantitative methods to the geography of environmental problems. System analysis, measurement problems, strategies of management. Techniques applied to land, water and atmosphere as they relate to people.

Geog 503 Rural Land Use
A alternate years, will be offered A 1986. 4 cr. Rec.-Dis.
PREREQUISITE: Graduate standing.
Rural land use in the Rocky Mountain west. Land supply, organization, allocation, aesthetics, history of land use both public and private, cropland, rangeland, forestland, recreation, water, and mineral resources.

Geog 504 Climatology of the Rocky Mountain Region
S alternate years, will be offered S 1988. 4 cr. Rec.-Dis.
PREREQUISITE: Geog 301 or Biol 419.
Application of climatology to problems of resource management, food production, energy supply, human health and comfort, and policy development.

Geog 510 Rocky Mountain Physiography
A alternate years, will be offered A 1987. 4 cr. Lec. 3; Lab. 3.
History of physiographic analysis, boundary analysis, Southern Rocky Mountains, Wyoming Basin, Middle Rocky Mountains, Northern Rocky Mountain.

Geog 520 Legalistic Land Use Controls
S alternate years, will be offered S 1987. 4 cr. Lec. 2; Rec.-Dis. 2.
PREREQUISITE: Graduate standing.
History and philosophy of land use controls, law, zoning, subdivision regulation, site planning, eminent domain and transferable development rights.

Geog 570 Individual Problems
A,W,Su. 1-5 cr. Ind. St. Maximum 9 cr.
PREREQUISITES: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies.
Directed research and study on an individual basis.

Geog 580 Special Topics
On demand. 1-5 cr. Maximum 12 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.
Citation Index, bibliographic formats, citation, geoscience writing styles, figure formats, table formats, proposition formulation, rewriting, peer review; audience identification and writing strategies.

Geol 307 Principles of Geomorphology
A. 4 cr. Lect. 3; Lab. 1.
PREREQUISITES: ESci 102 or Geol 101 or Geol 231, junior standing.
Framework, process, system, and time as factors which control the generation of landforms. Laboratories involve field trips and map interpretation.

Geol 309 Principles of Sedimentation
A. 4 cr. Lect. 3; Lab. 1.
PREREQUISITES: Geol 206, 208, 210, Math 183, concurrent enrollment in Geol 301, recommend concurrent enrollment in Geol 307.
Physical, chemical and biological processes and their combined effects on provenance, dispersal, deposition and diagenesis. Labs emphasize description, analysis and interpretation of sediments and sedimentary rocks in selected local areas.

Geol 310 Invertebrate Paleontology
W. 4 cr. Lect. 2; Lab. 2.
PREREQUISITE: Geol 309.
Invertebrates and their contributions to and effects on the sedimentary rock record. Emphasis is on morphology and paleoecology as well as on the stratigraphic and sedimentologic significance of important invertebrate groups. Labs stress fossil recognition.

Geol 311 Principles of Stratigraphy
S. 4 cr. Lect. 3; Lab. 1.
PREREQUISITES: Geol 309; recommend concurrent enrollment in Geol 315.
Applications of sedimentation to the study of the geometry and interrelationships of sedimentary rock bodies. Labs emphasize stratigraphic data gathering and mapping techniques in selected local areas.

Geol 315 Principles of Structural Geology
S. 4 cr. Lect. 3; Lab. 1.
PREREQUISITES: Geol 206, 210; recommend concurrent enrollment in Geol 315.
The geometry, kinematics, and dynamics of rock deformation. Laboratories will involve field study of outcropping local structural features and laboratory analysis of rock deformation.

Geol 400 Seminar
A.W.S. 1 cr. Sem. Maximum 6 cr.
PREREQUISITE: Junior standing in earth sciences (geology or geophysics).
Seminar organized around a theme in geosciences. Topic varies from quarter to quarter.

Geol 408 Igneous and Metamorphic Petrology
S. 4 cr. Lect. 3; Lab. 1.
PREREQUISITES: Geol 206 and 208.
Characteristics of igneous and metamorphic rocks, including field relations, petrography, petrogenetic processes, and tectonic setting. Igneous and metamorphic principles applied to geologic systems.

Geol 411 Vertebrate Paleontology
W alternate years, will be offered W 1987. 4 cr. Lect. 2; Lab. 2.
PREREQUISITE: Junior standing in earth sciences or biology.
Vertebrate organisms in the geologic record. Osteology, skeletal anatomy, osteologic histology, functional morphology, evolution, facial relationships, biostratigraphy, taphonomy, paleoecology, collection techniques, laboratory identification techniques.

Geol 415 Metallic Mineral Deposits
A. 4 cr. Lect. 3; Lab. 1.
Origin of economic metallic deposits including igneous, sedimentary and hydrothermal processes, techniques of mineral exploration and development. Includes gold, silver, lead, zinc, nickel, copper, molybdenum, chromium, platinum.

Geol 416 Nonmetallic Mineral Deposits
W alternate years, will be offered W 1987. 4 cr. Lect. 3; Rec.-Dis. 1.
PREREQUISITE: Geol 206.
Origin of nonmetallic mineral deposits including igneous, metamorphic, and sedimentary processes; techniques of mineral exploration and development. Includes evaporites, clay, sand, talc, asbestos, kyanite, garnet, pegmatites, gems, phosphate, cement, clinders, perlite, coal, and petroleum resources.

Geol 423 Field Geology
Su. 9 cr. Lab.
PREREQUISITES: Geol 307, 315 and 311; enrollment in Geol 400 during preceding spring quarter.
An intensive, six-week summer course stressing application of standard field procedures and mapping techniques to a series of field problems in south-central Montana. A practical, integrated field application of each student's previous geologic experience is emphasized.

Geol 433 Tectonics
A. 4 cr. Lect. 3; Rec.-Dis. 1.
PREREQUISITE: Geol 315.
Plates tectonics, regional tectonics and the structural architecture of the world's orogenic belts. Related topics in geophysics will also be covered where appropriate.

Geol 437 Geophysics
W. 4 cr. Lect. 3; Rec.-Dis. 1.
Seisimology, gravity, magnetism, heat flow, radioactivity, and geodynamics. Applications to tectonic processes and solid earth physics.

Geol 460 Glacial Geology
S alternate years, will be offered S 1988. 4 cr. Lect. 2; Lab. 2.
PREREQUISITE: Geol 307.
Glacier dynamics, distribution in time and space, and effects on the landscape. Lab time is spent in quantitative analysis of glaciation and its effects, as well as field trips.

Geol 470 Individual Problems
A.W.S.Su. 1-5 cr. Ind. St. Maximum 9 cr.
PREREQUISITES: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies.
Directed research and study on an individual basis.

Geol 480 Special Topics
On demand. 1-5 cr. Maximum 10 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Graduate Courses in Geology

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

Geol 505 Structural Geology
A alternate years, will be offered A 1987. 4 cr. Rec.-Dis. 3; Lab. 1.
PREREQUISITE: Geol 315.
Regional structural geology of the Rocky Mountains. Application of structural techniques including balanced cross sections and finite strain analysis.

Geol 507 Geomorphology
S alternate years, will be offered S 1987. 4 cr. Rec.-Dis. 3; Lab. 1.
PREREQUISITE: Geol 307.
Quantitative landscape analysis: historical and modern efforts to understand landforms through their measurable properties. Lab work will include quantitative map interpretation and field studies.

Geol 508 Sedimentology
S alternate years, will be offered S 1988. 4 cr. Rec.-Dis. 3; Lab. 1.
PREREQUISITES: Geol 311 and 315.
Application of modern facies models to stratigraphic and sedimentologic problems. Labs include detailed stratigraphic analysis and interpretation of selected local stratigraphic sequences.

Geol 510 Sedimentary Petrology
A alternate years, will be offered A 1986. 4 cr. Rec.-Dis. 3; Lab. 1.
PREREQUISITES: Geol 208, 311, 315.
Detailed analysis and interpretation of the mineralogy, fabric and genesis of sedimentary rocks. Analytical and interpretive techniques are emphasized in laboratory.

Geol 511 Igneous Petrology
W alternate years, will be offered W 1988. 4 cr. Rec.-Dis. 3; Lab. 1.
PREREQUISITE: Geol 408.
An advanced consideration of igneous processes including their role in crust-mantle interactions. Igneous processes in ore formation.

Geol 512 Metamorphic Petrology
W alternate years, will be offered W 1987. 4 cr. Rec.-Dis. 3; Lab. 1.
PREREQUISITE: Geol 408.
Chemical and mechanical processes of metamorphism: heterogeneous phase equilibria, the relationship between mechanical deformation and metamorphism.

Geol 570 Individual Problems
A.W.S.Su. 1-5 cr. Ind. St. Maximum 9 cr.
PREREQUISITES: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies.
Directed research and study on an individual basis.

Geol 580 Special Topics
On demand. 1-5 cr. Maximum 10 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Geol 583 Applied Geological Hydrology
On demand. 3 cr. Rec.-Dis. 2; Lab. 1.
PREREQUISITES: Math 170 or Stat 216, ESci 102 and graduate standing. Hydrology course work or background strongly recommended.
Application of geologic principles and methods to problems in hydrology, land-use planning, land reclamation, geologic hazard analysis and hazard mitigation.

Health Education

Department of Health, Physical Education and Recreation
994-4001

Head of Department: Dr. A.W. McNeill.
Associate Professor: W. Serdabaly.
Adjunct Lecturer: G. Lustin.

Hlth 106 Personal Health
A.W.S. 3 cr. Lect.
Designed to help students become familiar with health principles and values and to apply these to their own lives.

Hlth 220 Community Health Education
W 3 cr. Lect.
PREREQUISITE: Hlth 106.
An examination of selected community health problems, health careers and professions, and the functions of agencies involved in providing health services.
Hlth 221 First Aid, Advanced Emergency Care  
A,W,S,Su. 2 cr. Lect.  
PREREQUISITE: Concurrent enrollment in Hlth 222.  
Emergency first aid procedures and skills, including Red Cross Certification.

Hlth 222 First Aid, Advanced Emergency Care Lab  
A,W,S. 1 cr. Lab.  
PREREQUISITE: Concurrent enrollment in Hlth 221.  
Practical application of procedures and skills.

Hlth 230 Drugs, Alcohol and Tobacco  
A,W,S,Su. 3 cr. Lect.  
An examination of drugs, alcohol and tobacco effects; their impact on society and an exploration of individual use and values clarification.

Hlth 240 Health and Sex Education  
A,W,S,Su. 3 cr. Lect.  
A study of all aspects of human sexuality, including the sexual reproductive systems, sexual behaviors, birth control, sex roles, sexual functioning, and the clarification of sexual values.

Hlth 250 Application of Health Principles  
S. 3 cr. Lect.  
PREREQUISITES: Hlth 106, HEc 221, Psy 103 and 220.  
Analysis of mental and physical well-being through health appraisal, behavior modification and habit change.

Hlth 270 Individual Problems  
A,W,S,Su. 1-3 cr. Ind. St. Hlth 270 plus 470, maximum 6 cr.  
PREREQUISITES: Freshman or sophomore standing, consent of instructor, and approval of department head.  
Directed research and study on an individual basis.

Hlth 275 Chronic Disease and Disability  
W. 3 cr. Lect.  
Analysis of the physiological and pathological influences on the major body systems in relation to chronic disease and disorders. Diagnostic and treatment procedures. Impact of chronic illness on lifestyle of individual; economic, social and personal implications.

Hlth 280 Special Topics  
On demand. 1-5 cr. Lect. Maximum 6 cr.  
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Hlth 290 Pre-Physical Therapy Internship  
Students will have an opportunity to assist in a physical or occupational therapy experience for one quarter.

Hlth 308 Elementary/Secondary School Health Problems  
A. 5 cr. Lect.  
An in-depth analysis of school health programs and services including practical field experience in visual, auditory and nutritional defect screening. Major childhood diseases and selected health problems of adolescents will be added.

Hlth 325 Health Curriculum Development  
A. 5 cr. Lect.  
PREREQUISITES: Junior or senior standing in health and/or physical education option.  
Development and evaluation of health curricula and programs.

Hlth 326 Program Designs K-12  
W. 3 cr. Lect.  
PREREQUISITES: Junior or senior standing in health and/or physical education option.  
Intended for those students seeking certification in physical education and health K-12. Approaches and styles of teaching health and the development of health curriculum.

Hlth 402 First Aid Instructors Seminar  
A,W. 2 cr. Sem.  
PREREQUISITE: Hlth 221 or current American Red Cross advanced card.  
American Red Cross instructor certification.

Hlth 430 Values and Teaching Health  
W. 3 cr. Lect.  
Intended to teach future health teachers about the theory and practice of values education, including values clarification.

Hlth 440 Peer Birth Control Education  
A alternate years, will be offered A 1986. 3 cr. Lect.  
PREREQUISITE: Hlth 240.  
To train students to conduct a peer birth control program for students residing on campus.

Hlth 470 Individual Problems  
A,W,S,Su. 1-3 cr. Lab. Maximum 6 cr.  
Directed research and study on an individual basis.

Hlth 480 Special Topics  
On demand. 1-5 cr. Maximum 15 cr.  
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Graduate Courses in Health Education

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

Hlth 510 Program Design in Sex and Drug Education  
S,Su. 3 cr. Lect.  
PREREQUISITES: Hlth 250, 240 and graduate standing.  
Background in sex and drug education; skills to design and implement curricula.

Hlth 570 Individual Problems  
PREREQUISITES: Graduate standing, approval of department head and Dean of Graduate Studies.

Hlth 580 Special Topics  
On demand. 1-5 cr. Maximum 15 cr.  
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

History

Department of History and Philosophy  
994-4395

Head of Department: E.E. Barry, Jr  
Associate Professors: J. Ober, P.E. Petrik,  
R.W. Rydell, B.G. Smith  
Assistant Professors: D.C. Large

Hlth 106F History of Western Civilization  
W. 4 cr. Lect.  
The origins of modern Europe with emphasis upon the Renaissance, Reformation and Enlightenment.

Hlth 107F History of Western Civilization  
A,S. 4 cr. Lect.  
Survey of the modern world from the French Revolution to the present.

Hlth 108 The Contemporary World and Western Civilization  
S. 4 cr. Lect.  
A continuation of the History of Western Civilization sequence that will introduce the student to important trends in international politics and economics during the period since 1945.

Hlth 200 Introduction to the Historical Process  
A alternate years, will be offered A 1986. 4 cr. Sem.  
An introduction to the writing history and instruction in the basic research skills necessary for historical narrative.

Hlth 204F The History of the Social Definitions of Sexuality  
W. 4 cr. Lect.  
Male and female sexuality, birth, contraception, homosexuality and pornography from an historical perspective. The course is intended not as a biological or psychological exploration of these topics but as an exploration of changes in society's perceptions.

Hlth 216 History of Russia to 1917  
W. 4 cr. Lect.  
Emergence of Russia as a modern nation and developments which led to the Bolshevik Revolution.

Hlth 219 History of American Agriculture  
S. 3 cr. Lect.  
Major movements and organizations in the development of American agriculture.

Hlth 235 Violence in the American Past  
S. 4 cr. Lect.  
An introduction to the various aspects of violence in the American past.

Hlth 255F Survey of American History  
A,W,S. 4 cr. Lect.  
European exploration of the New World, the American colonial and revolutionary periods.

Hlth 256F Survey of American History  
A,W,S. 4 cr. Lect.  
Early National period, the Age of Jackson, sectionalism, civil war, reconstruction and industrialization.

Hlth 257F Survey of American History  
A,W,S. 4 cr. Lect.  
Late 19th and 20th Century America, its modernization and rise to world power in an age of war and revolution.

Hlth 280 Special Topics  
On demand. 1-5 cr. Maximum of 8 cr. Maximum of Hist 280 plus Hist 480. 16 cr.  
PREREQUISITE: Must be lower division students.  
Course not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Hlth 301F (MLF 301F) History of the Civilization of France  
A alternate years, will be offered A 1986. 4 cr. Rec-Disc.  
Survey of French culture from the Middle Ages to the modern era, an interdisciplinary course which focuses on historical, artistic, literary and social developments.
Hist 302 History of Montana  
S. 4 cr. Lect.  
PREREQUISITE: Sophomore standing or above.  
Evaluation of important personalities, periods and trends in the development of the territory and state.

Hist 307 Women in America, Colonial Times to 1848  
A. 4 cr. Lect.  
A more detailed and in-depth exploration of women's experience than is ordinarily encountered in other U.S. history courses.

Hist 308 Women in America, 1848 to the Present  
W. 4 cr. Lect.  
A more detailed and in-depth exploration of women's experience than is ordinarily encountered in other U.S. history courses.

Hist 314S The Roots of the American Economy  
S alternate years, will be offered S 1988. 4 cr. Lect.  
PREREQUISITE: Hist 255 or 256.  
Economic history of North America before 1865, the social and political consequences of economic development during that period, and the use and application of economic analysis to history.

Hist 315 Business in America, 1860-1981  
S. 4 cr. Lect.  
The major themes in the development of corporate America; views of the market, price, business relation to politics, labor and the appearance of monopolists. Because the field of business history is a broad one, the course will concentrate on manufacturers, men who made things, and manufacturing.

Hist 317 History of Ancient Egypt and Mesopotamia  
S alternate years, will be offered S 1988. 4 cr. Lect.  
PREREQUISITE: Hist 105.  
Lectures and readings will emphasize the origins of civilization and the development of the earliest empires.

Hist 318 History of Greece to 146 B.C.  
A. 4 cr. Lect. 3; Rec.-Dis. 1.  
PREREQUISITE: Hist 105.  
The essential characteristics of Greek civilization and the background for the development and decline of democracy as a viable political form. Reading will include works by ancient authors.

Hist 319 History of Rome to 330 A.D.  
W. 4 cr. Lect. 3; Rec.-Dis. 1.  
PREREQUISITE: Hist 105.  
Survey of the history of Rome from the foundation of the city to the reign of Constantine. Emphasis on Roman imperial expansion, frontier problems and constitutional development.

Hist 321F The Renaissance  
A. 4 cr. Lect.  
PREREQUISITE: Junior standing.  
Emphasis on the transition from medieval to early modern society in England, Italy, France and Germany, 1300-1525.

Hist 322 Protestant Reformation  
W. 4 cr. Lect.  
The rise of Protestantism, 1500-1640, and its impact on European society. Emphasis on Germany, France and England.

Hist 323 The Age of Absolutism and Reason  
S. 4 cr. Lect.  
Political, intellectual and economic history of Europe during the 17th and 18th centuries.

Hist 324 Catholic Reformation  
A alternate years, will be offered A 1986. 2 cr. Lect.  
Exploration of Catholicism and its institutions during the 16th century. Focus on reaction to Protestantism and the establishment of the modern Roman Catholic Church.

Hist 325 19th-Century Europe  
W alternate years, will be offered W 1988. 4 cr. Lect.  
PREREQUISITE: Hist 255 or 256.  
Ideas and events in Britain and on the Continent from the Congress of Vienna to the outbreak of World War I. Social and intellectual ideas as well as political and economic events.

Hist 326 20th-Century Europe  
S alternate years, will be offered S 1988. 4 cr.-Lect.  
Events and forces in 20th Century Europe from World War I to the present. The rise of fascism, communism and the interwar crisis along with post-World War II developments.

Hist 328 Modern Germany  
A. 4 cr. Lect.  
An in-depth look at the economic, social and political developments of modern Germany.

Hist 330 History of Latin America  
A. 4 cr. Lect.  
The cultural and political history of pre-Columbian and colonial Peru and Mexico.

Hist 331 History of Latin America  
W. 4 cr. Lect.  
The cultural and economic growth of Mexico and Peru in the 19th century.

Hist 332 History of Latin America  
S. 4 cr. Lect.  
The political and economic development of Central America from the colonial period to the 20th century.

Hist 336 History of Mexico  
S. 4 cr. Lect.  
The political and economic history of 20th century Mexico.

Hist 341 American Revolution  
S alternate years, will be offered S 1988. 4 cr. Lect.  
PREREQUISITE: Hist 255 or 256.  
Struggle for home rule, revolution and independence and the formation of the new nation.

Hist 346 U.S. Era of Sectionalism and Civil War  
W alternate years, will be offered W 1987. 4 cr. Lect.  
PREREQUISITE: Hist 325 or 256.  
Political, economic, and social developments 1850-1877. Breakdown of political accommodation leading to Civil War and Reconstruction.

Hist 347 History of the North American Indian  
W alternate years, will be offered W 1988. 4 cr. Lect.  
PREREQUISITE: Hist 255, 256, 257.  
Indian affairs in America from 1600-1970. Emphasis on white reaction to the American Indians and the effect of the European invasion on Indian culture.

Hist 348 The Modern American Presidency  
A alternate years, will be offered A 1986. 4 cr. Lect.  
Major trends and developments, domestic and foreign, as reflected in Presidential administrations of the 20th century.

Hist 356F American Thought and Culture, Puritans-Civil War  
A alternate years, will be offered A 1986. 4 cr. Lect.  
The fundamental purpose of this course is to show the interconnectedness of science, philosophy and religion in shaping the American intellectual tradition from the Puritan founding to the eve of the Civil War.

Hist 357F American Thought and Culture, 1865-Present  
A alternate years, will be offered A 1987. 4 cr. Lect.  
The fundamental purpose of this course is to show the interconnectedness of science, philosophy and religion in shaping the American intellectual tradition from the Civil War through the present.

Hist 367 American Military Tradition  
W. 4 cr. Lect.  
PREREQUISITES: Hist 255 or 256 or 257.  
Historical examination of the American way of war from the Revolution to the present.

Hist 368 War in the Twentieth Century  
A. 4 cr. Lect.  
PREREQUISITE: Hist 105 or 106 or 107.  
Topics will include preparations for war, causes of conflict, social and economic consequences of war, and opportunities for resolving conflict peacefully.

Hist 400 Seminar in History  
PREREQUISITE: Senior standing.  
Introduces history major to sound research and writing methods, bibliographical tools and historiography.

Hist 402 The Trans-Mississippi Frontier  
S alternate years, will be offered S 1988. 4 cr. Lect.  
PREREQUISITE: Junior standing.  
The far-western American frontier in the 19th century from the Louisiana Purchase through the Progressive Movement of the early 20th century.

Hist 417 Old World Archaeology  
S alternate years, will be offered S 1987. 4 cr. Lect. 2; Rec.-Dis. 2.  
The history and methodology of archaeology. Archaeology has always been one of the primary sciences used by scholars to reconstruct the history of the ancient past, and modern historians of antiquity are relying more and more heavily on archaeological methodology for the writing of history.

Hist 420 Pre-Industrial Europe  
A alternate years, will be offered A 1987. 4 cr. Lect.  
PREREQUISITE: Junior standing or above.  
Survey of European economic and social developments from the end of the Middle Ages to the eve of the Industrial Revolution. Emphasis on the disintegration of the feudal and manorial systems as well as the pre-conditions for industrialization.

Hist 421 History of the American Constitution  
A. 4 cr. Lect.  
PREREQUISITES: Hist 255, 256 and 257.  
Development of American constitutional theory up to 1870.

Hist 422 History of the American Constitution  
W. 4 cr. Lect.  
PREREQUISITES: Hist 255, 256 and 257.  
Development of American constitutional theory since 1870.

Hist 430T The Scientific Revolution  
A. 4 cr. Lect.  
PREREQUISITE: Junior standing.  
The origins of modern science.

Hist 431T Science, Technology and Society: 1700-1850  
W. 4 cr. Lect.  
PREREQUISITE: Junior standing.  
Industrialization in Europe, science, technology and change; evolution and national science.

Hist 432T Science, Technology and Society: 1850-Present  
S. 4 cr. Lect.  
PREREQUISITE: Junior standing.  
Topics include special relativity and quantum mechanics, science, society and national security (Manhattan Project), DNA and developmental biology.
Hist 450 American Historiography
W. 4 cr. Lect. 2; Rec.-Dis. 2.
Analysis of the writings, schools, philosophies and theories of great American historians.

Hist 455T History of American Technology
W. 4 cr. Lect.
PREREQUISITE: Junior standing.
Within the broad framework of assessing "the human prospect," the course will provide an historical understanding of the interpenetration of technology and culture. Readings, lectures and films will address these issues from a variety of perspectives.

Hist 460 European Intellectual History
Since 1789
S alternate years, will be offered S 1987. 4 cr. Lect.
The ideologies and major thinkers who have influenced European history from the French Revolution to the present day.

Hist 470 Individual Problems
A.W,S,Su. 1-3 cr. Ind. St. Maximum 6 cr.
PREREQUISITES: Consent of instructor and department head.
Directed research and study on an individual basis.

Hist 473 U.S. Foreign Affairs, 1898 to Present
W. 4 cr. Lect.
Twentieth century U.S. foreign affairs, emphasizing American overseas expansionism, the two world wars and the response to international communism.

Hist 476 Career Internship
W.S.Su. 6-12 cr. Ind. St.
PREREQUISITES: Junior standing and approval of department head.
Interns are selected by departmental faculty to work in governmental, public service or corporate positions during one academic quarter. Selected interns are given significant assignments at the management level to broaden their understanding of professional expectations in the chosen field.

Hist 480 Special Topics
On demand. 1-5 cr. Maximum of Hist 280 plus Hist 480, 16 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Graduate Courses in History

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

Hist 500 Seminar
On demand. 1 cr. Sem. Maximum 6 cr.
PREREQUISITE: Graduate standing.
Emphasis on research and writing methods, bibliographical tools and historiography.

Hist 503 History of America and Its Frontier Before 1860
W. 4 cr. Lect. 2; Rec.-Dis. 2.
PREREQUISITE: Graduate standing or one of the following courses: Hist 314, 341, or 346.
Focus on the social, economic and political development of America before the Civil War, with a special emphasis on the American frontier.

Hist 505 U.S. History, 1860 to Present
S. 4 cr. Lect. 2; Rec.-Dis. 2.
PREREQUISITE: Graduate standing or one of the following courses: Hist 315, 348, 451, 455, 473.
Graduate analysis of important problems in recent American history.

Hist 515 Northern Plains and Rockies
A on demand. 4 cr. Lect. 2; Rec.-Dis. 2.
PREREQUISITE: Graduate standing or Hist 402.
Directed graduate research and analysis in the history of the Northern Plains and Rockies.

Hist 540 Historical Method and Archives
A. 4 cr. Lect. 2; Rec.-Dis. 2.
PREREQUISITE: Graduate standing or either Hist 400 or 450.
Introduction to historical thinking, the uses of evidence, and historical methodology. Discussion of the use of sources will be supplemented by case studies of problems of interpretation based on manuscript and other archival material.

Hist 550 Professional Historical Writing
S. 4 cr. Lect. 2; Rec.-Dis. 2.
PREREQUISITE: Graduate standing or either Hist 400 or 450.
Development of writing techniques accepted by the historical profession as appropriate for published scholarly work.

Hist 570 Individual Problems
A.W,S,Su. 1-3 cr. Ind. St. Maximum 9 cr.
PREREQUISITES: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies.
Directed research and study on an individual basis.

Hist 576 Internship
A.W,S,Su. 1-12 cr. Ind. St.
PREREQUISITES: Graduate standing, consent of instructor and department head.
Practical experience in the area of their course of study within historical societies, archives, museums, and public agencies concerned with historic preservation.

Hist 580 Special Topics
On demand. 1-5 cr. Maximum 15 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Hist 589 Graduate Consultation
A.W,S,Su. 3 cr. Tut.
PREREQUISITES: Master's standing and approval of the Dean of Graduate Studies.
This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) for a master's degree but who need additional faculty for help or time.

Hist 590 Master's Thesis
A.W,S,Su. 3-12 cr. Ind. St. May be repeated.
PREREQUISITE: Master's standing.

Home Economics
994-3241

Head of Department: Dr. M. Briggs.
Professors: M. Briggs, R. Marotz-Baden.
Instructors: C. Brown, J. Bullock, P. Demnez, P. Harris, J. Milford, B. Warford.

HEc 111 Basic Clothing Construction
W.S. 3 cr. Lect. 1; Lab. 2.
Basic techniques and common terminology used in clothing construction. Construction processes focusing on independent work and high standards in constructing garments using commercial patterns.

HEc 130 Design Fundamentals
A.W.S. 2 cr. Lect.
The development of values and judgments through the study of design as applied to visual environment—foods, clothing, interiors and housing.

HEc 138 Issues in Consumer Decision Making
A.W.S. 4 cr. Lect.
Focus on today's consumer issues and strategies for understanding and functioning in today's complex marketplace.

HEc 151S Human Development: Conception Through Adolescence
A.W.S. 4 cr. Lect.
Biological, psychological and social factors in human growth and development from conception through adolescence. Concentration on classical and contemporary theories and practical implications. Designed for non-child development majors.

HEc 152S Human Development: Adult Development and Aging
A.W.S. 4 cr. Lect.
Biological, psychological and sociological aspects of human development from young and early adulthood to old age. Emphasis on classical and recent theory and research. Designed for non-child development majors.

HEc 155 Child Development: Early Childhood
A.S. 4 cr. Lect. 3; Rec.-Dis. 1.
Growth and development: prenatal through five years with particular focus on the theories of Erickson, Maslow and Piaget and the observation of those theories in children.

HEc 163 Personal Development and Human Relations
A.W.S. 4 cr. Lect. 2; Rec.-Dis. 2.
Concepts, insights and attitudes related to the dynamics of personal development and interpersonal styles of relating.

HEc 170 Professional Foundations
A.W.S. 1 cr. Lect.
Orientation to professional opportunities in home economics and evaluation of preparation for professional roles.

HEc 211 Introduction to Fashion Marketing
S. 3 cr. Lect.
Overview of the fashion business, foreign and domestic producers of fashion, retailers and retailing, and auxiliary fashion industries.

HEc 215 Consumer Textiles
A.S. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: Chem 121 or 122.
Fibers, yarns, fabric construction and finishing related to appreciation, selection, use and care of current textiles. Laboratory opportunities in testing and analysis of textile fibers and fabrics.

HEc 218 Weaving I
W.S. 4 cr. Lect. 2; Lab. 2.
Weaving techniques utilizing floor looms.

HEc 219 Principles of Fit and Construction
A.S. 3 cr. Lect. 1; Lab. 2.
PREREQUISITE: HEc 111 or minimum score on placement test.
Adaptation of standard patterns and construction of garments for individual proportions.

HEc 221N Basic Nutrition
A.W.S. 4 cr. Lect. 3; Rec.-Dis. 1.
PREREQUISITE or COREQUISITE: High school chemistry or Chem 121 or 122.
Basic concepts of human nutrition: digestion, absorption and metabolism of basic nutrients; application of these concepts as they relate to various stages of the life cycle.
HEc 222 Clinical Nutrition
A,W,S,Su. 2 cr. Lect.
PREREQUISITES: HEc 221, Biol 211 and Chem 122. (Biol 211 and Chem 122 may be taken concurrently with HEc 222).

Nutritional assessment (anthropometric, biochemical, clinical, dietary) in health and disease, and general dietary modifications used for major diseases and special conditions.

HEc 226 Food Science I

HEc 227 Food Science I Laboratory
A,W,S,Su. 1 cr. Lab.
PREREQUISITE: HEc 226. (HEc 226 may be taken concurrently with HEc 227).

Practical experiences which illustrate the principles of food preparation, purchasing, storage, management and service, utilizing knowledge from HEc 226.

HEc 230 Personal and Family Finance
A,W,S,S. alternate years, will be offered W 1988. 4 cr. Lect. 5; Rec.-Dis. 1.
PREREQUISITE: HEc 158.

A survey of U.S. courtship, marriage and family relationships, emphasizing budgeting.

HEc 233 Consumer Housing
W 3 cr. Lect.
PREREQUISITES: HEc 130, 138.

HEc 252 Parenting
S 3 cr. Lect. 2; Rec.-Dis. 1.
PREREQUISITE: HEc 151 or 155.

Factors which influence the selection and use of household appliances including characteristics of materials and construction, energy use, and trends in equipment.

HEc 255 Child Development: School Age Child
A,W,Su. 3 cr. Lect.

A survey of U.S. courtship, marriage and family relationships. Cultural differences explored and factors contributing to successful marriage emphasized.

HEc 256 Discussion of Courtship, Marriage and Family Relations
A,W,Su. 3 cr. Lect.

A survey of U.S. courtship, marriage and family relationship patterns. Cultural differences explored and factors contributing to successful marriage emphasized.

HEc 260 Human Development: Adolescence
A,W,4 cr. Lect.

Developmental processes related to social and educational issues influencing the adolescent's development. Multicultural and special needs examined.

HEc 262 Food Science II
A,W,S,Su. 1 cr. Lab.
PREREQUISITE: HEc 222, 271 and 333.

Principles of quantity food production that include menu development, recipe standardization, food preparation, cost control, consumer acceptance studies, equipment evaluation, work flow and product evaluation.

HEc 263 Human Development: Adolescence
A,W,4 cr. Lect.

A survey of U.S. courtship, marriage and family relationship patterns. Cultural differences explored and factors contributing to successful marriage emphasized.

HEc 271 Paraprofessional Experience
A,W,Su. 1 cr. Lab. Maximum 4 cr.
PREREQUISITE: HEc 170.

Participation in and/or observation in a work situation related to career choice.

HEc 280 Special Topics
On demand. 1-4 cr. Maximum of HEc 280 plus 480, 16 cr.

Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

HEc 314 Flat Pattern Design
A,4 cr. Lect. 1; Lab. 3.
PREREQUISITE: HEc 219.

Theory and application of flat pattern design principles in garment construction; application of fitting principles to achieve individual fit.

HEc 315 Fashion Illustration and Design
W alternate years, will be offered W 1987. 3 cr. Lect. 1; Lab. 2.
PREREQUISITE: HEc 130 or Art 101 or Art 110.

Creative approach to the study of clothing through fashion drawing and design. Practice in drawing the fashion figure, illustrating garment detail and various fabrics through a variety of media, and applying knowledge to an area of special interest.

HEc 316 Visual Merchandising
W 3 cr. Lect.
PREREQUISITES: HEc 150, 211.

The relationship of visual merchandising to the image and environment of the store. Planning effective displays, fashion shows, special events and fashion publicity.

HEc 317 Behavioral Science Aspects of Clothing
W 3 cr. Lect.
PREREQUISITES: Soc 101 or Psy 103 or Anth 204.

Application of concepts from cultural anthropology, economics, psychology and sociology to the study of clothing and personal appearance.

HEc 318 Weaving II
S alternate years, will be offered S 1987. 3 cr. Lect. 1; Lab. 2.
PREREQUISITE: HEc 218.

In-depth study and weaving of multiple harness weaves.

HEc 321 Nutrition and the Human Life Cycle
A,4 cr. Lect.
PREREQUISITE: HEc 221.

Factors influencing food intake; nutritional assessment of normal populations; specialized needs of individuals throughout the normal human life cycle (infancy through geriatric).

HEc 322 Food Systems: Production
W 4 cr. Lect. 2; Lab. 2.
PREREQUISITES: HEc 227, 271 and 333.

Principles of quantity food production that include menu development, recipe standardization, food preparation, cost control, consumer acceptance studies, equipment evaluation, work flow and product evaluation.

HEc 323 Food Systems: Production Experience
A,W,4 cr. Lect. 3; Lab. 1.

Principles of institutional procurement for food and equipment. Develop policies, product specifications and purchase orders.

HEc 325 Food Systems: Management
S alternate years, will be offered S 1987. 4 cr. Lect.
PREREQUISITE: HEc 322. 1 & ME 131 or Mgmt 340.

Principles of management and organization principles in food service: communications, labor unions, decision making, hiring and firing. Occupational goals, policies and procedures, training programs, and position descriptions.

HEc 327 Food Science II
S alternate years, will be offered S 1987. 4 cr. Lect. 2; Lab. 2.
PREREQUISITES: Chem 134 or 273, HEc 227 and 371, Stat 216.

Composition, structure and other properties of water-, carbohydrate- and lipid-containing foods as they relate to chemical reactions and physical processes resulting from various treatments. Some group experimentation.

HEc 333 Household Equipment
A,S. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: HEc 138.

Factors which influence the selection and use of household appliances including characteristics of materials and construction, energy use, and trends in equipment.

HEc 335 Home Furnishings
A,S. 3 cr. Lect.
PREREQUISITES: HEc 215; HEc 150 or Art 110.

Interior design factors influencing selection; arrangement and combination of furnishings to derive the greatest satisfaction from home environment.

HEc 337 Family and Household Management
W alternate years, will be offered W 1987, 5 alternate years, will be offered S 1988. 4 cr. Lect. 2; Lab. 2.
PREREQUISITE: HEc 138 or 230.

Family resource management theory, the planning and management of human resources/time to accomplish personal family goals in daily life.

HEc 350 Early Childhood Classroom Management
A,4 cr. Lect. 2; Lab. 1.
PREREQUISITES: HEc 155 and 271 (Child Development section).

Philosophy, ethics, physical environment, teaching methods, guidance principles, self-concept, and management in an early childhood classroom.

HEc 355 Curriculum for Early Childhood
W 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: HEc 350.

Development of a comprehensive curriculum file focusing on the development of the whole child with a learning center approach. Lab experience in planning, presentation and evaluation of small group activities in an early childhood classroom.

HEc 356 Introduction to Exceptional Children
W,Su. 3 cr. Lect.
PREREQUISITE: HEc 151 or 155 or 255.

History, legal requirements and prevention of handicapping conditions; attitudes about handicaps. Survey of categories of exceptionality in childhood.

HEc 357 Exceptional Children Laboratory
A,W,S. 2 cr. Lab.
PREREQUISITE: HEc 356 (HEc 356 may be taken concurrently with HEc 357).

Direct experience with children with special needs.

HEc 371 Research Methods in Home Economics
A,S. 3 cr. Lect.
PREREQUISITE: HEc 120 or 216 or Psy 203.

Applied and basic research principles and application to solution of home economics problems. Emphasis on types of research design and preparation of a research proposal.

HEc 372 Home Economics Public Affairs
S. 3 cr. Lect. 2; Lab. 1.
PREREQUISITES: HEc 138 and 271.

Synthesis of home economics public affairs strategies to achieve coordination in planning, developing, presenting and validating home economics information.
HEC 400 Senior Seminar
PREREQUISITE: Senior standing.
Problems and concerns related to the home economics profession.

HEC 413 Fashion Merchandising I
A. 3 cr. Lect.
PREREQUISITE: HEC 211.
Organizational structure of fashion retail operations, focusing on merchandising and managerial knowledge and skills needed to make decisions. Understanding the techniques of merchandising fashion products through visual presentations.

HEC 414 Fashion Merchandising II
W. 2 cr. Lect.
PREREQUISITE: HEC 413.
The quantitative and qualitative planning and control methods used in the procurement of fashion products to provide a background for evaluating fashion merchandising efforts.

HEC 416 Tailoring
W. 5 cr. Lect. 1; Lab. 2.
PREREQUISITE: HEC 219.
Principles and procedures of tailoring applied to garment construction.

HEC 419 History of Costume
W alternate years, will be offered W 1988. 3 cr. Lect.
PREREQUISITE: HEC 215 or 317.
A chronological study of costume and textiles from ancient civilization to modern times, with consideration of cultural forces that affected that development.

HEC 421 Physiological Nutrition I
W alternate years, will be offered W 1987. 4 cr. Lect.
PREREQUISITES: Biol 211, Chem 211, and HEC 321.
Digestion, absorption and metabolism of proteins, carbohydrates and lipids with reference to specialized cellular functions, energy metabolism, protein and amino acid requirements, and evaluation of protein quality.

HEC 422 Physiological Nutrition II
W alternate years, will be offered W 1988. 4 cr. Lect.
PREREQUISITES: Biol 211, Chem 211, and HEC 321.
Human requirements and biological functions of vitamins and minerals, including body composition, water and electrolyte balance.

HEC 427 Food Science III
S alternate years, will be offered S 1987. 4 cr. Lect. 2; Lab. 2.
PREREQUISITES: Chem 134 or 273, HEC 327 and 371.
Composition, structure and other properties of protein-containing foods as they relate to chemical reactions and physical processes resulting from various treatments. Some group and/or individual experimentation.

HEC 428 Diet and Disease I
W alternate years, will be offered W 1988. 4 cr. Lect. 3; Lab. 1.
PREREQUISITES: HEC 321; HEC 421 or 422; Chem 211. (Prerequisites may be taken concurrently with HEC 428.)
Changes in nutrient requirements in the disease process. Special emphasis on nutritional assessment, nutrient-drug interactions, enteral and parenteral nutrition, fever, trauma, counseling techniques and the study of appropriate medical terminology.

HEC 429 Diet and Disease II
S alternate years, will be offered S 1988. 4 cr. Lect. 3; Lab. 1.
PREREQUISITES: HEC 428, Chem 212.
Metabolic changes, nutrient requirements and the planning of therapeutic diets for the following conditions: diabetes; anemia; allergies; hepatic, metabolic and endocrine disorders; neuromuscular disorders; cancer; and cardiovascular and renal disorders.

HEC 433 Family Housing Plans
S. 1 cr. Rec-Dis.
PREREQUISITES: HEC 130, 233 and 333.
Evaluation of design components of house plans related to household needs and family preferences.

HEC 440 Program Analysis and Design in Home Economics
S. 4 cr. Lect.
PREREQUISITE: Junior standing.
Design of curriculum and instructional materials for home economics programs at the elementary, secondary and postsecondary levels. Attention to evaluation, career education, budgeting and planning, and multicultural and special needs.

HEC 441 Field Experience Consultation
PREREQUISITE OR COREQUISITE: HEC 472 or Edsd 410 and 411, senior standing. Pass/fail grading only.
Analysis and evaluation of home economics field experiences.

HEC 444 Strategies and Skills for Working with Adults
A,W. 4 cr. Rec.-Dis. 2; Lab. 2.
PREREQUISITE: Edsd 208 or HEC 268 or Psy 103.
Plan, present and evaluate programs for adults based on their needs, interests, characteristics and on the psychological principles of adult learning.

HEC 446 Occupational Home Economics Programs
S,Su on demand. 4 cr. Lect.
PREREQUISITE: Edsd 559.
Philosophy and organization of occupational education programs. Planning and coordinating on-the-job work experience and related class instruction. Integrating FHA/HERO and 4-H into the home economics program.

HEC 447 Family Relations Education: Content and Methods
W. 4 cr. Lect. 2; Rec.-Dis. 2.
PREREQUISITES: HEC 155 and 265.
Content and methods for family life education including human development and child development programs in the public schools.

HEC 451 Parent-Infant Relations
A. 3 cr. Lect. 2; Rec.-Dis. 1.
PREREQUISITE: HEC 151 or 155.
Skills necessary for effective parent-infant relations; organizing and providing services for infants; referral to community support groups.

HEC 454 Practicum in Early Childhood Teaching
PREREQUISITES: HEC 355.
Participation and teaching in programs for young children; preparation of lesson plans and structured learning centers; supervised experience under direction of experienced professional.

HEC 455 Administration of Early Childhood Centers
S. 4 cr. Lect. 3; Lab. 1.
PREREQUISITES: HEC 355.
Skills for establishing and administering various types of centers for preschool children.

HEC 458 Assessment of Special Needs in Early Childhood
A. 4 cr. Lect. 3; Rec.-Dis. 1.
PREREQUISITES: HEC 356 and 357.
Models of assessment (formal and informal assessment techniques), assessment instruments for use with young children, interpretation of test results, educational goal-setting.

HEC 459 Intervention Strategies in Early Childhood
W. 4 cr. Lect. 3; Rec.-Dis. 1.
PREREQUISITE: HEC 458.
Designing and implementing early intervention programs for preventing and/or ameliorating developmental delays. Focus on program models, special techniques and resources, and working with parents of handicapped children.

HEC 460 Issues in Family Relations
S. 3 cr. Sem.
PREREQUISITE: HEC 263 or Soc 314; HEC 371.
Evaluation of current family relations issues and research with emphasis on integration, synthesis and application.

HEC 463 Family Communication Patterns
A alternate years, will be offered A 1986. 3 cr. Lect.
PREREQUISITES: HEC 163, 265; Soc 314 recommended.
Events likely to occur in families and the kinds of interactions they may precipitate; investigation of strategies to improve family communication.

HEC 465 The Middle and Later Adult Years
W. 3 cr. Lect.
PREREQUISITE: HEC 165; Psy 321 recommended.
A survey of the problems and concerns confronting older adults; development of strategies and skills for dealing with them in applied real life situations.

HEC 468 Individual and Family Crisis
A. 3 cr. Rec.-Dis.
PREREQUISITE: HEC 263 or Soc 314.
Crisis theory; crisis intervention techniques; normative crises in human development and catastrophic crises. Emphasis on crisis intervention with individuals and families.

HEC 470 Individual Problems
PREREQUISITES: Consent of instructor and department head.
Directed study and research on an individual basis. Application forms for consent are available in department office. Application must be filed during preregistration.

HEC 472 Field Experience in Home Economics
PREREQUISITES: Senior standing, HEC 271.
Application of knowledge and skills from professional preparation by direct experience in a home economics field.

HEC 476 Career Internship in Home Economics
A,W,Su. 1-12 cr. Lab.
PREREQUISITES: HEC 271, junior or senior standing. Consent of instructor and department head.
Structured work experience under supervision in a professional setting in one's chosen field for 8-12 weeks.

HEC 480 Special Topics
On demand. 1-4 cr. Maximum of HEC 280 plus 480, 16 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Graduate Courses in Home Economics

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

HEC 500 Seminar
Problems, concerns and issues related to the home economics profession.
HEc 521 Metabolic Roles of Nutrients
A alternate years, will be offered A 1986. 4 cr. Lect.
Homeostatic integration of the macro and micro-nutrients in the human cell and in various organ systems.

HEc 522 Nutrition Education
S alternate years, will be offered S 1988. 4 cr. Rec.Dis.
PREREQUISITES: HEc 521 and graduate standing.
Materials, techniques and factors in human nutrition education for groups of varying ages, sizes and educational levels in and out of the classroom.

HEc 526 Nutrition
A alternate years, will be offered A 1987. 4 cr. Lect.
PREREQUISITE: Chem 441. COREQUISITE: Chem 442.
Human nutrition directed toward maintaining optimum health; nutritional needs and problems from prenatal period through old age, including aspects of therapeutic nutrition.

HEc 545 Supervision in Home Economics Programs
On demand. 3 cr. Rec.Dis.
PREREQUISITES: Graduate standing and one year professional experience.
Objectives, techniques and personal skills for supervising student teachers, district programs or state programs.

HEc 554 Theories of Human Development
W alternate years, will be offered W 1986. 4 cr. Rec.Dis.
PREREQUISITES: HEc 255 and 371.
Classical and contemporary theories in human development. Emphasis on psychoanalytic theory, psycho-social theory, learning theory, social learning theory, cognitive development approach and Werner's developmental point of view.

HEc 555 Perspectives in Child Development
S alternate years, will be offered S 1987. 3 cr. Rec.Dis.
PREREQUISITES: HEc 155, 255, and graduate standing.
Current issues and trends in field of child development and early childhood education.

HEc 560 Human Development: Gender Roles and Identity
A alternate years, will be offered A 1987. 3 cr. Rec.Dis.
PREREQUISITES: HEc 265 and 460 or 468 or Soc 314.
Influences of socialization and heredity on social, emotional and intellectual development; socialization explanations for cross-cultural patterns, particularly those related to gender differentiation.

HEc 561 Family Interaction Patterns
S alternate years, will be offered S 1987. 3 cr. Rec.Dis.
PREREQUISITE: HEc 265 or Soc 314.
Theories of family interaction including marital, parent-child and sibling relationships. Emphasis on analysis of family communication, problem-solving, intimacy, etc. Cultural and racial differences in family interaction patterns.

HEc 563 Courtship, Marriage and Family Relations
W alternate years, will be offered W 1987. 3 cr. Rec.Dis.
PREREQUISITES: HEc 263 and one of the following courses: HEc 460, 465, 468.
Application of social choice theory in courtship, marriage, and family relations. Exploration of American ethnic families, their differences, and their integration into the larger culture.

HEc 564 Developmental Psychopathology
S alternate years, will be offered S 1987. 4 cr. Rec.Dis.
PREREQUISITE: HEc 554 or 555.
PRE- or COREQUISITES: EdFd 501 or P&S 418, and EdFd 506 or Psy 431 or ABIE 506.
Developmental roots of mental disorders and family dysfunction. Topics include disorders of childhood, adolescence and adulthood and appropriate intervention strategies.

HEc 565 Divorce and Remarriage
Su. 3 cr. Rec.Dis.
PREREQUISITES: HEc 263, 468, graduate standing.
The developmental process of marital dissolution from marital disenchantment and dissatisfaction to divorce; factors affecting adjustment; effects of divorce, single-parenting and remarriage on emotional and social lives of adults and children; therapeutic helping skills for emotional trauma and the adjustment process.

HEc 567 Aging: The Individual and Family
S alternate years, will be offered S 1988. 3 cr. Rec.Dis.
PREREQUISITE: HEc 460 and graduate standing.
Research methodology, theoretical approaches, and behavioral processes in the integration of life transitions within a lifespan perspective.

HEc 568 Marriage and Family Therapy
PREREQUISITE: HEc 468.
Theories and approaches to marriage, family and sex therapy. Examination of outcome studies in marriage and family therapy.

HEc 569 Dysfunctional Families
S alternate years, will be offered S 1988. 4 cr. Rec.Dis.
PREREQUISITES: HEc 561 and 568.
Family dysfunctions and interventions and counseling strategies useful in treating these dysfunctions from a family systems perspective. Topics include the alcoholic family, sexual dysfunctions and spouse and child abuse.

HEc 570 Individual Problems
A.W.Su. 1-4 cr. Ind. St. Maximum 4 cr.
PREREQUISITES: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies.
Directed research and study on an individual basis. To obtain consent of instructor and department, application forms are available in the home economics office; these must be submitted during preregistration. Signature forms for the approval of the department head and dean are available at the graduate office.

HEc 572 Professional Practical
A.W.Su. 2-8 Lab. Maximum 12 cr.
PREREQUISITE: Master's standing and approval of department head.

HEc 575 Professional Paper
A.W.Su. 1-6 cr. Ind. St. Maximum 6 cr.
PREREQUISITES: EdFd 506 and HEc 500.
Preparation of a professional paper on a home economics topic mutually agreed upon by student and committee.

HEc 576 Internship
A.W.Su. 1-12 cr. Ind. St. Maximum 12 cr.
PREREQUISITES: Graduate standing and approval of department head.

HEc 580 Special Topics
On demand, 1-4 cr. Maximum 12 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

HEc 589 Graduate Consultation
A.W.Su. 3 cr. Tut.
PREREQUISITES: Master's standing and approval of the Dean of Graduate Studies.
This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) for a Master's degree but who need additional faculty help or time.

HEc 590 Master's Thesis
A.W.Su. 3-12 cr. Ind. St. May be repeated.
PREREQUISITE: Master's standing.

Humanities
Department of History and Philosophy
994-4395
Hum 201 Citizen, Self and the State: The Western Tradition
A. 4 cr. Lect.
Introduces students to some of the classic texts in the western tradition, the historical context in which they were written and the characteristic methods used to interpret them.
Hum 202 Self-Discovery and Society in England, France and Italy during the Renaissance
W. 4 cr. Lect.
An introduction to Renaissance literature concentrating on the new concern with the value of the individual human being and the potential for human self-discovery and self-knowledge.
Hum 203 Passage to Modernity: Western European Society and Culture in an Age of Transition
S. 4 cr. Lect.
An introduction to the interplay and conflicts between nineteenth century romanticism, positivism and modernism as reflected in literature, music and art.

Industrial Arts
Department of Agricultural and Industrial Education
994-3201
Head of Department: Dr. M.L. Amberson.
Associate Professor: K.L. Bruzelbich.
Assistant Professors: J.L. Roiter, C.V. Shelhamer.
Instructors: J.E. Wheatley.
IA 108 Automotive Ownership
A.S. 2 cr. Lect.
A consumer oriented information class which acquaints individuals with how automobile components function, typical service requirements, guidelines for purchasing a new or used automobile and includes mechanical safety.
IA 200 Seminar
A.S. 2 cr. Sem.
Broad concepts of industry and technology in our society, career opportunities and history of the field.
IA 202 Power and Energy Technology
A. 5 cr. Lect. 2; Lab. 1.
Energy forms, energy sources, current and projected use, conversion systems, storage and consumption of energy in U.S. Alternative energy sources and consumer demands.
IA 203 Design Practices
W, S. 3 cr. Lect. 2; Lab. 1.
PREREQUISITE: ME 111 recommended.
Instruction and experience in the application of design fundamentals and principles to selected design problems. Includes: design organization, considerations, analysis and presentation techniques.

IA 204 Materials and Processes
A,W,Su. 2 cr. Lect. 1; Lab. 1.
Selection, use, and capabilities of a variety of industrial tools, machines, materials and processes.

IA 205 Woodworking Technology I
A. 4 cr. Lect. 2; Lab. 2.
PREREQUISITE: IA 204.
Problems, techniques and procedures applicable to the use of hand and power tools with the use of wood as a construction material.

IA 206 Woodworking Technology II
W. 4 cr. Lect. 2; Lab. 2.
PREREQUISITE: IA 205.
An advanced study of separating, combining and forming of wood and wood products.

IA 207 Product Finishing
On demand. 3 cr. Lect. 1; Lab. 2.
Research and experimentation into the materials and practices used to finish and refresh the surfaces of industrial products.

IA 208 Metals Fabrication I
A,W 4 cr. Lect. 1; Lab. 3.
PREREQUISITE: IA 204.
Development of basic metalworking skills for industrial arts or vocational agriculture teachers. Included are properties and characteristics, correct materials handling and selection. Foundry, forging and bench metal fabricating and heat treat operations are covered.

IA 210 Basic Graphic Arts
A,Su on demand. 3 cr. Lect. 1; Lab. 2.
Introduction to graphic arts technology, printing processes, type and typesetting, copy preparation, stripping and imposition, plate making, printing and binding.

IA 220 Computer Graphics Design
S. 3 cr. Lect. 1; Lab. 2.
This course is user oriented and provides experience in the operation and application of computer graphics hardware and software. Hardware devices include a variety of input and output devices. Software addresses applications which include: chart/graphics, technical drawings/illustrations, and free form graphics.

IA 234 Fundamentals of Electricity
A,W 4 cr. Lect. 2; Lab. 2.
Basic electrical theory. Relationship of electricity and magnetism. Lab practice with test instruments. Design and construction of electrical projects suitable for use at secondary school level. NEC requirements.

IA 250T Technology and Society
W. 4 cr. Lect.
The major technological periods, inventions and innovations that have altered the course of humanity and their impact on the civilization process.

IA 280 Special Topics
On demand. 1-4 cr. Lect. Maximum 12 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

IA 302 Foundations of Industrial Education
W. 2 cr. Lect.
Philosophical base for industrial/technology education programs in the public schools and its effect upon curriculum strategies and laboratory organization and management.

IA 305 Construction Practices I
A. 4 cr. Lect. 2; Lab. 2.
PREREQUISITE: IA 204.
The application of practical carpentry as a training medium to acquaint the student with estimating, concrete form work, placing concrete, common framing practices, and installation of siding and shingles.

IA 306 Construction Practices II
W. 4 cr. Lect. 2; Lab. 2.
PREREQUISITE: IA 305.
The knowledge and skills needed to install doors, windows, insulation, interior wall coverings, the finished floor and other finish carpentry jobs.

IA 311 Power Mechanics
A. 5 cr. Lect. 3; Lab. 2.
Power from internal combustion engines including history, design, application and economy. The various engine systems are studied. Lab activity includes operation, maintenance, service and repair of engines.

IA 312 Transmission of Power
W. 4 cr. Lect. 2; Lab. 2.
Power transmission systems including belt, chain, gear, hydraulic and pneumatic. Design and application of systems are discussed. Lab includes servicing, adjusting and repairing of system components.

IA 313 Fuel and Electrical Systems
S. 4 cr. Lect. 2; Lab. 2.
A study of fuel, electrical and emission control devices found on modern engines. Laboratory activities will deal with testing components and minor adjustments for economy and performance.

IA 317 Technical Woodworking
W. 4 cr. Lect. 1; Lab. 3.
PREREQUISITE: IA 206.
An advanced course designed to give the student knowledge of the problems, techniques and procedures applicable to the more technical methods used in the manufacture of wood products.

IA 320 Sheet Metal
W. 3 cr. Lect. 1; Lab. 2.
PREREQUISITE: IA 204.
Layout and construction with various sheet materials, emphasizing sheet metal construction. Materials handling, layout techniques, properties and fabrication limitations are emphasized.

IA 335 Introduction to Electronics
S. 4 cr. Lect. 2; Lab. 2.
PREREQUISITE: IA 234
Types, characteristics and operation of electronic tubes and semiconductors, basic rectifiers, amplifiers, oscillator and associated circuits. Lab includes assembling, testing and repair of electronic devices.

IA 336 Electric Motors and Controls
W. 4 cr. Lect. 2; Lab. 2.
PREREQUISITE: IA 234
Basic knowledge of electric motors and the prevalent methods of motor control. The student will develop skills relating to the problems inherent to electric power and control. For IA majors and industries option students.

IA 400 Seminar
A,S 1-2 cr. Sem.
PREREQUISITE: Seniors in the teaching option.
For seniors who have completed student teaching. Topics such as teaching philosophy, program planning, community needs, resources and major problems encountered while teaching will be discussed.

IA 405 Industrial Plastics Technology
Su on demand. 4 cr. Lect. 2; Lab. 2.
PREREQUISITE: IA 204.
Materials and practices used to produce industrial plastic products. Experience in both mold design and production is provided.

IA 406 (AEd 406) Program Development for Agricultural and Industrial Arts Teachers
W,S. 4 cr. Lect.
PREREQUISITES: EdSd 410, 411 and 413.
Determining appropriate industrial arts and vocational curriculum based on an analysis of student and community needs. Organizing subject matter materials and laboratory resources to promote effective teaching and learning. The organization and administration of school laboratories is also included.

IA 408 Supervision and Teaching Practice
A,W,S. 1-3 cr. Lab.
PREREQUISITE: INS 552.
For students who want additional student contact prior to their formal student teaching experience. Experience in organization and laboratory supervision will be provided.

IA 409 Metals Fabrication II
S. 4 cr. Lect. 1; Lab. 3.
PREREQUISITE: IA 208.
Advanced experience in metals fabrication. Basic metal machining principles and practices with stress on individual project design, fabrication techniques, industrial processes and craftsmanship.

IA 411 Machine Tool Maintenance
S. 4 cr. Lect. 1; Lab. 3.
PREREQUISITES: IA 206 and 208.
Selecting, ordering, maintaining and repairing tools and machines used in material processing.

IA 417 Mass Production Methods and Practices
S. 4 cr. Lect. 1; Lab. 3.
PREREQUISITES: IA 206, 208 and 234.
Mass production and assembly line concepts common to industry, including the stages of initial planning, prototype construction, market research and analysis, jig and fixture construction, trial production run, inspections, finishing and packaging.

IA 420 Advanced Laboratory Techniques for I A Teachers
On demand. 1-3 cr. Lect.
Developing advanced knowledge and skills in constructing lab apparatus, instructional methods and new technology. Involves current technologies and their application to teaching industrial arts.

IA 470 Individual Problems
A,W,Su. 1-3 cr. Ind. St. Maximum 6 cr.
PREREQUISITE: Consent of department head.
Directed study on an individual basis. During the first week of the quarter, the student must prepare an outline of the tasks to be accomplished and present it for approval to the staff member with whom the student wishes to work.

IA 480 Special Topics
On demand. 1-4 cr. Lect. Maximum 12 cr.
Developing advanced knowledge in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Graduate Courses in Industrial Arts

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

IA 500 Seminar
On demand. 1 cr. Sem. Maximum 6 cr.
Discussion of current classroom problems and procedures that confront industrial arts teachers. Topics will vary with interest of students and staff.
Industrial and Management Engineering

IA 501 Trends and Issues in Industrial Arts Education
A on demand, Su on demand. 3 cr. Lect.
PREREQUISITES: Graduate standing and one year teaching experience.
National trends and issues in industrial arts/technology education and their implications for program development at the local and state level.

IA 570 Individual Problems
PREREQUISITES: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies.
Directed study on an individual basis. Student must present, the first week of quarter, a written proposal on nature of work to staff member with whom he or she plans to work.

IA 576 Internship
A,W,S,Su. 1-6 cr. Ind. St.
PREREQUISITES: Graduate standing, consent of department head and dean of college.
An opportunity for students to gain understanding and skills through experience in a selected field. Each program is cooperatively planned and supervised by the local employer and the department. Student arrange program individually through staff.

IA 580 Special Topics
On demand. 1-4 cr. Maximum 12 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

IA 589 Graduate Consultation
A,W,S,Su. 3 cr. Tut.
PREREQUISITES: Master's standing and approval of the Dean of Graduate Studies.
This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) for a master's degree but who need additional faculty help or time.

IA 590 Master's Thesis
A,W,S,Su. 3-12 cr. Ind. St. May be repeated.
PREREQUISITE: Master's standing.

IDME 201 Professional Practice
A,W,S,Su. 3 cr. Lect. Must be taken in sequence.
One of a series of courses for I&M&E students who are following the special cooperative education program. Completion of the series of six courses will qualify the student for a co-op certificate.

IA 202 Professional Practice
A,W,S,Su. 3 cr. Lect. Must be taken in sequence.
One of a series of courses for students in industrial and management engineering who are following the special cooperative education program. Completion of the series of six courses will qualify the student for a co-op certificate.

IA 203 Professional Practice
A,W,S,Su. 3 cr. Lect.
One of a series of courses for I&M&E students who are following the special cooperative education program. Completion of the series of six courses will qualify the student for a co-op certificate.

IA 271 Industrial Computation
W. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: CS 154 and 172.
Typical industrial engineering applications are used to teach sound systems design and implementation concepts. The BASIC and FORTRAN languages will be used.

IA 280 Special Topics
On demand. 1-3 Maximum 16 cr. Maximum of I&M&E 280 plus I&M&E 480, 16 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

IA 301 Seminar
S. 1 cr. Sem.
Transition to professional engineering practice. Career planning, ethics, communications, job interviewing and related professional topics.

IA 304 Professional Practice
A,W,S,Su. 3 cr. Lect.
PREREQUISITE: I&M&E 303.
One of a series of courses for I&M&E students who are following the special cooperative education program. Completion of the series of six courses will qualify the student for a co-op certificate.

IA 305 Professional Practice
A,W,S,Su. 3 cr. Lect.
PREREQUISITE: I&M&E 304.
One of a series of courses for I&M&E students who are following the special cooperative education program. Completion of the series of six courses will qualify the student for a co-op certificate.

IA 306 Professional Practice
A,W,S,Su. 3 cr. Lect.
PREREQUISITE: I&M&E 305.
One of a series of courses for I&M&E students who are following the special cooperative education program. Completion of the series of six courses will qualify the student for a co-op certificate.

IA 313 Methods and Standards
W. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: Junior standing.
Methods of study and work measurement for improved cost effectiveness and system optimization as related to human factors and man-machine systems. Operations analysis, process flow, motion study, time study, synthetic standards, work sampling and wage payment plans.

IA 325 Engineering Economy
A,W,S,Su. 4 cr. Lect.
PREREQUISITE: Junior standing.
The generation of alternatives and methods for their comparison. Concepts include the time value of money, rates of return, annual cost, annual worth and present worth comparisons, influences of taxes and replacement analysis.

IA 331 Law for Engineers and Architects
A,W. 4 cr. Lect.
PREREQUISITE: Junior standing.
Review of courts, contracts, doctrine of agency and independent contractor; b) nuns of organization, real property and water law; tort and product liability; malpractice, industrial accident law; patents, copyrights and trade secrets, preventive law in technology.

IA 354 Engineering Statistics
A,W,S,Su. 4 cr. Lect.
PREREQUISITES: Math 185 and junior standing.
Emphasis on techniques for collecting, organizing and interpreting data for engineering problems. Topics constitute a complete course in the application of fundamental statistical principles for engineering and science students.

IA 356 Probability in Engineering
A. 4 cr. Lect.
PREREQUISITES: Math 185 and junior standing.
Primarily for I&M&E majors. Discrete and continuous probability distributions and their use in I&M&E. Topics include the collecting, organizing and use of engineering data.

IA 357 Variation in Engineering Data
W. 4 cr. Lect.
PREREQUISITE: I&M&E 356.
Identification, characterization and analysis of variation in engineering data. Includes applications of non-parametric statistics, curve fitting and the design of engineering experiments.

IA 364 Linear Programming in Operations Research
A,S. 4 cr. Lect.
PREREQUISITE: Math 221 or 224.
Linear programming techniques for management systems and decision making: allocation, transportation, assignment, integer; and networks including PERT/CMP.

IA 365 Nonlinear Programming in Operations Research
W. 4 cr. Lect.
PREREQUISITE: Math 221 or 224.
In-depth study of nonlinear programming techniques for management systems and decision making: combinatorial analysis, nonlinear programming with primal-dual emphasis, and dynamic programming.

IA 366 Statistical Applications in Operations Research
S. 4 cr. Lect.
PREREQUISITES: Math 221 or 224, I&M&E 354 or 356. Probabilistic models for management systems and decision making: Markov chain, inventory, queuing, and Monte Carlo simulation.

IA 373 Production Cost Analysis
A,W. 4 cr. Lect.
PREREQUISITE: Junior standing.
Industial cost accounting processes and cost estimation; tools used in the cost analysis of industrial processes, economic decision making and cost control.

IA 425 Managerial Economy
A. 4 cr. Lect.
PREREQUISITES: I&M&E 325 and CS 172.
In-depth study of industrial practices in decision making. Specific emphasis upon discounted cash
I&ME 433 Human Relations in Industry
A.W.S.Su. 4 cr. Lect.
PREREQUISITE: Junior standing.
Physical and psychological characteristics and limitations of humans at work. Improvement of productivity through motivation and control of the human element; organization theory; communication and control.

I&ME 434 Principles of Engineering Management
S. 4 cr. Lect.
PREREQUISITE: Junior standing.
Managerial functions applicable to technical and engineering situations. Planning and control to achieve goals of engineering management.

I&ME 443 Facilities Planning and Design
W. 4 cr. Lect.
PREREQUISITE: I&ME 475.
Principles and techniques of planning and designing production facilities. Plant layout from the traditional standpoint, computer-aided design and mathematical models, plant location and material handling systems.

I&ME 444 Senior Design Project
S. 4 cr. Lect.; Lab. 1
PREREQUISITES: I&ME 313, 443 and 475.
Review of industrial and management engineering centered around the senior design project; an in-depth facility analysis and other topics depending on the interests and needs of the students.

I&ME 470 Individual Problems
A.W.S.Su. 1-5 cr. Ind. St. Maximum 6 cr.
PREREQUISITES: Consent of instructor and department.
Directed research and study on an individual basis.

I&ME 471 Computerized Production Systems
A. 4 cr. Lect.; Lab. 1
PREREQUISITE: I&ME 271.
Microprocessors and their applications to computer-aided manufacturing systems. Programming, computer architecture, sensing and scanning devices, process control, and automation.

I&ME 472 Manufacturing Systems Simulation
W. 4 cr. Lect.
PREREQUISITES: Senior standing, I&ME 354 or 356.
Basic properties of manufacturing systems and flow chart analyses; simulation of manufacturing systems for identifying production bottlenecks, evaluating alternative layouts, considering work load leveling, determining manufacturing and materials handling costs.

I&ME 474 Production Planning and Control
A.W.S.Su. 4 cr. Lect.
PREREQUISITE: Junior standing.
Methods of production management; design of production systems and related subjects of planning and control such as inventory, forecasting, scheduling, quality economic analysis, and plant location and layout. For non-I&ME majors only.

I&ME 475 Management Control Systems
A. 4 cr. Lect.
PREREQUISITE: I&ME 356.
Analysis and design of consistent and integrated control systems; production planning and control, inventory control, quality control, classical production optimization problems and production simulation.

I&ME 477 Quality Assurance in Organizations
S. 4 cr. Lect.
PREREQUISITE: I&ME 356.
Statistical and non-statistical aspects of quality assurance program; quality costs, education and training of employees, reliability costs and organization, life testing, fatigue studies and selected statistical quality control topics.

I&ME 480 Special Topics
On demand. 1-6 cr. Lect. Maximum 12 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Graduate Courses in Industrial and Management Engineering

I&ME 501 Development of Mathematical Planning Models
A. 4 cr. Lect.
PREREQUISITE: Graduate standing.
Derivation of multi-equation models. Uses macro-to-micro approach. Interactive computer program features tutorial examples, model development and solution, dynamic system response, data base creation and scenario simulation. Useful for resource planning and management.

I&ME 509 Systems Simulation
S.Su. 4 cr. Lect.
PREREQUISITES: CS 154, 172 and I&ME 356.
Systems analysis through simulation utilizing prior computer training; systems are modeled and simulated through use of sampling and statistical techniques. Emphasis on simulation and improvement of existing real-world system.

I&ME 511 Mathematical Programming in Operations Research
Su. 4 cr. Lect.
PREREQUISITE: Math 224 and graduate standing.
Emphasizes problem identification, structuring and solution of linear programming, nonlinear programming and network models. Especially for students who may be called upon to develop and/or implement such models using existing computer programs.

I&ME 513 Factors in Work Design
On demand. 4 cr. Lect.
PREREQUISITE: I&ME 513.
Advanced analysis of work systems leading to their optimal design. The human organism and its physiological limitations; advanced topics in methods engineering and work measurement.

I&ME 525 Economic Analysis of Managerial Decisions
S. 4 cr. Lect.
PREREQUISITE: I&ME 325.
Economic analysis and the decision making process. Emphasis on current literature and the structuring of symbolic models to assist the decision maker.

I&ME 535 Productivity Improvement Systems
On demand. 4 cr. Lect.
PREREQUISITE: I&ME 434.
Use and effectiveness of various systems directed toward productivity improvement. Psychological and sociological background for motivation in the industrial environment.

I&ME 545 Facilities Design, Location and Distribution Systems
On demand. 4 cr. Lect.
PREREQUISITE: I&ME 443.
Analysis and design methodologies related to facilities location and layout, material handling and distribution systems. Both traditional and analytical approaches are covered. Special problem areas are selected for detailed investigation.

I&ME 556 Design of Industrial Experiments
On demand. 4 cr. Lect.
PREREQUISITE: I&ME 356.
Statistical analysis applied to experiments in engineering and industry. Experimental designs and analyses for a wide variety of problems; EVOP and response surface analyses.

I&ME 557 Applied Statistical Decision Theory
S. 4 cr. Lect.
PREREQUISITE: I&ME 356.
Decision making with emphasis on the Bayesian approach using costs and prior probabilities. Utility theory, treatment of sequential and n-stage decision processes and standard statistical methodologies and their application.

I&ME 558 Managerial Forecasting
W. 4 cr. Lect.
PREREQUISITE: I&ME 356.
Time series data (e.g., demand, price, energy consumption, etc.) are analyzed for unique statistical properties. These properties are used to estimate forecast models. Computations are handled by easily accessed state-of-the-art computer programs.

I&ME 567 Optimization Techniques
A. 4 cr. Lect.
PREREQUISITE: I&ME 364.
Fundamental principles of optimization are applied in solving nonlinear programming problems. Methods of mathematical programming in general and the simplex method in particular. General and specific forms of the differential algorithm and geometric programming are methodically illustrated.

I&ME 569 Large Scale Systems
W. 4 cr. Lect.
PREREQUISITE: Graduate standing.
Complex systems structured around the concept of feedback analysis. A multidisciplinary approach intended to serve students with varying backgrounds. Emphasis is upon structuring, communicating and analyzing systems.

I&ME 570 Individual Problems
A.W.S.Su. 1-5 cr. Ind. St. Maximum 9 cr.
PREREQUISITES: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies.
Directed research and study on an individual basis.

I&ME 574 Management Planning and Control Models
On demand. 4 cr. Lect.
PREREQUISITES: I&ME 364, 365 and 366.
Planning and control models to provide a state-of-the-art knowledge: Investment planning models, line-balancing models, maintenance planning and control models, scheduling models and resource allocation models.

I&ME 580 Special Topics
On demand. 1-6 cr. Maximum 12 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

I&ME 589 Graduate Consultation
A.W.S. 3 cr. Tit.
PREREQUISITES: Master's standing and approval of the Dean of Graduate Studies.
This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) for a master's degree but who need additional faculty help or time.

I&ME 590 Master's Thesis
A.W.S. 3-12 cr. Ind. St. May be repeated.
PREREQUISITE: Master's standing.
Intercultural Studies

International Education 995-4031
ICS 280 Special Topics
On demand. 1-5 cr. Maximum 15 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand. These courses must include a significant intercultural focus.

ICS 301-302-303 Intercultural Communication
A; W; S. 3, 3, 3 cr. Lect.
These courses are offered on demand and are normally taken in conjunction with a University study/travel program. Specific content is related to area study or specific country/culture orientation. Students must get approval of a faculty member and meet enrollment requirements for study/travel programs.

ICS 470 Individual Problems
A,W,Su. 1-5 cr. Ind. St. Maximum 6 cr.
PREREQUISITES: Consent of instructor and department head.
Intercultural research and study in intercultural relations on an individual basis to meet a special need of the student's program or the department's interests.

ICS 480 Special Topics
On demand. 1-5 cr. Maximum 15 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Interior Design

School of Architecture 994-4255
See Architecture for faculty listings.

IntD 202 Interior Design I
W. 5 cr. Lect. 1; Rec.-Dis. 1; Lab. 3.
PREREQUISITE: Arch 156.
The spatial, perceptual, and conceptual aspects of interior design as related to both creative and pragmatic small scale environments for human use. Additional emphasis is placed on furniture layouts, color coordination and interior finishes.

IntD 203 Interior Design II
S. 5 cr. Lect. 1; Res.-Dis. 1; Lab. 3.
A comprehensive approach for space planning and designing of residential interior environments. Emphasis on spatial organization, human dimensions, environmental comforts and interior materials.

IntD 304 Interior Design Studio
A,W,S. 5 cr. Lect. 1; Res.-Dis. 1; Lab. 3. Maximum 15 cr.
PREREQUISITES: Art 225, IntD 203.
Office programming and the development of office design solutions for medium and large corporate clients. Store planning methods and the execution of interior design solutions for small to medium scale retail environments. In-depth study of the design criteria and the development of design solutions for small to medium scale hotels and restaurants.

IntD 405 Interior Design Theory and Process
A,W. 5 cr. Lect. 1; Res.-Dis. 1; Lab. 3. Maximum 10 cr.
PREREQUISITE: 15 credits of IntD 304.
Exhibitions/display methods and the development of design solutions for small to large scale exhibits. In-depth study of human factors and the development of design solutions for small to medium scale environments for the elderly, handicapped and children.

IntD 406 Interior Design Senior Project
S. 5 cr. Independent Study
PREREQUISITES: Arch 232, 333, 334 and 10 credits of IntD 405.
An interior design project chosen by the student and subject to the approval of the project coordinator. Special research, information gathering, and programming will be stressed along with the development of a sophisticated conceptual design.

Land Rehabilitation

Department of Animal and Range Sciences 994-3721
Head of Department: A.C. Linton.
Associate Professors: D.J. Dollbooj, F.F. Munsbwer.
Adjunct Assistant Professor: D.R. Neuman.

LReh 401 Applied Surfacial Rehabilitation Methods
W. 4 cr. Lect. 3; Lab. 1.
PREREQUISITES: RaS 306 and 404 (RaS 404 may be taken concurrently).
Applied revegetation methods, including plant materials, seeding and planting methods, fertilization, irrigation, mulching and revegetation strategies. Watershed considerations, including sloping, contouring, surface manipulation and erosion control.

LReh 402 Minesoils and Overburden in Rehabilitation
A. 4 cr. Lect. 3; Lab. 1.
Edaphic and surface considerations associated with rehabilitation, including pre-mining studies, soil-soiling, fertility, soil development, toxic or inimical elements, sampling and analysis procedures, soil amendments, selective handling practices and subsurface hydrology.

LReh 470 Individual Problems
A,W,Su. 1-4 cr. Ind. St. Maximum 6 cr.
PREREQUISITES: Senior standing or consent of instructor and department head.
Directed research and study on an individual basis.

LReh 480 Special Topics
On demand. 1-5 cr. Maximum 15 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Graduate Courses in Land Rehabilitation

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

LReh 500 Seminar
Group discussions of topics of special interest.

LReh 501 Rehabilitation Administration and Policy
A alternate years, will be offered A 1987. 2 cr. Lect.
Current state and federal legislation and regulations concerning land rehabilitation procedures; issues and public attitudes pertaining to rehabilitation.

LReh 502 Rehabilitation Planning and Design
S alternate years, will be offered S 1988. 3 cr. Lect.
PREREQUISITES: LReh 401 and 402.
Integration of preceding coursework into land rehabilitation strategies, pre-planning and baseline studies, post-rehabilitation management, regional planning and relationship of rehabilitation to engineering aspects of mineral extraction.

LReh 503 Rehabilitation Field Problems
Su. 3 cr. Lab.
PREREQUISITES: LReh 401 and 402.
Extended field trip to areas where land rehabilitation is being presently practiced. On-site meetings with rehabilitation professionals in regulatory agencies and industry to discuss current, real problems and progress.

LReh 570 Individual Problems
PREREQUISITES: Graduating standing, consent of instructor, approval of department head and Dean of Graduate Studies.
Directed research and study on an individual basis.

LReh 575 Professional Paper
PREREQUISITE: Graduate standing.
A professional paper written on a land reclamation topic mutually agreed upon by the student and his or her graduate committee.

LReh 580 Special Topics
On demand. 1-4 cr. Maximum 15 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

LReh 589 Graduate Consultation
A,W,Su. 3 cr. Tut.
PREREQUISITES: Master's standing and approval of the Dean of Graduate Studies.
This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) for a master's degree but who need additional faculty help or time.

LReh 590 Master's Thesis
A,W,Su. 3-12 cr. Ind. St. May be repeated.
PREREQUISITE: Master's standing.

Mathematics

Department of Mathematical Sciences 994-3601
Head of Department: Dr. K.J. Tiabtr.


Math 005 Individual Aid in Mathematics
A,W,Su. 1 cr. No university credit. Ind. St. Repeatable.
COREQUISITE: Concurrent enrollment in another mathematics course.
Individual aids in learning mathematics are available to students enrolled in special programs. A variety of special learning techniques will be provided.

Math 010 Numeric Operations
Number systems, basic operations, fractions, decimals, percent, conversions, estimating.
Math 001  Linear Equations
PREREQUISITE: Math 010.
Solving linear equations, graphs, and systems of linear equations.

Math 012  Polynomials and Fractional Equations
PREREQUISITE: Math 011.
Properties of polynomials, multiplication, factoring, complex fractional expressions, solving fractional equations.

Math 019  Basic Geometry
Introduction to fundamental concepts and definitions embodied in Euclidean geometry and the metric system (SI) of measurement.

Math 107  Mathematics for Elementary School Teachers I
A,W. 4 cr. Lect.
An introduction to problem solving, sets and relations and numeration systems as a mathematical structure for prospective elementary teachers.

Math 108M Mathematics for Elementary School Teachers II
W,S. 4 cr. Lect.
PREREQUISITES: Math 107 and 140.
Introductory number theory, rational and irrational numbers, probability and statistics for prospective elementary teachers.

Math 109  Mathematics for Elementary School Teachers III
A,S. 4 cr. Lect.
Geometry from an intuitive approach for prospective elementary school teachers.

Math 140  Exponents and Quadratic Equations
PREREQUISITE: Math 012.
Algebraic skills of exponents, powers, roots, the quadratic formula, and solutions to quadratic equations.

Math 143  Matrices and Determinants
PREREQUISITE: Math 140.
Matrix operations, inverses, determinants and their properties.

Math 144  Exponential and Logarithmic Functions
PREREQUISITE: Math 140.
Logarithmic functions, exponential functions, change of base, their properties, and equations.

Math 145  Conic Sections
PREREQUISITE: Math 140.
Second degree equations and their graphs, ellipses, hyperbolas and parabolas. Systems of second degree polynomials.

Math 146  Series and Sequence
PREREQUISITE: Math 140.
Arithmetic and geometric sequences and series, binomial sequences, monotone sequences and series.

Math 150M Finite Mathematics
A,W,S. 4 cr. Lect.
PREREQUISITE: Math 140.
Decision theory, finance, probability, linear equations, matrices, logic, linear programming.

Math 155M Linear Algebra for Business
A,W,S. 4 cr. Lect.
PREREQUISITE: Math 140.
Set theory, Boolean algebra, vectors, matrix algebra, ratio and index numbers. Course stresses application to business and economics.

Math 165  Trigonometry
A,W,S. 5 cr. Lect. or Prgm. Ins.
PREREQUISITE: Math 140.
Trigonometric functions and identities, solutions of triangles, inverse functions, trigonometric equations, complex numbers. Note: A CLEP exam administered by the Testing Service will, if passed, yield five credits of Math 165 in lieu of taking this course.

Math 170M Survey of Calculus
A,W,Su. 5 cr. Lect.
PREREQUISITE: Math 140.
Calculus with emphasis on applications to natural and social science problems.

Math 175M Calculus for Technology I
W,S. 4 cr. Lect.
PREREQUISITE: Math 165.
Calculus with emphasis on problems of interest to engineers. Includes analytic geometry, derivatives and differentiation.

Math 176M Calculus for Technology II
A,S. 4 cr. Lect.
PREREQUISITE: Math 175.
Calculus with emphasis on problems of interest to engineers. Includes integration, infinite series and differential equations.

Math 181M Calculus and Analytic Geometry I
A,W,S. 4 cr. Lect.
PREREQUISITES: Math 165.
Functions, graphs of functions, operations on functions, limits of functions, continuity of functions, one-sided limits and continuity, limits at infinity, infinite limits, vertical and horizontal asymptotes, derivatives, differentiation formulas, derivatives of trigonometric functions, the chain rule, implicit differentiation, higher derivatives, extrema of functions, the mean value theorem, first and second derivative tests, rectilinear motion, related rates, L'Hopital's rule, definitions and properties of the Riemann integral, the fundamental theorem of calculus, indefinite integrals.

Math 182M Calculus and Analytic Geometry II
A,W,Su. 4 cr. Lect.
PREREQUISITE: Math 181.
The natural logarithm as an integral, improper integrals, planar areas, volumes of solids of rotation, volume as the integral of cross-sectional area, arc length, surface area for surfaces of revolution, inverse functions, exponential functions, exponential growth and decay, separable differential equations, integration by parts, integration of trigonometric polynomials, integration by trigonometric substitution, integration by partial fractions.

Math 183M Calculus and Analytic Geometry III
A,W,Su. 4 cr. Lect.
PREREQUISITE: Math 182.
Cartesian coordinates, graphing in polar coordinates, areas in polar coordinates, parametric equations of plane curves, tangent lines to parametric curves, arc length of parametric curves, parabolas, ellipses, hyperbolas, rotation of axes, polar coordinates, vectors, the dot product, the cross product, planes and lines in space, vector-valued functions, differentiation of vector-valued functions, arc length as parameter, unit tangent and normal vectors, curvature, spatial velocity and acceleration, Newton's and Kepler's laws of motion.

Math 215M Probability
A, 4 cr. Lect.
PREREQUISITE: Math 170 or 183.
Elementary probability. Applications to the social sciences, natural sciences and games. Simple difference equations arising in the social and natural sciences.

Math 225M Calculus and Differential Equations I
A,W,Su. 4 cr. Lect.
PREREQUISITE: Math 183.
Systems of linear equations, matrix algebra, determinants, vector algebra and geometry in Euclidean 3-space, introduction to Euclidean n-space and general vector spaces.

Math 224M Calculus and Differential Equations II
A,W.Su. 4 cr. Lect.
PREREQUISITE: Math 224.
Multiple integration, first order differential equations with applications; vector spaces, linear transformations, and differential operators, determinants.

Math 226 Calculus and Differential Equations III
A,W,Su. 4 cr. Lect.
PREREQUISITE: Math 225.
Higher order differential equations, series solutions, systems of equations, numerical methods, applications of differential equations.

Math 256 Foundations of Abstract Algebra
A,S. 4 cr. Lect.
Equivalence relations, mappings, the rational numbers, introduction to groups, rings, field, integral domains, and polynomials.

Math 280 Special Topics
On demand. 1-6 cr. Maximum of Math 280 plus 480, 16 cr. Lect.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Math 316 Applied Modern Algebra I
A. 4 cr. Lect.
Concepts of modern algebra including an introduction to algebraic systems, Boolean algebras and groups.

Math 317 Applied Modern Algebra II
W. 4 cr. Lect.
PREREQUISITE: Math 316.
Concepts of modern algebra including rings, fields, and polynomials.

Math 330 History of Mathematics
W alternate years, will be offered W 1988. 4 cr. Lect.
PREREQUISITE: Math 165.
Ancient numerical systems and the history of arithmetic, geometry, algebra and trigonometry.

Math 333 Linear Algebra
5-4 cr. Lect.
PREREQUISITE: Math 221.
Vector spaces, inner product spaces, linear transformations and matrices, eigenvalues and eigenvectors, canonical forms.

Math 338 Modern Geometry I
W. 4 cr. Lect.
PREREQUISITE: Math 256.
Euclidean geometry. Primarily for students who teach or expect to teach high school geometry.
Math 339 Modern Geometry II  
S. 4 cr. Lect.  
PREREQUISITE: Math 338.  
Non-Euclidean geometry, 4-dimensional geometry, transformational geometry and coordinate geometry.

Math 348 Applied Mathematics I  
A. 4 cr. Lect.  
PREREQUISITE: Math 226.  

Math 349 Applied Mathematics II  
W. 4 cr. Lect.  
PREREQUISITE: Math 226.  
Boundary value problems, special functions, applications to science and engineering.

Math 350 Applied Mathematics III  
S. 4 cr. Lect.  
PREREQUISITE: Math 226.  
Optimization methods, mathematical programming, variational methods, transform methods, and analysis of systems.

Math 351 Advanced Calculus I  
A. 4 cr. Lect.  
PREREQUISITE: Math 350.  
A rigorous development of calculus. Formal proofs, sequences, limits, continuity, differentiation.

Math 352 Advanced Calculus II  
W. 4 cr. Lect.  
PREREQUISITE: Math 351.  
A rigorous development of integration, differentiation and integration of functions of several variables.

Math 353 Advanced Calculus III  
S. 4 cr. Lect.  
PREREQUISITE: Math 352.  
Line and surface integrals, infinite series, sequences and series of functions, Taylor series, improper integrals.

Math 400 Seminar  
Topics selected from material not covered in regular courses. Students participate in preparing and presenting lectures.

Math 421 Stochastic Processes I  
W. 4 cr. Lect.  
Modeling and analysis of processes in which probability plays a role. Applied probability, games, random walks, Markov chains, Poisson processes.

Math 422 Stochastic Processes II  
S. 4 cr. Lect.  
PREREQUISITE: Math 421.  
More advanced stochastic modeling and analysis, Markov processes, population growth processes.

Math 441 Numerical Analysis I  
A. 4 cr. Lect. 3; Lab. 1.  
PREREQUISITES: Math 226.  
Solution of nonlinear equations, interpolating polynomials, numerical differentiation, numerical integration.

Math 442 Numerical Analysis II  
W. 4 cr. Lect. 3; Lab. 1.  
PREREQUISITE: Math 226.  
Numerical solution of initial value problems in ordinary differential equations, solution of linear systems of equations, curve fitting and approximation of functions.

Math 443 Numerical Analysis III  
S. 4 cr. Lect.  
PREREQUISITE: Math 226.  
Solution of nonlinear systems of equations, numerical solution of boundary value problems in ordinary differential equations, numerical solution of partial differential equations.

Math 444 Theory of Numbers  
W. 4 cr. Lect.  
PREREQUISITE: Math 221 or 225.  
Basic concepts of number theory including divisibility, congruence, prime numbers, Diophantine equations, quadratic reciprocity and number theoretic functions.

Math 445 Combinatorics  
S alternate years, will be offered 1987. 4 cr. Lect.  
Combinatorial analysis including enumeration, existence and applications. Topics include permutations, combinations, binomial and multinomial theorems, inclusion-exclusion principle, recurrence relations, generating functions, coloring problems.

Math 446 Graph Theory  
S alternate years, will be offered 1988. 4 cr. Lect.  
Graph and network theory. Basic properties, paths, circuits, trees, blocks, connectivity, line graphs, transversality, coverings, planarity, colorability, digraphs.

Math 449 Applied Complex Analysis I  
W. 4 cr. Lect.  
PREREQUISITE: Math 226.  
Complex numbers, analytic functions, integration and Cauchy integral theorems, Taylor and Laurent series.

Math 450 Applied Complex Analysis II  
S. 4 cr. Lect.  
PREREQUISITE: Math 449.  
The residue theorem, evaluation of real definite integrals, conformal mappings, applications.

Math 454 Differential Equation Theory I  
A alternate years, will be offered 1986. 4 cr. Lect.  
PREREQUISITE: Math 226.  
Solution of single, and systems of ordinary, differential equations; boundary value problems; applications; existence; uniqueness and continuous dependence.

Math 455 Differential Equation Theory II  
W alternate years, will be offered 1987. 4 cr. Lect.  
PREREQUISITE: Math 226.  
Laplace functions, stability of solutions, first order partial differential equations, existence and uniqueness.

Math 456 Differential Equation Theory III  
S alternate years, will be offered 1987. 4 cr. Lect.  
PREREQUISITE: Math 226.  
Elliptic, parabolic and hyperbolic partial differential equations, canonical forms, existence and uniqueness, applications.

Math 470 Individual Problems  
A,W,S,Su. 1 cr. Ind. St. Maximum 6 cr.  
Directed research and study on an individual basis.

Math 476 Career Internship  
Su. 6-12 cr. Ind. St. Maximum 12 cr.  
PREREQUISITE: Junior standing and approval of department head.  
Students will participate in an internship as employees of industrial or governmental operations. They will engage in mathematical or statistical work under the direct supervision of an experienced individual.

Math 480 Special Topics  
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Graduate Courses in Mathematics  
There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

Math 500 Seminar  
Topics not covered in regular courses. Students participate in preparing and presenting lectures.

Math 501 Topology  
A. 4 cr.  
PREREQUISITE: Math 317, 335 or 353.  

Math 502 Advanced Algebra I  
W. 4 cr. Lect.  
PREREQUISITE: Math 501.  
Integers, elementary group theory, Cayley's theorem, elementary ring theory, Euclidean rings, polynomial rings, rational polynomials, elementary vector space theory, elementary field theory, Galois theory.

Math 503 Advanced Algebra II  
S. 4 cr. Lect.  
PREREQUISITE: Math 502.  

Math 509 Complex Analysis I  
W. 3 cr. Lect.  
PREREQUISITE: Math 353.  
Specific examples of analytic functions, differentiation of elementary functions, contour integrals, Cauchy's Theorem, Cauchy's Integral Formula, Maximum Modulus Theorem.

Math 510 Complex Analysis II  
S. 3 cr. Lect.  
PREREQUISITE: Math 509.  
Convergent series of analytic functions, power series and Taylor's Theorem, Laurent Series, the Residue Theorem, definite integrals, conformal mappings, fractional linear transformations, analytic continuation.

Math 513 Real Analysis I  
A. 3 cr. Lect.  
PREREQUISITE: Math 353.  
Set theory, the real number system, Lebesque measure, Lebesque integral, differentiation and integration.

Math 514 Real Analysis II  
W. 3 cr. Lect.  
PREREQUISITE: Math 513.  
General measure theory and integration, measure and outer measure, mappings of measure spaces, measure and topology.

Math 515 Real Analysis III  
S. 3 cr. Lect.  
PREREQUISITE: Math 514.  
Classical Banach space, Banach Spaces.
Math 523 Modern Algebra for Teachers I
Su alternate years, will be offered Su 1987. 4 cr. Lect.
PREREQUISITES: Graduate standing and teacher certification or teaching experience.

Math 524 Modern Algebra for Teachers II
Su alternate years, will be offered Su 1986. 4 cr. Lect.
PREREQUISITES: Graduate standing and teacher certification or teaching experience.

Math 525 Analysis for Teachers I
Su alternate years, will be offered Su 1986. 4 cr. Lect.
PREREQUISITES: Graduate standing and teacher certification or teaching experience.

Math 526 Analysis for Teachers II
Su alternate years, will be offered Su 1987. 4 cr. Lect.
PREREQUISITES: Graduate standing and teacher certification or teaching experience.

Math 527 Geometry for Teachers I
Su alternate years, will be offered Su 1986. 4 cr. Lect.
PREREQUISITES: Graduate standing and teacher certification or teaching experience.

Math 528 Geometry for Teachers II
Su alternate years, will be offered Su 1987. 4 cr. Lect.
PREREQUISITES: Graduate standing and teacher certification or teaching experience.

Math 529 Theory of Ordinary Differential Equations I
A alternate years, will be offered A 1987. 3 cr. Lect.
PREREQUISITES: Math 333 and 353.

Math 530 Theory of Ordinary Differential Equations II
W alternate years, will be offered W 1988. 3 cr. Lect.
PREREQUISITE: Math 529.

Math 531 Theory of Ordinary Differential Equations III
S alternate years, will be offered S 1988. 3 cr. Lect.
PREREQUISITE: Math 530.

Math 541 Probability Theory
S alternate years, will be offered S 1987. 3 cr. Lect.
PREREQUISITE: Math 513, or concurrent enrollment in 513 and 541.

Math 571 Boundary Value Problems
Su alternate years, will be offered Su 1986. 3 cr. Lect.
PREREQUISITE: Math 535 or 533.

Math 572 Advanced Applied Mathematics
Su alternate years, will be offered Su 1987. 3 cr. Lect.
PREREQUISITE: Math 530 or Math 535.

Math 580 Special Topics
On demand. 1-5 cr. Maximum 15 cr.
PREREQUISITE: Math 595.

Math 581 Numerical Solutions of Differential Equations I
A. 3 cr. Lect.
PREREQUISITES: Math 441, 442 and 443.

Math 582 Numerical Solutions of Differential Equations II
W. 3 cr. Lect.
PREREQUISITE: Math 581.

Math 583 Numerical Solutions of Differential Equations III
S. 3 cr. Lect.
PREREQUISITE: Math 582.

Math 584 Advanced Numerical Analysis I
A alternate years, will be offered A 1986. 3 cr. Lect.
PREREQUISITES: Math 441, 442 and 443.

Math 585 Advanced Numerical Analysis II
W alternate years, will be offered W 1987. 3 cr. Lect.
PREREQUISITE: Math 584.

Math 586 Advanced Numerical Analysis III
S alternate years, will be offered S 1987. 3 cr. Lect.
PREREQUISITE: Math 585.

Math 589 Graduate Consultation
AWS Su. 3 cr. Tut.
PREREQUISITES: Master's standing and approval of the Dean of Graduate Studies.
ME 214 Manufacturing Processes I  
W. 4 cr. Lect.  
PREREQUISITE: ME 213.  
Basic methods of processing materials to change shapes, dimensions and finishes; special attention to attendant forces, temperatures and property changes.

ME 276 Internship  
A,W,S,Su. 1-6 cr. Ind.St.  
PREREQUISITE: Approval of department head. Mechanical engineering experience in industry or government for college credit.

ME 280 Special Topics  
On demand. 1-4 cr. Lect. Maximum 12 cr.

ME 310 Design of Dynamic Systems  
A. 4 cr. Lect. 2; Lab. 2.  
PREREQUISITES: CS 172, EM 252, Math 226.  
Kinematics and dynamics of machinery with matrix formulation and computer solution.

ME 312 Mechanical Components Design  
A. 4 cr. Lect.  
PREREQUISITES: EM 253 and Math 226.  
Applications of mechanics of solids to design of mechanical systems.

ME 318 Manufacturing Processes II  
S. 4 cr. Lect. 3; Lab. 1.  
PREREQUISITE: ME 214.  
Advanced materials processing, process selection and optimization of process variables.

ME 324 Mechanical Measurements  
S. 4 cr. Lect. 5; Lab. 1.  
PREREQUISITES: EE 303 and 306, SpCm 301 or Engi 221 or Engi 326, CS 172.  
Fundamentals of measurement systems.

ME 331 Thermodynamics I  
A. 4 cr. Lect.  
PREREQUISITES: Phys 228 and Math 225.  
Basic thermodynamic concepts, first and second laws, open and closed systems, properties of ideal and real substances.

ME 332 Thermodynamics II  
W. 4 cr. Lect.  
PREREQUISITE: ME 331.  
Vapor and gas power and refrigeration cycles, mixtures, combustion, reversibility and availability.

ME 334 Thermodynamics  
W,S. 4 cr. Lect.  
PREREQUISITES: Math 225 and Phys 228.  
Thermodynamics for non-mechanical engineers. Thermodynamic systems, heat, work, laws of thermodynamics; practical applications.

ME 337 Introduction to Numerical Analysis of Structures  
W. 4 cr. Lect.  
Numerical analysis of skeletal structures by the stiffness method.

ME 405 Internal Combustion Engines  
W. 4 cr. Lect.  
PREREQUISITES: ME 332 and 456.  
Theory, analysis and performance characteristics of internal combustion engines.

ME 411 Advanced Mechanical Design I  
W. 4 cr. Lect.  
PREREQUISITES: ME 310 and 312.  
Design and analysis of mechanical components and subsystems.

ME 412 Advanced Mechanical Design II  
S. 4 cr. Lect. 1; Lab. 1.  
PREREQUISITES: ME 337 and 411.  
Design and analysis of mechanical systems and devices.

ME 413 Metallic Materials  
W. 4 cr. Lect.  
PREREQUISITE: ME 213.  
Advanced consideration of the structure and behavior of metals.

ME 414 Polymeric Materials  
A alternate years, will be offered A 1986. 4 cr. Lect.  
PREREQUISITE: ME 213.  
Advanced consideration of the structure and behavior of polymeric materials.

ME 415 Ceramic Materials  
A alternate years, will be offered A 1987. 4 cr. Lect.  
PREREQUISITE: ME 213.  
Advanced consideration of the structure and behavior of ceramic materials.

ME 420 Engineering Analysis  
A. 4 cr. Lect.  
PREREQUISITE: Math 226 and senior standing in mechanical engineering.  
Mathematical modeling of engineering systems, special mathematical methods of engineering analysis, approximation techniques for complex engineering problems.

ME 424 Mechanical Engineering Laboratory  
W,S. 4 cr. Lect.  
PREREQUISITES: ME 324, 337 and 456.  
Correlation of theory with engineering practice.

ME 426 Energy Systems Design  
S. 4 cr. Lect.  
PREREQUISITE: ME 456.  
Theory, analysis and design of renewable energy systems including solar energy, wind energy, biomass and ocean energy.

ME 437 Microprocessors for Mechanical Engineering  
W. 4 cr. Lect. 3; Lab. 1.  
PREREQUISITE: CS 172.  
Introduction to the operations and applications of microprocessors to mechanical engineering.

ME 438 Numerical Techniques in Mechanical Engineering  
S. 4 cr. Lect. 3; Lab. 1.  
PREREQUISITES: CS 172 and ME 456.  
Study of numerical methods in the solution of engineering problems, including finite differences, interpolation and extrapolation, numerical integration and solution of equations.

ME 442 Dynamics of Fluids  
W alternate years, will be offered in W 1988. Subject matter offered in EM 455 in W 1987. 4 cr. Lect.  
PREREQUISITES: EM 335 and Math 226.  
A study of fluid dynamics, including incompressible and compressible inviscid fluids, and viscous flow theory and application.

ME 451 Linear Control Systems  
S. 4 cr. Lect.  
PREREQUISITES: EE 303, EM 252, Math 226.  
Analysis and synthesis of linear control systems.

ME 452 Seminar  
A. 1 cr. Sem.  
PREREQUISITE: Senior standing in mechanical engineering.  
Discussion of mechanical engineering role in industry.

ME 456 Heat Transfer  
A. 4 cr. Lect.  
PREREQUISITES: CS 172, EM 335, ME 331.  
Basic conduction, radiation, convection. Differential relationships, solutions to engineering heat transfer problems.

ME 457 Thermal Systems Design  
W. 4 cr. Lect.  
PREREQUISITE: ME 456.  
Design and analysis of thermal systems, boundary layers, ablation cooling, heat exchanger analysis, boiling and condensation.

ME 459 Nuclear Applications  
S. 4 cr. Lect.  
PREREQUISITE: ME 456.  
Application of nuclear reaction phenomena to practical engineering situations.

ME 460 Mechanical Vibrations  
A. 4 cr. Lect.  
PREREQUISITE: EM 253 and Math 226.  
Single degree of freedom systems in free, forced and transient conditions. Two degrees of freedom.

ME 470 Individual Problems  
PREREQUISITES: Consent of instructor and department head.  
Directed research and study on an individual basis.

ME 476 Internship  
A,W,S,Su. 1-4 cr. Ind. St.  
PREREQUISITE: Junior standing and approval of department head. Mechanical engineering experience in industry or government for college credit.

ME 480 Special Topics  
On demand. 1-4 cr. Lect. Maximum 12 cr.  
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Graduate Courses in Mechanical Engineering

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

ME 500 Seminar  
S. 1 cr. Sem. Maximum 6 cr.  
PREREQUISITE: Graduate standing.

ME 505 Propulsion Systems  
On demand. 3 cr. Lect.  
PREREQUISITE: ME 332.  
Theory, analysis and performance characteristics of turbojets, rockets, and hybrid propulsion systems.

ME 513 Corrosion Theory  
S. 3 cr. Lect.  
PREREQUISITES: ME 215 and graduate standing.  
Application of chemical thermodynamics and reaction kinetics to corrosion and oxidation.

ME 520 Mechanical Analysis I  
A. 3 cr. Lect.  
PREREQUISITES: Math 226 and graduate standing.  
Introduction to mathematical modeling of engineering systems.

ME 521 Mechanical Analysis II  
W. 3 cr. Lect.  
PREREQUISITE: ME 520.  
Mathematical methods in engineering.

ME 522 Mechanical Analysis III  
S. 3 cr. Lect.  
PREREQUISITE: ME 521.  
Numerical methods in engineering.
Mechanical Engineering Technology

Department of Mechanical Engineering

994-2203

See Mechanical Engineering for faculty list.

McET 112 Engineering Graphics
W,Su. 3 cr. Lect. 2; Lab. 2.
PREREQUISITE: ME 111.
Working drawings, dimensioning, symbols and conventions, charts and graphs.

McET 203 Machining Processes
A,S. 4 cr. Lect. 2; Lab. 2.
PREREQUISITE: McET 112.
Machining processes used in the processing of raw materials.

McET 276 Internship
A,W,S,Su. 3-6 cr. Ind. St.
PREREQUISITE: Approval of department head.
Mechanical engineering experience in industry or government for college credit.

McET 280 Special Topics
On demand. 1-4 cr. Lect. Minimum 12 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

McET 321 Materials and Processes I
A. 4 cr. Lect. 3; Lab. 1.
PREREQUISITES: Chem 121 and 125.
Properties of materials for technology curricula students.

McET 322 Materials and Processes II
W. 4 cr. Lect. 3; Lab. 1.
PREREQUISITES: McET 203 and 321.
Metallurgy, metallography and seminar for technology students.

McET 331 Materials and Processes III
S. 4 cr. Lect. 3; Lab. 1.
PREREQUISITES: McET 203 and 321.
Plastic forming, foundry and other manufacturing processes for technology students.

McET 341 Thermodynamics I
A. 4 cr. Lect.
PREREQUISITES: Math 175 and Phys 206.
Basic thermodynamics for technology majors, first and second laws, properties of ideal and real substances.

McET 342 Thermodynamics II
W. 4 cr. Lect.
PREREQUISITE: McET 341.
Applied thermodynamics for technology majors, cycles, mixtures and combustion.

McET 343 Heat Transfer
S. 4 cr. Lect.
PREREQUISITE: McET 341.
Basic laws of conduction, convection and radiation with application.

McET 403 Industrial Safety
W. 4 cr. Lect. 3; Rec-Diss. 1.
PREREQUISITE: Professional standing.

McET 411 Mechanical Technology Laboratory I
A. 4 cr. Lect. 2; Lab. 2.
PREREQUISITES: EEET 341, EM 324, McET 341, Phys 205, Eng 221 or Eng 326 or SpCm 301.
Engineering measurements, data analysis and measuring systems.

McET 412 Mechanical Technology Laboratory II
W. 4 cr. Lab.
PREREQUISITES: McET 323, 342, 343 and 411.
Laboratory experiments, correlation of theory with actual practice.

McET 421 Kinematics
A. 4 cr. Lect. 2; Lab. 2.
PREREQUISITES: EM 319 and McET 321.
Introduction to kinematics.

McET 422 Design Technology I
W. 4 cr. Lect. 3; Lab. 1.
PREREQUISITES: McET 321 and 421.
Introduction to design of machine elements and mechanical systems.

McET 423 Design Technology II
S. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: McET 422.
Design of mechanical systems.

McET 426 Tool Design
A. 4 cr. Lect. 1; Lab. 1.
PREREQUISITE: McET 323.
Principles and techniques for the design of cutting tools, dies, fixtures and related tooling.

McET 440 Heating and Air Conditioning
S. 4 cr. Lect.
PREREQUISITE: McET 324.
For technology majors. Heating, ventilating and air conditioning systems, building insulation, characteristics, applications and installation requirements.

McET 445 Building Systems
W. 4 cr. Lect.
PREREQUISITE: Junior standing.
A survey of the systems and equipment for water supply, sanitation, fire protection, electrical service, heating, air conditioning and acoustical systems of buildings.

McET 470 Individual Problems
PREREQUISITES: Consent of instructor and department head.
Directed research and study on an individual basis.

McET 476 Internship
A,W,S,Su. 1-6 cr. Ind. St.
PREREQUISITE: Junior standing.
Mechanical engineering experience in industry or government for college credit.

McET 480 Special Topics
On demand. 1-4 cr. Lect. Maximum 12 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.
Medical Science

WAMI Medical Program

994-4411

Director: Dr. S.J. Guggenheim

Professors: W. Dorgan (Biology), A. Fiscus (Microbiology), K. Hapner (Chemistry), L. Jackson (Chemistry), D. Phillips (Biology), N. Robert (Microbiology), J. Robbins (Chemistry), H. Watling (Zoology, Emeritus).

Associate Professors: P. Croxile (Biology), J. Culier (Microbiology), J. McMillian (Biology), S. Rogers (Chemistry).

Assistant Professors: R. Boik (Statistics), A. Russow (Biology).

Adjunct Assistant Professor: M. Swanson (Biology).

Lecturers: S. Gibson (Biology).

Graduate Courses in Medical Science

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

MedS 500 Seminar

A.W.S. 1 cr. Sem. Maximum 8 cr.
PREREQUISITE: WAMI medical student or consent of the Director of the WAMI Medical Program and the Dean of the College of Graduate Studies.

MedS 510 Anatomy (Micro)

A 4 cr. Lect.; 2 Lab. 2.
PREREQUISITE: WAMI medical student or consent of the Director of the WAMI Medical Program and the Dean of the College of Graduate Studies.

MedS 511 Anatomy (Gross)

A 6 cr. Lect. 3; Lab. 3.
PREREQUISITE: WAMI medical student or consent of the Director of the WAMI Medical Program and the Dean of the College of Graduate Studies.

Dissection study of the anatomy of the human thorax, abdomen, pelvis and perineum. The course integrates a detailed study of adult anatomical features, innervations, blood supplies, and lymphatics with basic embryonic development, both normal and abnormal.

MedS 512 Mechanisms in Cellular Physiology

A 6 cr. Lect.
PREREQUISITE: WAMI medical student or consent of the Director of the WAMI Medical Program and the Dean of the College of Graduate Studies.

Physiological mechanisms common to different organ systems: excitation and conduction, functional transmission, muscle contraction, epithelial transport, sensory reception. Integration of physiological mechanisms within and between organ systems: spinal reflexes, autonomic nervous system function, gastrointestinal function, temperature regulation.

MedS 513 Introduction to Clinical Medicine I

A 2 cr. Lect.
PREREQUISITE: WAMI medical student.

Communication skills and interview techniques to form the basis for the doctor-patient relationship and for the skill of communicating with patients.

MedS 514 Molecular and Cellular Biology I

A 4 cr. Lect. 3; Rec.-Dis. 1.
PREREQUISITE: WAMI medical student or consent of the Director of the WAMI Medical Program and the Dean of the College of Graduate Studies.

Coordinated course covering classical molecular and cellular biochemistry, cellular physiology and molecular genetics. Metabolic interrelations as they occur in the individual are stressed and related to disturbances in disease states.

MedS 515 Ages of Man

W. 4 cr. Lect. 3; Rec.-Dis. 1.
PREREQUISITE: WAMI medical student or consent of the Director of the WAMI Medical Program and the Dean of the College of Graduate Studies.

Physical and psychological development of the whole individual from birth through old age, including neonatal adaptation, nutrition and developmental milestones in childhood and adolescence, degenerative problems of senescence.

MedS 516 Clinical Preceptorship

A 1 cr. Lab.
PREREQUISITE: WAMI medical student.

Opportunity to gain personal experience with, and insight into, medical practice situations by observation of carefully selected clinical faculty members in their offices.

MedS 520 Cell and Tissue Response to Injury

W 7 cr. Lab. 5; Lab. 2.
PREREQUISITE: WAMI medical student or consent of the Director of the WAMI Medical Program and the Dean of the College of Graduate Studies.


MedS 521 Natural History of Infectious Diseases and Chemotherapy

S 7 cr. Lect. 6; Lab. 1.
PREREQUISITE: WAMI medical student or consent of the Director of the WAMI Medical Program and the Dean of the College of Graduate Studies.


MedS 522 Introduction to Clinical Medicine II

W 2 cr. Lect.
PREREQUISITE: WAMI medical student.

Continuation of communication skills. The medical history is introduced and instruction in data collection begins. Some experience with patients in continuing a medical interview for the purpose of obtaining the medical history and patient profile.

MedS 523 Systems of Human Behavior I

S 3 cr. Lect.
PREREQUISITE: WAMI medical student or consent of the Director of the WAMI Medical Program and the Dean of the College of Graduate Studies.

Overview of conceptual systems and models of behavior, normality and abnormality, environment and social learning, conditioning learning in the autonomic nervous systems, catecholamines and behavior, illness behavior, feelings, emotion and cognition, physician-patient interaction and disease and techniques of behavior change.

MedS 524 Molecular and Cellular Biology II

W 3 cr. Lect. 2; Rec.-Dis. 1.
PREREQUISITE: WAMI medical student or consent of the Director of the WAMI Medical Program and the Dean of the College of Graduate Studies.

Coordinated course covering classical molecular and cellular biochemistry, cellular physiology and molecular genetics. Metabolic interrelations as they occur in the individual are stressed and related to disturbances in disease states.

MedS 530 Epidemiology

S 2 cr. Lect.
PREREQUISITE: WAMI medical student or consent of the Director of the WAMI Medical Program and the Dean of the College of Graduate Studies.

Terminology and principles of epidemiology. Statistical description, rates and adjusted rates, screening a population for disease, measures of risk, epidemiological detection, epidemiological study design, statistical inference, methods for critically reviewing biomedical research publications.

MedS 531 Head, Neck, Ear, Nose and Throat

W. 6 cr. Lect. 4; Lab. 2.
PREREQUISITE: WAMI medical student or consent of the Director of the WAMI Medical Program and the Dean of the College of Graduate Studies.


MedS 532 Nervous System

S 8 cr. Lect. 5; Lab. 3.
PREREQUISITE: WAMI medical student or consent of the Director of the WAMI Medical Program and the Dean of the College of Graduate Studies.

Integrated approach to the normal structure and function of the human nervous system, basic neuro-pathological concepts and an introduction to the clinical evaluation of typical neurological lesions. Laboratory includes dissection of human brain and histologic study of brain stem cross sectional anatomy.

MedS 535 Introduction to Clinical Medicine III

S 8 cr. Lect.
PREREQUISITE: WAMI medical student.

Screening physical examination; further experience and instruction in the medical history; the problem-oriented medical record.

MedS 570 Individual Problems

A.W.S.Su. 1-5 cr. Ind. St.
PREREQUISITES: Graduate standing, consent of instructor; approval of the Director of the WAMI Medical Program and Dean of Graduate Studies.

Directed research and study on an individual basis.

MedS 580 Special Topics

On demand. 1-4 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.
Microbiology

994-2903

Head of Department: Dr. N. D. Reed.
Associate Professors: C. W. Bond, J. E. Cutler, S. J. Guggenheim, D. A. Schemmann, J. R. Starkey (Adjunct), D. M. Ward.
Lecturers: J. M. Henson, A. Luder (Adjunct).

MB 100 Orientation
A. 1 cr. Lect.
Orientation and guidance for freshmen majoring in microbiology, medical technology or environmental health and those in other curricula seeking information about these fields.

MB 101N Microbiology in Today's World
A.W.S. Su. 4 cr. Lect. 3; Lab. 1.
Microbes have harmful consequences in pollution and disease but are also useful in many ways such as food production and genetic engineering. New important examples of how microorganisms influence human activities will be studied. Applications will be presented to link concepts of microbiology to other disciplines and relate these concepts to present and future human needs. Laboratory exercises are designed to introduce the scientific method as well as to illustrate important principles. This course is designed for the student without an extensive background in science and who will probably not take further coursework in microbiology.

MB 206 Introduction to Infectious Diseases
A.S.Su. 5 cr. Lect.
PREREQUISITES: Biol 211, MB 101 or 207.

MB 207 General Microbiology I
A. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: Biol 121, Chem 134 (Chem 134 may be taken concurrently with MB 207).
Development of microbiology; techniques in microbiology; survey of major groups; cell structure; bacterial nutrition and growth.

MB 280 Special Topics
On demand. 1-6 cr. Lect. Maximum of MB 280 plus 480, 15 cr.
PREREQUISITES: Consent of instructor and department head.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

MB 308 General Microbiology II
W. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: MB 207.
Microbial ecology; classification systems; microbial diversity; non-medical applications of microbiology.

MB 309 General Microbiology III
S. 4 cr. Lect. 5; Lab. 1.
PREREQUISITE: MB 207.
Virus replication, microbial genetics; genetic engineering; host-parasite relationships; immunology; and infectious disease.

MB 400 Seminar
A.W.S. 1 cr. Sem. Maximum 3 cr.
PREREQUISITE: MB 309.
Review of current literature with supplementary problems.

MB 401 Immunology
A. 5 cr. Lect.
PREREQUISITES: Biol 211 or 212, Chem 134.
Fundamentals of molecular, humoral and cellular mechanisms of immunity, including consideration of chemistry of antibody molecules, gene expression involved in antibody synthesis; biological functions of antibodies; cell-mediated immune function and regulation of the immune system at the cellular level; immunological tolerance; immunological diseases, including autoimmunity and hypersensitivity.

MB 402 Medical Mycology
S. 4 cr. Lect. 2; Lab. 2.
PREREQUISITES: MB 309.
Fungal structure and physiology; taxonomic considerations; disease and host-parasite relationships; procedures used to isolate and identify pathogenic fungi.

MB 403 Virology
S. 4 cr. Lect. 3; Lab. 1.
PREREQUISITES: MB 207 and Chem 134.
Fundamentals of virology with emphasis on animal viruses. Consideration of structure, multiplication, host response to viral infection and antiviral therapy. Laboratories emphasize principles and practice of virological techniques.

MB 404 Immunology Laboratory
A. 1 cr. Lab.
PREREQUISITE: MB 401 (MB 401 may be taken concurrently with MB 404).
A laboratory study of techniques useful in basic and clinical immunology.

MB 406 Medical Bacteriology
W. 5 cr. Lect. 3; Lab. 2.
PREREQUISITES: MB 207 and 401.
Bacteria pathogenic for man including mechanisms of pathogenicity; host response to infection; principles of chemotherapy; epidemiology; prevention and control of disease. Laboratory sessions emphasize principles and practice of laboratory diagnosis of bacterial infections of humans.

MB 407 Microbiology Instructing
A.W.S. 3 cr. Lect. 1; Lab. 2.
PREREQUISITE: MB 309.
Practice in preparing laboratory materials, assisting a class and grading papers.

MB 411 Food Microbiology
S alternate years, will be offered S 1987. 3 cr. Lect.
PREREQUISITE: MB 101 or 207.
Microbiological aspects of food spoilage, preservation, processing and safety.

MB 412 Food Microbiology Laboratory
S. Alternate years, will be offered S 1987. 2 cr. Lab.
PREREQUISITE: MB 308 and 411 (MB 411 may be taken concurrently with MB 412).
Development of laboratory skills necessary for examination of foods for microbial indicators of quality and safety, isolation of foodborne pathogens, and detection of bacterial toxins.

MB 413 Water Microbiology
W alternate years, will be offered W 1987. 3 cr. Lect.
PREREQUISITE: MB 101 or 207.
Microorganisms in aquatic environments including ecological relationships, biochemical processes, modification of organic and inorganic pollutants in treatment and natural systems, use of indicator organisms to assess water quality and safety, and the epidemiology and control of waterborne disease.

MB 414 Water Microbiology Laboratory
W alternate years, will be offered W 1987. 2 cr. Lab.
PREREQUISITE: MB 508 and 413. (MB 413 may be taken concurrently with MB 414.)
Analytical techniques used to monitor the microbiological quality of water such as biochemical oxygen demand, indicator organisms, and pathogenic bacteria, plus exercises on microbial degradation and alteration of pollutants, bacterial injury and survival, and disinfection.

MB 415 Disinfection, Sterilization and Preservation
A alternate years, will be offered A 1987. 3 cr. Lect. 2; Lab. 1.
PREREQUISITES: MB 101 or 207, Chem 121.
Various physical and chemical methods used for the destruction and control of microorganisms, such as irradiation, filtration, chemical disinfection and thermal processing. Emphasis on control in medical care facilities.

MB 416 Topics in Molecular Microbiology
W. 3 cr. Lect.
PREREQUISITES: MB 308 and Chem 134.
Molecular biology of microorganisms for undergraduates in microbiology and related disciplines. Basic concepts in recombinant DNA technology, molecular genetics, macromolecular synthesis and regulation in prokaryotes and eukaryotes. Current literature will be studied in depth.

MB 423 Physiology of Microorganisms
A. 3 cr. Lect.
PREREQUISITES: MB 309, Chem 213 or 273.
Metabolic control mechanisms and bioenergetics in microbial systems.

MB 424 Microbial Physiology Laboratory
A. 2 cr. Lab.
PREREQUISITE: MB 423 (MB 423 may be taken concurrently with MB 424).
Experiments designed to demonstrate the role of metabolic control mechanisms and bioenergetics in microbial activities.

MB 431 Hematology
W. 3 cr. Lect.
PREREQUISITE: Biol 211.
Anatomy and disorders of the blood, including origin and differentiation of blood cells; anemias due to nutritional, hereditary and immunologic defects; disorders of leukocytes, myeloproliferative and lymphoproliferative disorders; and coagulation.

MB 432 Hematology Laboratory
W. 1 cr. Lab.
PREREQUISITE: MB 431 (MB 431 may be taken concurrently with MB 432).
Methods of examining the blood.

MB 456 General Pathology
A. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: Biol 211 or 212.
Patterns of cell and tissue response to injury and aging. Chemical, physical and biological aspects of cell injury; acute and chronic inflammation; growth, development, regeneration and repair; hemostasis; thrombosis, embolism and infarction; atherosclerosis; abnormal growth and neoplasia.

MB 442 Medical Parasitology
S. 3 cr. Lect. 2; Lab. 1.
PREREQUISITE: MB 401.
Identification of the medically significant parasites of humans; pathogenesis, diagnosis and treatment of parasitic diseases.

MB 445 Microbial Genetics
A. 3 cr. Lect.
PREREQUISITES: Chem 211 or 441, MB 207.
DNA structure and replication of bacterial chromosomes, plasmids and bacteriophage genomes; mutagenesis, DNA repair and recombination mechanisms, genetic mapping techniques, including conjugation, transduction, transformation, and recombinant DNA technology; regulation of gene expression in bacteria and their bacteriophages.
MB 470 Individual Problems
A,W,S,Su. 1-5 cr. Ind. St. Maximum 6 cr.
PREREQUISITES: Consent of instructor and department head.
Directed research and study on an individual basis.

MB 475 Undergraduate Projects
PREREQUISITE: Junior standing.
Research and field experience in various aspects of microbiology.

MB 480 Special Topics
On demand. 1-6 cr. Lecture. Maximum 15 cr.
PREREQUISITE: Junior standing.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Graduate Courses in Microbiology

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

MB 500 Seminar
PREREQUISITE: Graduate standing.
Literature in microbiology and related subjects.

MB 514 Advanced Microbiological Physiology
W alternate years, will be offered W 1987. 3 cr. Lect.
PREREQUISITES: MB 423, Chem 443.

MB 515 Microbial Ecology
S alternate years, will be offered S 1988. 3 cr. Lecture.
PREREQUISITE: MB 309.
The distribution and activity of microorganisms in relation to their physiological capabilities and the physical and chemical nature of the environment. In depth examination of the physiological ecology of microorganisms in aquatic, sedimentary, soil, extreme natural and man-made environments. Geomicrobiological cycling of elements.

MB 517 Microbial Ecology Laboratory
S alternate years, will be offered S 1988. 1 cr. Laboratory.
PREREQUISITE: or COREQUISITE: MB 515.
Current methods for assessing microbial activity in natural environments. An intensive course taught by arrangement during the last four weeks of spring quarter.

MB 518 Research Methods in Microbiology
S. 4 cr. Lecture; 2, Lab. 2.
Fundamentals of research methodology for graduate students in microbiology and related disciplines. Emphasis on theory, hands-on use and care of research instrumentation in laboratory applications.

MB 525 Advanced Immunology
S alternate years, will be offered S 1987. 3 cr. Lecture.
PREREQUISITE: MB 401.
Recent advances in immunochrometry, immunonecatics, immunopathology, molecular and cellular immunology.

MB 570 Individual Problems
A,W,S,Su. 1-5 cr. Ind. St. Maximum 9 cr.
PREREQUISITES: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies.
Directed research and study on an individual basis.

MB 576 Internship
PREREQUISITE: Graduate standing.
Supervised work in local, state and regional agencies.

MB 580 Special Topics
On demand. 1-6 cr. Maximum 15 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

MB 589 Graduate Consultation
A,W,S,Su. 3 cr. Tutor.
PREREQUISITES: Master's standing and approval of the Dean of Graduate Studies.
This course may be used only by students who have completed all of their course work (and thesis, if any, per thesis plan) for a master's degree but who need additional faculty help or time.

MB 590 Master's Thesis
A,W,S,Su. 3-12 cr. Ind. St. May be repeated.
PREREQUISITE: Master's standing.

MB 690 Doctoral Thesis
A,W,S,Su. 3-12 cr. Ind. St. May be repeated.
PREREQUISITE: Doctoral standing.

Microbiology

Environmental Health

Department of Microbiology
994-2903
See Microbiology for faculty list.

MBEH 210 Principles of Environmental Health Science
W. 3 cr. Lecture.
Examination of various environmental programs and activities concerned with the description and control of physical-chemical-biological factors that have some impact on human health. Water pollution and treatment, food protection, air pollution, hazardous waste disposal, vectorborne disease control, community sanitation, and hazard control in institutional and occupational environments.

MBEH 280 Special Topics
On demand. 1-5 cr. Maximum 8 cr. Maximum of MBEH 280 plus MBEH 480, 16 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

MBEH 311 Environmental Health Practice
S. 3 cr. Lecture; 2, Lab. 1.
Organization, administration and statutory basis for environmental control programs in the United States. Emphasis on principles of environmental management. Lab provides for field trips to public agencies, industries and facilities concerned with environmental monitoring and control.

MBEH 400 Seminar
PREREQUISITE: MBEH 311.
A seminar series with student presentations and class discussions of current literature on environmental health subjects: (A) biological aspects; (W) physical-chemical aspects; (S) administrative-management-statutory aspects.

MBEH 409 Principles of Epidemiology
S. 4 cr. Lecture.
PREREQUISITES: Stat 216.
Principles and methods used to establish factors essential or contributing to the occurrence of disease, both infectious and noninfectious, and resulting development of controls for disease prevention.

MBEH 470 Individual Problems
A,W,S. 1-6 cr. Ind. St. Maximum 6 cr.
PREREQUISITE: Consent of instructor and department head.
Directed research and study on a problem related to environmental health science.

MBEH 475 Field Project in Environmental Health Science
On demand. 1-6 cr. Ind. St. Maximum 6 cr.
PREREQUISITE: Junior standing.
Research and field experience in various aspects of environmental health.

MBEH 476 Internship in Environmental Health Service
On demand. 12 cr. Ind. St.
PREREQUISITE: Senior in environmental health option.
Off-campus experience in any agency, industry or organization involved in some activity related to environmental conditions and human health.

MBEH 480 Special Topics
On demand. 1-6 cr. Lecture. Maximum of MBEH 280 plus MBEH 480, 15 cr.
PREREQUISITE: Junior standing.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Military Science

994-4288
Coordinator: Dennis Brown, Dean, College of Letters and Science.

Military Aerospace Studies

994-6552
Head of Department: Lt. Col. R.A. Davis.
Professor: R.A. Davis.
Assistant Professors: D.A. Barnew, L.W. Brockman, C.M. Bladock.

General Military Course

MAS 105 U.S. Military Forces in the Contemporary World
W. 1 cr. Lecture.
Officer's professionalism and ethics in the military profession; nature and source of national power; comparison of the U.S. and U.S.S.R. defense structure. A lab component is required.

MAS 106 Structure of the U.S. Air Force
W. 1 cr. Lecture.
A look at the major commands within the Air Force, their structure and function. Familiarization and recognition of their responsibilities and relationship between commands. A lab component is required.
MAS 107 Air Forces's Relationship Within the Armed Forces
S. 1 cr. Lect.
The role and responsibility of the Air Force in its cooperation with the other armed forces. Emphasis upon how each have their particular mission. A lab component is required.

MAS 208 Field Training
Su. 4 cr. Lab. (six weeks)
Substitute for General Military Course. Selection during fall, winter or spring quarter by head of department. Conducted on an Air Force base. Study of U.S. military forces, military justice, career opportunities, customs and courtesies, drill and ceremonies, survival and small arms training.

MAS 215 History of Air Power I
A. 1 cr. Lect.
An introduction to the study of air power. The course is developed from a historical perspective beginning with man’s first balloon flight in 1783, continuing through WWI, up to the beginning of WWII. A lab component is required.

MAS 216 History of Air Power II
W. 1 cr. Lect.
A continuation of the study of the development of air power. Begins with the study of WWII, the emergence of the Air Force as a separate service up to the beginning of the Korean War. A lab component is required.

MAS 217 History of Air Power III
S. 1 cr. Lect.
Begins with the use of air power in the Korean War. Continues with the large buildup of the Air Force in the 1950s, development of our current deterrent air weapons, and concludes with the Vietnam War and space development. A lab component is required.

MAS 218 Flight Ground School I
W. 2 cr. Lect.
Basics required for learning to fly single-engine land type aircraft. Covers material tested on the FAA Private Pilot written exam, to include performance, the science of flight and meteorology.

MAS 219 Flight Ground School II
S. 2 cr. Lect.
Continuation of MAS 218. Covers use of aviation weather, federal aviation regulations, navigation and the physiology of flight.

MAS 220 Flight Training
W.S. 1 cr. Lab.
PREREQUISITE: MAS 218 or 219.
Practical application of material taught in MAS 218 and 219. Flight training from an FAA approved flight school to include all that is required to achieve solo flight. Students must pay for their own instruction.

MAS 280 Special Topics
On demand. 1-4 cr. Lab. Maximum 6 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

MAS 308 Field Training
Su. 2 cr. Lab. (four weeks)
Required for all AFROTC cadets except those who have completed MAS 308. Orientation on an Air Force base, flying orientation, survival and small arms training, physical training, drill and ceremonies.

Professional Officer Course
PREREQUISITE: Completion of General Military Course or consent of instructor and department head.

MAS 325 Air Force Management
A. 3 cr. Lect.
Management principles and their application to the Air Force environment. Concepts covered include: communications, motivation, individual/group behavior, and management functions. Introduction to Air Force written/oral communications. A lab component is required.

MAS 326 Air Force Leadership
W. 3 cr. Lect.
Study of leadership styles and their application. Successful leader styles are analyzed for personal traits and situational requirements. Review of Air Force written/oral communications. A lab component is required.

MAS 327 Air Force Leadership and Management
S. 3 cr. Lect.
Practical application of leadership and management principles and management principles in developing business options. Air Force written/oral communications are stressed. A lab component is required.

MAS 425 Problems of National Security I
A. 3 cr. Lect.
A study of players in the national security policy making process. Includes a study of the President, Congress, the military and intelligence communities and how they influence national security decisions. National security issues such as nuclear strategies, limited war and alliances are also discussed. Practice in oral and written communication is emphasized.

MAS 426 Problems of National Security II
W. 3 cr. Lect.
National Security issues and how the Air Force impacts the issues. Regional studies are emphasized. A study of the military as a profession is included. Practice in oral and written communication is emphasized.

MAS 427 Problems of National Security III
S. 3 cr. Lect.
Special topics in American national security affairs. Precommissioning topics are emphasized. A basic study of military law is included.

MAS 470 Individual Problems
A.W.S(Su. 1-3 cr. Ind. St.
PREREQUISITE: Consent of instructor and department head.
Directed study of a problem related to the Air Force.

MAS 480 Special Topics
On demand. 1-4 cr. Lab. Maximum 6 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Military Science—Army
994-4044
Head of Department: Lt. Col. W.L. Carpenter
Professor: W.L. Carpenter
Assistant Professors: M. Callahan, C. Chambless,
B. Conrey, M. Grauener, M. Schons,
L. Stomprud.

Basic

MSG 101 Military Orientation
A.W.S. 1 cr. Lect.
Organization of the Army and ROTC with emphasis on career opportunities for ROTC graduates; practical applications of military skills to include rappelling, map reading and land navigation. A laboratory component is required.

MSG 102 Introduction to Military Leadership
A.W.S. 1 cr. Lect.
An introduction to the principles and fundamentals of military leadership to include cross country skiing, cold weather survival and additional map reading. A laboratory component is required.

MSG 103 Military Leadership and Management
A.W.S. 1 cr. Lect.
Application of military leadership skills to include small boat operations, mountaineering and communication techniques. A laboratory component is required.

MSG 204 Basic ROTC Summer Camp
Su. 4 cr. Lab.
PREREQUISITE: Junior standing.
Practical application of basic knowledge required of an Army officer. Subject matter parallels above listed courses. Satisfies prerequisites for advanced course below in lieu of basic course.

MSG 205 Leadership Assessment
A.W.S. 2 cr. Lect. 1; Lab. 1.
Assessment of leadership potential based upon performance data derived from practical exercises. Strengthening of assessed weaknesses through instruction and modules. A laboratory component is required.

MSG 206 American Military History
A.W.S. 2 cr. Lect. 1; Lab. 1.
Evolution of warfare. Study of principles of war and American way of war. A laboratory component is required.

MSG 207 Map Reading and Land Navigation
A.W.S. 2 cr. Lect. 1; Lab. 1.
Application and use of topographical maps, aerial photographs and compasses to assist in land navigation. A laboratory component is required.

MSG 280 Special Topics
On demand. 1-4 cr. Maximum 4 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Advanced

MSG 301 Small Unit Tactics
A. 3 cr. Lect. 2; Lab. 1.
PREREQUISITE: Basic course.
Small unit tactics, land navigation, weapons and communications systems with emphasis on practical exercise. A field trip is required. A laboratory component is required.

MSG 302 Methods of Instruction
W. 5 cr. Lect. 2; Lab. 1.
PREREQUISITE: MSG 301.
Military methods of instruction with emphasis on developing each student's ability to organize, prepare and conduct training. Practical exercises stress development of the student's oral and written communication skills. A laboratory component is required.

MSG 303 Preparation for Advanced Field Training
S. 3 cr. Lect. 2; Lab. 1.
PREREQUISITE: MSG 302.
Duties and responsibilities of junior leaders. Preparation for advanced camp. A laboratory component is required.
Modern Languages and Literatures
994-4448

Head of Department: Dr. J. Jelinski.
Associate Professors: R. Dabit, D. Daniels,
J. Jelinski, C. Pinet.
Assistant Professors: E. Reichmuth, D. Soneson,
F. Toner.

NOTE: Courses marked with an asterisk are taught in English and are designed not only for language students but for all students interested in the literature and culture of French, German and Spanish speaking countries.

ML 280 Special Topics
On demand. 1-4 cr. Maximum of ML 280 plus ML 480, 15 cr.
PREREQUISITE: Must be lower division students.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

ML 300 100 Practicum
PREREQUISITES: ML-F 352 or ML-G 310 or ML-S 304.
Advanced students in the respective language assist the instructor of the first-year sequence 101-102-103 in all aspects of instruction for experiential learning.

ML 470 Individual Problems
PREREQUISITE: Consent of instructor and department head.
Directed study and research on an individual basis.

ML 476 Career Internship
W,S,Fu. 6-12 cr. Ind. St.
PREREQUISITE: Junior standing and approval of department head.
Intensive practice conducted by faculty to work in government, public service or corporate positions during one quarter. Selected interns are given significant assignments at the management level to broaden their understanding of professional expectations in the field.

French

ML-F 101-102-103 Elementary French
A,W,S,Su on demand; W,S,Fu on demand; Su,Fu on demand. 5,5,5 cr. Rec.-Dis.
PREREQUISITE: ML-F 101 for ML-F 102; ML-F 102 for ML-F 103.
A fundamental skills approach in which a basic foundation is established in listening, speaking, reading and writing. Emphasis on ear training and oral practice followed by development of reading and writing skills.

ML-F 201-202 Intermediate French
A,W. 4,4 cr. Rec.-Dis.
PREREQUISITE: ML-F 103 for ML-F 201; ML-F 201 for ML-F 202.
Continuation of oral practice; intensive, organized review of grammar. Discussion of reading conducted in the language and formal writing on topics directly related to reading materials.

ML-F 301F (Hist 301F) History of the Civilization of France
A alternate years with ML-F 301, will be offered A 1987. 4 cr. Rec.-Dis.
PREREQUISITE: Normally limited to juniors and seniors.
The study of certain aspects of Francophone literature and culture not already covered in the curriculum. The seminar may treat a single author or theme. Taught in French.

ML-F 404 Survey of French Literature
W alternate years with ML-F 405, will be offered W 1987. 4 cr. Rec.-Dis.
Survey of French literature from the Middle Ages through the 18th century. Taught in French.

German

ML-G 101-102-103 Elementary German
A,W,S,Su on demand; W,S,Fu on demand; Su,Fu on demand. 5,5,5 cr. Rec.-Dis.
A fundamental skills approach in which a basic foundation is established in listening, speaking, reading and writing. Emphasis on ear training and oral practice followed by development of reading and writing skills.
ML-G 201-202  Intermediate German
Continuation of oral practice; intensive, organized review of grammar. Discussion of reading conducted in the language and formal writing on topics directly related to reading materials.

ML-G 301  German Culture and Civilization
A alternate years with ML-G 315, will be offered A 1986. 4 cr. Lect.
PREREQUISITE: ML-G 310.
Readings, lectures and discussions in German, based upon significant cultural contributions to world civilization by German-speaking peoples from 1750.

ML-G 302  German Culture and Civilization
W alternate years with ML-G 320, will be offered W 1987. 4 cr. Rec.-Dis.
PREREQUISITE: ML-G 310.
Readings, lectures and discussions in German, based upon significant cultural contributions to world civilization by German-speaking peoples from 1750 to the present.

ML-G 305  The Germanic Heritage of Europe
S 4 cr. Rec.-Dis.
PREREQUISITE: Generally limited to upper division students.
Modern Austrian, German and Swiss culture as manifested through literature, communications media and government sources. Contrastive analysis with North American culture and emphasis on nonverbal cultural elements.

ML-G 310  Literature and Contemporary Culture
S 4 cr. Rec.-Dis.
Reading and discussion of representative literary figures and works. Introduction to contemporary German culture. Both areas supplemented by slides, film and other aids.

ML-G 315  Survey of German Literature
A alternate years with ML-G 301, will be offered A 1987. 3 cr. Lect.
PREREQUISITE: ML-G 310.
A survey of German literature. Representative readings from selected literary periods from the beginning to 1750.

ML-G 320  Survey of German Literature
W alternate years with ML-G 302, will be offered W 1988. 3 cr. Lect.
PREREQUISITE: ML-G 310.
Survey of representative German literary works of the 18th and 19th centuries.

ML-G 350  Advanced Grammar and Conversation
W alternate years with ML-G 351, will be offered W 1987. 4 cr. Rec.-Dis.
PREREQUISITE: ML-G 310.
Emphasis on writing German with in-depth concentration on grammar as required in written expression.

ML-G 351  Advanced Grammar and Conversation
W alternate years with ML-G 350, will be offered W 1988. 4 cr. Rec.-Dis.
PREREQUISITE: ML-G 310.
Emphasis on speaking German with in-depth concentration on grammar and idioms as applied to the spoken language.

ML-G 360  German Literature in Translation
A alternate years with ML-G 361, will be offered A 1986. 3 cr. Lect.
PREREQUISITE: Generally limited to upper division students

ML-G 361  German Literature in Translation
A alternate years with ML-G 360, will be offered A 1987. 3 cr. Lect.
PREREQUISITE: Generally limited to upper division students

ML-G 400  Seminar
S alternate years with ML-G 410, will be offered S 1987. 5 cr. Lect.
PREREQUISITE: Senior standing.
Reading and discussion of representative literary figures, works or movements which have recently achieved worldwide acclaim such as Che Guevara, Borges, Cortazar, and Marquez (100 Years of Solitude). All reading is in English. Designed especially for non-language majors.

ML-S 302  German Culture and Civilization
W alternate years with ML-S 301, will be offered W 1987. 4 cr. Lect.
PREREQUISITE: ML-S 304.
Reading, lectures and discussions in Spanish. This course examines the historical, social and ideological aspects of modern Latin American culture.

ML-S 304  Advanced Conversation
S 4 cr. Rec.-Dis.
Designed to follow the second year review of grammar and basic skills. Taught through a series of carefully selected readings in Spanish culture, civilization and literature which will provide the basis for writing essays and reports and developing advanced conversational skills.

ML-S 307  History and Revolution in Latin American Literature
S alternate years, will be offered S 1988. 5 cr. Lect.
Unique historical approach to Latin American literature. Examination of the relationships between historical events and literary production. Instruction in English by a member of the Spanish faculty. No knowledge of Spanish is required.

ML-S 320  Survey of Spanish Literature
S alternate years with ML-S 321, will be offered S 1987. 4 cr. Lect.
PREREQUISITE: ML-S 304.
A survey of Spanish literature from 1700 to the present through an examination of the masterpieces of each literary period.

ML-S 321  Contemporary Latin American Literature
S alternate years with ML-S 320, will be offered S 1988. 4 cr. Lect.
PREREQUISITE: ML-S 304.
An examination of the major authors, works and literary movements of the 19th and 20th centuries in Latin American literature. Survey of the major authors, works and literary movements of the 19th and 20th centuries in Latin American literature.

ML-S 323  Latin American Culture and Civilization
S alternate years with ML-S 322, will be offered S 1987. 4 cr. Lect.
PREREQUISITE: ML-S 304.
An examination of the major authors, works and literary movements of the 19th and 20th centuries in Latin American literature. Survey of the major authors, works and literary movements of the 19th and 20th centuries in Latin American literature.

ML-S 325  Intensive Grammar Review
A alternate years, will be offered A 1987. 4 cr. Rec.-Dis.
PREREQUISITE: ML-S 304.
Review of the details of Spanish grammar to increase proficiency in the four skills.

ML-S 350  Advanced Oral and Written Composition
W alternate years with ML-S 351, will be offered W 1988. 4 cr. Rec.-Dis.
PREREQUISITE: ML-S 350.
Emphasis on the active use of the language by practice in written and oral expression.

ML-S 360F Don Quixote and the Western Tradition
W alternate years with ML-S 361, will be offered W 1987. 4 cr. Lect.
PREREQUISITE: Junior standing.
Cervantes' masterpiece examined as both a revolutionary romantic manifesto and as a text which represents a lesson in the prudential morality of the Counter-Reformation. All reading is in English. No knowledge of Spanish is necessary.

ML-S 361  Latin American Literature in Translation
W alternate years with ML-S 360, will be offered W 1988. 3 cr. Lect.
PREREQUISITE: Junior standing.
Major contemporary Latin American authors who have recently achieved worldwide acclaim such as Che Guevara, Borges, Cortazar, Fuentes and Garcia Marquez (100 Years of Solitude). All reading is in English. Designed especially for non-language majors.

ML-S 400  Seminar in Hispanic Literature
W alternate years with ML-S 399, will be offered W 1988. 4 cr. Sem.
PREREQUISITE: ML-S 304.
This seminar is designed to allow students to study important literary figures, works or movements which
have influenced the course of literary history in Spain and in Latin America.

ML 410 Spanish Phonetics
S alternate years, will be offered S 1987. 4 cr. Rec.-Dis. PREREQUISITE: Junior standing.

A practical study of Spanish sounds— their production, combination, description and representation by written symbols. Contrastive linguistic study, Spanish-English, for teaching application.

Graduate Courses in Modern Languages and Literatures

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

ML 570 Individual Problems
PREREQUISITES: Graduate standing, consent of instructor, approval of department head, and Dean of Graduate Studies.
Directed research and study on an individual basis.

ML 580 Special Topics
Su on demand. 1-9 cr. Maximum 15 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Music

994-3561

Head of Department: Dr. W. J. Rost.
Associate Professors: G. R. Johnston, A. B. Leech, K. D. Leech (Adjunct), G. Makeever, E. Sedivy (Emeritus).

Mus 100 Music Orientation
A. 0 cr. Lect.
For those interested in music as a profession.

Mus 101 Marching Band
A. 1 cr. Lab. May be repeated for credit. PREREQUISITE: Successful audition.
Experience in outdoor performance and marching techniques.

Mus 102 University Chorus
A, W, S, Su. 1 cr. Lab. May be repeated for credit.
Non-auditioned choir from all disciplines performs a variety of serious music.

Mus 114 Applied Music
A, W, S, Su. 2-4 cr. Tut. May be repeated for credit. Fee—$12 per quarter for private lessons for each instrument studied, including voice. PREREQUISITE: Successful audition.
Techniques of performance and interpretation to develop musical ability, expressivity and accuracy in student's performance area.

Mus 117 Fundamentals of Music
A. S. 3 cr. Lect.
Elements of music, their combination in musical creation, performance on simple instruments, group composition of music. Primarily for the non-major.

Mus 118 Survey of Music Literature I
A. 2 cr. Lect.
Instrumental and vocal music from solo literature to chamber music, musical styles and forms in present and past cultures including multicultural and world music, historic and stylistic perspectives, social and aesthetic aspects. Primarily for the music major.

Mus 119 Survey of Music Literature II
W. 2 cr. Lect.
Continuation of studies begun in Mus 118. Instrumental and vocal music for larger ensembles of performers, musical styles and forms in contemporary and past cultures including jazz, historic and stylistic perspectives, social and aesthetic aspects. Primarily for the music major.

Mus 126 Skills of Music I
A. 2 cr. Lect; 1 Lab. 1.
PREREQUISITE: Mus 131.
Studies in ear training and sight-singing to develop aural perception of tonal and temporal relationships. Primarily for students with planned concentration in music.

Mus 127 Skills of Music II
W. 2 cr. Lect; 1 Lab. 1.
PREREQUISITE: Mus 126.
Continuation of studies in ear training and sight-singing to develop aural perception of tonal and temporal relationships. Primarily for students with planned concentration in music.

Mus 128 Skills of Music III
S. 2 cr. Lect; 1 Lab. 1.
PREREQUISITE: Mus 127.
Continuation of studies in ear training and sight-singing to develop aural perception of tonal and temporal relationships. Primarily for students with planned concentration in music.

Mus 131 Theory I
A. 3 cr. Lect.
PREREQUISITE: Mus 126 required for music majors and minors.
Musical fundamentals: harmony and form in common practice style, musical notation and language, function and interaction of the elements of music (tested in writing and at the keyboard).

Mus 132 Theory II
W. 3 cr. Lect.
PREREQUISITE: Mus 131.
PREREQUISITE: Mus 127 required for music majors and minors.
Continuation of study of music fundamentals: harmony and form in common practice style, musical notation and language, function and interaction of the elements of music (tested in writing and at the keyboard).

Mus 133 Theory III
S. 3 cr. Lect.
PREREQUISITE: Mus 132.
PREREQUISITE: Mus 128 required for music majors and minors.
Continuation of study of music fundamentals: harmony and form in common practice style, musical notation and language, function and interaction of the elements of music (tested in writing and at the keyboard).

Mus 140 Campus Band
A, W, S. 1 cr. Lab. May be repeated for credit.
Non-auditioned band of non-majors performs a variety of music.

Mus 142 Vocal Diction
A. 2 cr. Lect.
PREREQUISITE: Mus 114, 165 or 211.
Correct pronunciation of English and Latin for singing using international phonetic alphabet.

Mus 150 Techniques: Strings I
A. 1 cr. Lab.
Instruction and performance for violin and viola, emphasizes appropriate teaching literature and teaching techniques. For music education students.

Mus 151 Techniques: Strings II
W. 1 cr. Lab.
Instruction and performance for cello and bass, emphasizes appropriate teaching literature and teaching techniques. For music education students.

Mus 153 Techniques: Woodwinds I
S. 1 cr. Lab.
Instruction and performance for flute, clarinet and saxophone emphasizing appropriate teaching literature and teaching techniques. For music education students.

Mus 154 Techniques: Woodwinds II
A. 1 cr. Lab.
Instruction and performance for oboe and bassoon, emphasizes appropriate teaching literature and teaching techniques. For music education students.

Mus 156 Techniques: Brass I
W. 1 cr. Lab.
Instruction and performance for trumpet and French horn, emphasizes appropriate teaching literature and teaching techniques. For music education students.

Mus 157 Techniques: Brass II
S. 1 cr. Lab.
Instruction and performance for trombone, baritone, and tuba, emphasizes appropriate teaching literature and teaching techniques. For music education students.

Mus 159 Techniques: Percussion I
W. 1 cr. Lab.
Instruction and performance for tuned percussion, emphasizes appropriate teaching literature and teaching techniques. For music education students.

Mus 160 Techniques: Percussion II
S. 1 cr. Lab.
PREREQUISITE: Mus 159.
Instruction and performance for untuned percussion, emphasizes appropriate teaching literature and teaching techniques. For music education students.

Mus 164 Techniques: Vocal I
A. 1 cr. Lab.
Technical and interpretational aspects of vocal production for performance purposes. For instrumental music education students.

Mus 165 Techniques: Vocal II
W. 1 cr. Lab.
PREREQUISITE: Mus 164.
Continuation of studies of technical and interpretational aspects of vocal production for performance purposes. For instrumental music education students.

Mus 206 Para-Professional Experience
A, W, S. 1 cr. Ind. St.
PREREQUISITE: Sophomore standing in applied music.
Guided observation of experienced teachers. For Studio Option students.

Mus 207F Enjoyment of Music
A, W, S. Su. 3 cr. Lect.
Presentation of examples of great music literature to develop informed, perceptive listening and musical understanding. Intended for non-majors.
Mus 211 Voice in Class
A,W,S,Su. 2 cr. Rec.-Dis. May be repeated for credit.
Basic instruction in singing: tone production, interpretation, introduction to song literature.

Mus 212 Piano in Class
A,W,S,Su. 2 cr. Rec.-Dis. May be repeated for credit.
PREREQUISITE: Placement interview, successful audition.
Basic instruction in techniques of keyboard performance, interpretation of selections from keyboard literature.

Mus 213 Guitar in Class
A,W,S,Su. 2 cr. Rec.-Dis. May be repeated for credit.
COREQUISITE: Mus 260 or 360.
Basic instruction in techniques of chord guitar or classical guitar, music reading, and performance.

Mus 214 Applied Music
A,W,S,Su. 2-4 cr. Tut. May be repeated for credit.
Fee—$12 per quarter for private lessons for each instrument studied, including voice.
PREREQUISITE: Mus 114.
Continuing instruction in techniques of performance and interpretation to develop musical ability, expressivity, accuracy, and stylistic awareness in student's performance area.

Mus 215 Functional Instruments
COREQUISITE: Mus 241 or 242.
Functional proficiency on keyboard and/or fretted instruments sufficiently advanced to use the instruments for demonstration, accompaniment and transposition.

Mus 218 Practical Electronic Music
S. 1 cr. Lab.
PREREQUISITE: Mus 133.
Preparation for public school teaching using the tape recorders and synthesizers commonly available in schools.

Mus 222 Jazz Band I
A,W,S. 1 cr. Lab. May be repeated for credit.
PREREQUISITE: Successful audition.
Band of 20-25 musicians performs jazz literature in all 20th century styles. Introductory aspects of different style periods and improvisation.

Mus 223 Chamber Choir
A,W,S. 1 cr. Lab. May be repeated for credit.
PREREQUISITE: Successful audition.
Choir of 25-30 selected singers performs a variety of music from the past five centuries.

Mus 226 Skills of Music IV
A. 2 cr. Lect. 1; Lab. 1.
PREREQUISITE: Mus 128.
Continued development of aural and vocal skills that deal with tonal and temporal relationships. For music students.

Mus 227 Skills of Music V
W. 2 cr. Lect. 1; Lab. 1.
PREREQUISITE: Mus 226.
Continued development of aural and vocal skills that deal with tonal and temporal relationships. For music students.

Mus 228 Skills of Music VI
S. 2 cr. Lect. 1; Lab. 1
PREREQUISITE: Mus 227.
Continued development of aural and vocal skills that deal with tonal and temporal relationships. For music students.

Mus 231 Theory IV
A. 3 cr. Lect.
PREREQUISITE: Mus 133.
Aural and visual analysis of music utilizing techniques and ideas dealt with in prerequisite courses leading students to place compositions in historical and stylistic perspective.

Mus 232 Theory V
W. 3 cr. Lect.
PREREQUISITE: Mus 231.
Continued aural and visual analysis of music utilizing techniques and ideals dealt with in prerequisite courses leading students to place compositions in historical and stylistic perspective.

Mus 233 Theory VI
S. 3 cr. Lect.
PREREQUISITE: Mus 232.
Continued aural and visual analysis of music utilizing techniques and ideals dealt with in prerequisite courses leading students to place compositions in historical and stylistic perspective.

Mus 240 Vocal Diction
W,Su. 2 cr.
PREREQUISITES: Mus 142.
Correct pronunciation of Italian and German for singers using International phonetic alphabet.

Mus 241 Basic Music I
A,W,Su. 3 cr. Lect. 2; Lab. 1.
Rudiments, pre-orchestral instruments, and their application for creating musical experiences appropriate for children. Students may enroll concurrently in Music 215 to achieve required piano and guitar proficiency.

Mus 242 Basic Music II
W,Su. 3 cr. Lect. 2, Lab. 1.
PREREQUISITE: Mus 241.
Continued study of rudiments, pre-orchestral instruments, and their application for creating musical experiences appropriate for children. Students may enroll concurrently in Music 215 to achieve required piano and guitar proficiency required.

Mus 250 Recital Review
A,W,S. 1 cr. Ind. St. Maximum 12 cr.
Guided observation and critique of musical performance.

Mus 250 Special Topics
On demand. 1-5 cr. Maximum 8 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Mus 306 Ensemble
A,W,Su. 1 or 2 cr. Rec.-Dis. May be repeated for credit.
PREREQUISITE: Successful audition.
Selected students perform in small, coached instrumental and vocal ensembles. Includes Symphonic Choir.

Mus 307 Musical Theatre
A,W,S. 1 cr. Rec.-Dis. May be repeated for credit.
PREREQUISITE: Successful audition.
Applied study of staging, production, and musical interpretation of representative excerpts, scenes, acts or complete works.

Mus 309 Instrumental Pedagogy
S. 1 cr. Rec.-Dis.
PREREQUISITE: Mus 133.
Relevant studies, solo and ensemble literature in student's major applied music area, the learning process, evaluation of literature for educational value and stylistic nature.

Mus 311 Music History I
A. 3 cr. Lect.
PREREQUISITE: Mus 133.
Music as it relates to other arts and humanities from an historical and stylistic perspective, from antiquity through the Renaissance.

Mus 312 Music History II
W. 3 cr. Lect.
PREREQUISITE: Mus 311.
Music as it relates to other arts and humanities from an historical and stylistic perspective, the Baroque and Classic eras.

Mus 313 Music History III
S. 3 cr. Lect.
PREREQUISITE: Mus 512.
Music as it relates to other arts and humanities from an historical and stylistic perspective, 19th and 20th centuries.

Mus 314 Applied Music
A,W,S,Su. 2-4 cr. Tut. May be repeated for credit. Fee: $12 per quarter for private lessons for each instrument studied, including voice.
PREREQUISITE: Mus 214.
Continued study of techniques of performance and interpretation to develop musical ability, expressivity, accuracy, and stylistic awareness in student's performance area.

Mus 315 Piano in Class
A,W,S,Su. 2 cr. Rec.-Dis. May be repeated for credit. Maximum 12 cr.
PREREQUISITE: 6 cr. of Mus 212, or Mus 114 and 214.
Advanced piano study in small classes.

Mus 316 Vocal Literature
S,Su. 3 cr. Lect.
PREREQUISITE: Mus 318.
Materials appropriate for various ages and applications in teaching.

Mus 317 Vocal Methods
S. 2 cr. Lect.
PREREQUISITE: Mus 211 or 214.
Vocal pedagogy, teaching techniques, literature, and curriculum development.

Mus 321 Beginning Conducting
W,Su. 2 cr. Lect. 1; Lab. 1.
PREREQUISITE: Mus 133.
Basic conducting and choral rehearsal techniques, study and keyboard reading of choral scores, motivational techniques, laboratory experiences.

Mus 322 Intermediate Conducting
S,Su. 2 cr. Lect. 1; Lab. 1.
PREREQUISITE: Mus 321.
Continuation of conducting studies using instrumental literature, transposition, aural and visual perception of scores, laboratory experiences.

Mus 324 Symphonic Band
A,W,S. 1 cr. Lab. May be repeated for credit.
PREREQUISITE: Successful audition.
Advanced instrumental ensemble training.

Mus 325 Orchestra
A,W,S. 1 cr. Lab. May be repeated for credit.
PREREQUISITE: Successful audition.
Advanced orchestral performance training in the standard literature.

Mus 326 Montanans
A,W,S. 1 cr. Lab. May be repeated for credit.
PREREQUISITE: Successful audition.
Advanced orchestral performance training in small vocal ensemble using stylistic variety in programming.

Mus 327 Instrument Repair
W,Su. 2 cr. Lab.
PREREQUISITES: Mus 150, 151, 153, 154, 156, 157, 159, 160.
Maintenance and minor emergency repairs of band and orchestral instruments.
Mus 329 Jazz Band II  
A,W,S. 1 cr. Lab. May be repeated for credit. Maximum 12 cr.  
PREREQUISITE: Successful audition.  
Advanced performance training in jazz literature from all style periods, guided improvisational experience.

Mus 331 Percussion Ensemble  
A,W,S. 1 cr. Lab. Maximum 12 cr.  
PREREQUISITE: Successful audition.  
Advanced ensemble experience using a variety of percussion instruments.

Mus 332 Chamber Orchestra  
A,W,S. 1 cr. Lab. Maximum 12 cr.  
PREREQUISITE: Successful audition.  
Advanced training in literature for small orchestra.

Mus 334 Performance Seminar  
A,W,Su. 1 cr. Rec.-Dis. May be repeated for credit.  
Practice in performance in a master class situation to gain poise and confidence. Philosophical, emotional, and aesthetic aspects of music which add to the quality of a performance.

Mus 340 Vocal Diction  
S,Su. 2 cr. Rec.-Dis.  
PREREQUISITE: Mus 142.  
Correct pronunciation of French for singers using international phonetic alphabet.

Mus 344 Instrumental Arranging  
W,Su. 2 cr. Rec.-Dis.  
PREREQUISITE: Mus 233.  
Scoring principles for the instrumental ensemble. Some emphasis on arranging and adapting music for incomplete and/or beginning public school groups.

Mus 346 Survey of Electronic Music  
A. 2 cr. Lect.  
PREREQUISITE: Mus 119 or 207.  
The sounds, equipment, and processes employed in studio production of electronic music, and a survey of recorded literature.

Mus 347 Accompanying  
A alternate years, will be offered A 1987. 2 cr. Rec.-Dis.  
PREREQUISITE: Mus 114 or 212.  
Principles and techniques of accompaniment and ensemble performance in all style periods and laboratory experiences in accompanying instrumentalists and singers.

Mus 360 Parkening Observation  
A,SU. 1 cr. Ind. St. Maximum 8 cr. Offered only with Mus 431.  
Guided observation and critique of Parkening Master Class.

Mus 361F Music Literature I  
W. 3 cr. Lect.  
PREREQUISITE: Mus 207.  
Continuation of studies begun in Music 207, emphasis on musical style periods from c. 1600 to c. 1850.

Mus 362F Music Literature II  
S. 3 cr. Lect.  
PREREQUISITE: Mus 361.  
Continuation of studies begun in Mus 207 and Mus 361 with emphasis on musical style periods from c. 1850 to present.

Mus 365 American Improvisation I  
W alternate years, will be offered W 1988. 2 cr. Lect.  
PREREQUISITE: Successful audition.  
Improvisational experience for relatively advanced instrumentalists and vocalists, improvement of aural perception, techniques of teaching improvisation and utilizing it at various levels of technical proficiency, enhancing other approaches to music education.

Mus 366 American Improvisation II  
S alternate years, will be offered S 1988. 2 cr. Lect.  
PREREQUISITE: Mus 365.  
Application of the techniques learned in 365, continuation of improvisational and creative experiences.

Mus 405 Musical Styles I  
W. 3 cr. Lect.  
PREREQUISITE: Mus 235.  
Survey of historical, stylistic, and theoretical concepts. Analysis of exemplary composers' compositional styles.

Mus 406 Musical Styles II  
S. 3 cr. Lect.  
PREREQUISITE: Mus 405.  
Continuation of synthesis of historical, stylistic, and theoretical concepts. Analysis and imitation of exemplary composers' compositional styles.

Mus 414 Applied Music  
A,W,Su. 2-4 cr. Tur. May be repeated for credit. Fee $12 per quarter for private lessons for each instrument studied, including voice.  
PREREQUISITE: Mus 314.  
Continued studies of techniques of performance and interpretation to develop musical ability, expressivity, accuracy, and stylistic awareness in student's performance area.

Mus 416 Advanced Conducting  
S,Su. 2 cr. Rec.-Dis.  
Continued improvement of rehearsal and conducting skills and teaching abilities, planning and programming musical performances, through laboratory experiences.

Mus 421 Piano Pedagogy I  
W alternate years, will be offered W 1987. 1 cr. Lect.  
PREREQUISITE: Advanced piano standing.  
Piano methods, keyboard literature and supplementary material needed for the studio and class piano teacher.

Mus 422 Piano Pedagogy II  
S alternate years, will be offered S 1987. 2 cr. Lect.  
PREREQUISITE: Advanced piano standing.  
Continued study of piano methods, keyboard literature and supplementary material needed for the studio and class piano teacher, supervised teaching experience.

Mus 424 Choral Literature  
S alternate years, will be offered S 1988. 3 cr. Lect.  
PREREQUISITE: Mus 133.  
Survey of appropriate choral music for elementary and secondary levels, recent publications, traditional repertory.

Mus 426 Instrumental Literature  
W alternate years, will be offered W 1987. 3 cr. Lect.  
PREREQUISITE: Advanced piano standing.  
Survey of elementary, intermediate and advanced grades of band and orchestra literature for school use; educational and musical evaluation, relation to the total music program.

Mus 427 Chorale  
A,W,Su. 1 cr. Lab. May be repeated for credit.  
PREREQUISITE: Successful audition.  
Advanced choral performance training.

Mus 428 Electronic Music Techniques I  
W. 1 or 2 cr. Lab. Maximum 12 cr.  
PREREQUISITE: Mus 346.  
Classic tape music studio realization techniques.

Mus 429 Electronic Music Techniques II  
S. 2 cr. Lab.  
PREREQUISITE: Mus 428.  
Advanced work with analog synthesizing equipment and beginning approaches to electronic music composition techniques.

Mus 430 Principles of Composition  
On demand. 1-3 cr. Ind. St. May be repeated for credit.  
PREREQUISITE: Mus 133.  
Individual study of compositional practices in any musical idiom, compositional processes and techniques, aesthetic concepts applicable to the idiom of writing or creation of music.

Mus 431 Master Guitar  
A,S. 4 cr. Lect.  
PREREQUISITE: Successful audition.  
Advanced master class in classical guitar.

Mus 432 Master Guitar Seminar  
Su. 2 cr. Lect.  
PREREQUISITE: Successful audition.  
Pedagogical and performance techniques in classical guitar.

Mus 440 Field Experience in Studio Teaching  
A,W,S. 1 cr. Ind. St.  
PREREQUISITE: Senior standing in applied music, appropriate pedagogy class, and approval of major teacher.  
Supervised teaching in student's performance area. For studio teaching majors.

Mus 460 Recital  
A,W,Su. 1 cr. Ind. St. Maximum 6 cr.  
PREREQUISITE: Consent of instructor and department head.  
Student initiated, faculty directed study on an individual basis in subject areas not included in the courses offered by the Department of Music.

Mus 480 Special Topics  
On demand. 1-5 cr.  
PREREQUISITE: Consent of instructor and department head.  
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Mus 490 Professional Research  
A,W,Su. 1-6 cr. Ind. St.  
Guided research on a topic relevant to music education.

Graduate Courses in Music  
There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

MuEd 500 Seminar  
A,W,Su. 1 cr. Sem. May be repeated. Maximum 6 cr.  
Music education topics for all school levels.

MuEd 502 School Music Conducting  
Su alternate years, will be offered Su 1986. 3 cr. Rec.-Dis.  
PREREQUISITE: Mus 416.  
Rehearsal procedures, score study, conducting techniques for direction of instrumental and choral organizations in the public schools.

MuEd 505 Advanced Musical Styles  
A alternate years, will be offered A 1986; Su alternate years, will be offered Su 1987. 3 cr. Rec.-Dis.  
PREREQUISITES: Mus 405, 406.  
Vocal and instrumental jazz styles for use by public school music conductors.
### MuEd 506 Ethnomusicology
Su alternate years, will be offered Su 1987. 3 cr. Rec.-Dis. 
PREREQUISITES: Mus 405, 406.
Approaches to and utilization of music in representational world cultures. The influence of world music on Western music.

### MuEd 507 Contemporary Directions in Music
S alternate years, will be offered S 1987. 3 cr. Rec.-Dis. 
PREREQUISITES: Mus 405, 406.
Social implications and aesthetic values in major recent approaches to composition and performance.

### MuEd 509 Graduate Recital
On demand. 1 cr. Ind. St. Maximum 3 cr. 
PREREQUISITE: Graduate standing. 
Formal recital to include works from different eras.

### MuEd 510 Instructional Literature
A,W,S,Su. 1 or 2 cr. Tut. Maximum 8 cr. 
PREREQUISITE: Mus 314.
Literature used for teaching in the student's major field of performance.

### MuEd 520 Choral Workshop
Su. 2 cr. Lect. 1; Lab. 1. 
PREREQUISITE: Mus 416.
Pedagogical and performance techniques in a variety of styles.

### MuEd 525 Rehearsal Techniques and Literature
Su. 2 cr. Lab. 
PREREQUISITES: Graduate standing and high school conducting experience. 
Pedagogical and performance techniques for the public schools. Guided observation and discussion.

### MuEd 530 Psychological Foundations of Musical Perception and Learning
Su alternate years, will be offered Su 1986; W alternate years, will be offered W 1988. 3 cr. Lect. 
PREREQUISITE: Graduate standing. 
Cognitive, physical and emotional responses to music, their importance to the teaching of music; the application of learning theories to music instruction.

### MuEd 531 Individual Problems
PREREQUISITES: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies.
Student initiated, faculty directed research and study on an individual basis in subject areas not offered by the Department of Music.

### MuEd 535 Graduate Research Paper
A,W,S,Su. 1-6 cr. Ind. St. Maximum 6 cr. 
PREREQUISITE: Graduate standing. 
For the student whose program does not include a thesis. A research paper on a topic mutually agreed upon by the student and professor.

### MuEd 540 Internship
An individualized program of field experience in an educational institution.

### MuEd 550 Special Topics
On demand. 1-5 cr. Maximum 12 cr. 
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

The following Education Through Music courses are available only through Extended Studies. The offering sites will be determined by Extended Studies. Different but equivalent prerequisites may apply if courses are offered outside the U.S.

### MuEd 511 Introduction to Education Through Music
On demand. 1 cr. Rec.-Dis. 
PREREQUISITE: Graduate standing. 
Initial ETM song-experience-game approach to learning through a sequential program of techniques and materials for developing musical skills.

### MuEd 512 Basic Fundamentals of Education Through Music
On demand. 5 cr. Lect. 1; Rec.-Dis. 4. 
PREREQUISITE: Graduate standing. 
Guidelines and techniques for application of song-experience-game approach to learning.

### MuEd 513 Fundamentals of Education Through Music
On demand. 5 cr. Lect. 1; Rec.-Dis. 4. 
A continuation of MuEd 512.

### MuEd 514 Basic Education Through Music Teaching
On demand. 5 cr. Lect. 1; Rec.-Dis. 4. 
PREREQUISITES: MuEd 513, graduate standing. 
Continued work on musical skills, introduction to philosophical basis of ETM.

### MuEd 515 Advanced Education Through Music Teaching
On demand. 5 cr. Lect. 1; Rec.-Dis. 4. 
PREREQUISITES: MuEd 514, graduate standing. 
A continuation of MuEd 514. Students plan and team teach with instructor.

### MuEd 516 Education Through Music Summer Institute I
Su on demand. 4 cr. Lect. 1; Rec.-Dis. 3. 
PREREQUISITE: Graduate standing. Materials for development of musical skills and their use.

### MuEd 517 Education Through Music Summer Institute II
Su on demand. 4 cr. Lect. 1; Rec.-Dis. 3. 
PREREQUISITE: Graduate standing. A continuation of MuEd 516.

### Native American Studies
994-3881

**Director:** Mr. W.C. Fleming (Acting). 
**Associate Professor:** C.P. Morris. 
**Assistant Professor:** W.C. Fleming (Adjunct). 
**N.H. Tucker** (Adjunct). D. Voyich (Adjunct).

### NAS 1005 Introduction to Native American Studies
A.S. 3 cr. Lect. 
Traditional and contemporary American Indian culture, including art, music, dance, religion, literature, material culture. Current and historical issues in law, education, health, tribal government that play a significant role in Indian life; awareness of cultural differences.

### NAS 101 Selected Issues in Personal Development
A. 2 cr. Rec.-Dis. 
For students making an adjustment to university life. Topics include relationships to self, communication skills, goal setting, decision making, time management, and personal issues that face college students.

### NAS 201 Montana Indian Groups: Prior to 1862
A,S,Su. 3 cr. Lect. 
 Movements of the Indian nations which settled in present-day Montana. The social structures including kinship with emphasis on interpersonal relationships; political affiliations within tribes with regard to bands of nations; organization of military, warrior societies, religions; social interaction including music and dance; and the role of individuals in society (male, female, children and adult). Philosophies and morality; myths and legends.

### NAS 202 Montana Indian Groups: 1862 to Present
W,Su. 3 cr. Lect. 
Establishment of the reservations in Montana through an examination of the Congressional acts concerning Indian people, treaties and agreements between the Indian nations and the United States government; vested rights of the Indian people. The response of the Indian nations to the United States government and the establishment of intergovernmental relationships; issues of sovereignty and self-government; tribal councils; and Indian cultures and societies in the contemporary scene. Present-day reservation characteristics and populations will be identified.

### NAS 205 Plains Indians Culture and History
A,S,Su. 3 cr. Lect. 
Examination of the diversity of Plains Indian cultures from anthropological and historical perspectives; northern plains, southern plains, prairie and the sedentary village cultural groups; the interaction of tribal groups, the United States military and incoming settlers and adventurers; the responses of Plains groups to the changing environment and times and their impact on the developing policy of the federal government.

### NAS 206 Cultures and History of the Northwest Indians and Alaska Natives
W alternate years, will be offered W 1988. 3 cr. Lect. 
The indigenous cultures in the Pacific Northwest and Alaska from anthropological and historical perspectives; an ethnohistoric comparison of sedentary village groups and nomadic cultures; the impact of Russian, English, French and United States economic and military interests; the response of Native Americans to these changes and their impact on developing federal Indian policy.

### NAS 207 Cultures and History of the Southwestern Indians
W alternate years, will be offered W 1988. 3 cr. Lect. 
Indian cultures in the American Southwest from anthropological and historical perspectives; an ethnohistoric comparison of tribal groups and their response to Spanish, Mexican and American economic, social and religious influences.

### NAS 220 American Indian Art
A,W,S,Su. 3 cr. Lect. 
The aesthetic, cultural, symbolic meanings of Native American art; Northwest Coast, Southwestern and Plains Art.

### NAS 242 Visions of the Contemporary Indian
W. 3 cr. Lect. 
Selected contemporary economic, social, political, educational and cultural issues facing American Indians today, with special emphasis on tribal groups in Montana.

### NAS 276 Internship
A,W,S,Su. 3-6 cr. Ind. St. 
PREREQUISITE: Two courses from NAS cultures and history areas. 
Assignment at the lower- and mid-management levels of tribal, local, state or federal jurisdiction or quasi-public agency serving American Indians; designed to provide exposure to, and an understanding of, the environment and tasks of such governmental
jurisdictions and quasi-public bodies, as well as particular agencies and functions, thereby merging theory with practice.

NAS 280 Special Topics
On demand. 1-3 cr. Lect.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

NAS 310 American Indian Health
S alternate years, will be offered S 1988. 3 cr. Lect.
Diseases and disorders among Native Americans; social, economic and cultural aspects as they relate to Native American health; the contribution of Native Americans to the medical field; Native American health professionals; and the unique relationship of Native Americans with the federal government.

NAS 320F American Indian Religions and Philosophical Thought
A,W. 3 cr. Lect.
PREREQUISITE: Upper division standing.
Religious and philosophical themes developed by tribal peoples in the New World, various forms of religious and philosophical expression and how they relate to our human sense of an existing moral order.

NAS 330 American Indian Policy
A. 3 cr. Lect.
PREREQUISITE: Upper division standing.
Historical influences of colonial attitudes, U.S. governmental structure, institutions, policies and individuals on the development of tribes; identification of different historical periods of American Indian policy.

NAS 330F American Indian Literature
W. 3 cr. Lect.; 2 Rec; Dis. 1.
PREREQUISITE: Upper division standing.
Traditional and contemporary Native American literature including oral narratives, folktales, poetry, short stories, essays and the novel. Methods of literary analysis will be explored to assist students in determining the meaning and function of the various genre.

NAS 400 Seminar
On demand. 1 cr. Sem. Maximum 3 cr.
Selected research topics of special interest in Native American Studies.

NAS 430 American Indian Education
A,S. 3 cr. Lect.
PREREQUISITE: Upper division standing.
The historical development of American Indian education and the influence of historical roots on contemporary directions in American Indian education; values and assumptions inherent in programs devised at the state and federal levels and the results of these programs. The cultural basis of American Indian education and selected materials appropriate to the various levels of Indian education.

NAS 431 Issues in American Indian Education
W. 3 cr. Lect.
PREREQUISITE: Upper division standing.
Selected current issues in Indian education. Some of the issues to be discussed are: cognition and culture, cross-cultural learning, culturally sensitive curriculum, educational objectives for Native Americans, Indian control of education. The issues selected will reflect current concerns of the Indian community and educators involved in cross-cultural planning and research.

NAS 440 Tribal Economics—Past and Present
W alternate years, will be offered W 1986. 3 cr. Lect.
Reservation economics: their historical origins, contemporary organization, and relationship to tribal, corporate, state and federal interests. Impact of mineral and other tribal resources development.

NAS 450 Program Development and Proposal Writing
On demand. 3 cr. Rec.-Dis.
PREREQUISITE: Upper division standing.
The elements of proposal writing as they relate to program planning, development, implementation, evaluation and renewal. The processes inherent in program development as they relate to tribally identified needs and priorities in American Indian communities.

NAS 460 Law and the American Indian
S. 3 cr. Lect.
PREREQUISITE: NAS 330.
The unique legal status of the American Indian, including basic law concepts, a historical review of Indian tribes, federal Indian laws and court systems, and major cases dealing with Indian legal issues.

NAS 465 Tribal Governments and Community Development
W alternate years, will be offered W 1987. 4 cr. Lect.
PREREQUISITE: NAS 330.
The structure, organization and administration of tribal governing bodies; the federal relationship; types of business conducted; available resources; and methods for community development.

NAS 470 Individual Problems
A,W,S. 1-5 cr. Ind. St.
Directed research and study on an individual basis.

NAS 476 Internship
PREREQUISITE: Two courses from NAS cultures and history area, one course from NAS policy and law area, one course from community affairs area and one course from education area.
Assignment at the mid- and upper-management levels of a tribal, local, state or federal jurisdiction or quasi-public agency serving American Indians, designed to provide exposure to, and an understanding of, the environment and tasks of such governmental jurisdictions and quasi-public bodies, as well as particular agencies and functions, thereby merging theory with practice.

Nursing

N 214 Professional Socialization in Nursing
A,W,S. 3 cr. Lect.
PREREQUISITE: Soc 101. Open to non-majors.
Professional socialization; focuses on the influence of historical and current societal forces on nursing and health care delivery.

N 221 Nursing Care Fundamentals
A,W,S. 3 cr. Lect.; 2 Lab. 1
PREREQUISITE: Open to non-majors.
Selected concepts of health such as mobility, comfort and hygiene, infection control, teaching/learning principles and CPR; fundamental nursing care concepts and related skills.

N 225 Nursing Process
A,W,S. 4 cr. Lect.; 3 Lab. 1
PREREQUISITE: Biol 211 and 212, HEC 152, N 221 (N 221 may be taken concurrently with N 225), and enrollment in nursing curriculum.
Basic nursing concepts which emphasize the nursing process in applying to the clinical setting; providing for comfort and safety needs of individuals.

N 226 Health Assessment in Nursing
A,W,S. 5 cr. Lect.; 3 Lab. 2
PREREQUISITE: Biol 211, 212 and enrollment in nursing curriculum.
Concepts of homeostasis and principles from the behavioral, physical and social sciences applied in the nursing health assessment of adults.

N 227 Nursing Therapeutics
A,W,S. 3 cr. Lect.
PREREQUISITE: Chem 122, Biol 211 and 212, N 221 (N 221 may be taken concurrently with N 227), and enrollment in nursing curriculum.
Use of pharmacological concepts and their relationship to the promotion, restoration, or maintenance of homeostasis in the individual.

N 270 Individual Problems
On demand. 1-4 cr. Ind. St. Maximum 6 cr.
PREREQUISITE: Consent of instructor and Dean of Nursing.
Student initiated, faculty directed research and study on an individual basis in subject areas not included in the courses offered by the College of Nursing.

N 280 Special Topics
On demand. 1-5 cr. Lect. Maximum of N 280 plus N 480, 15 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

N 301 Spiritual Care: The Nurse's Role
On demand. 2 cr. Lect.
PREREQUISITE: Upper division standing in nursing, or R.N. and consent of instructor.
To assist the professional nurse in giving holistic nursing care by assessing and planning intervention to meet the spiritual needs of patients and families.

N 302 Human Sexuality for Nurses
On demand. 3 cr. Lect.; 2 Lab. 1
PREREQUISITE: N 221
NURSING major at upper division level.
Opportunity to acquire understanding of own feelings and attitudes about human sexuality and sexual behavior. This increased knowledge will enable the student to deliver more comprehensive health care.

N 325 Transition to Professional Nursing
Su. 3 cr. Lect.; 2 Lab. 1
PREREQUISITE: Registered nurse, required lower division non-nursing courses.
The nursing process, its application as well as the integration of theory and correlation of the process in the giving of quality nursing care.
N 326 Health Assessment
Su. 4 cr. Lect. 2; Lab. 2. PREREQUISITES: Registered Nurse, Biol 211 and 212. Primary focus is on obtaining health histories and performing physical assessments.

N 356 Medical-Surgical Nursing I
A,W,S. 6 cr. Lect. 3; Lab. 3. PREREQUISITES: Junior standing and satisfactory completion of required lower division courses. Nursing care of patients with common dysfunctions of the musculoskeletal system, sensorium and selected aspects of endocrine and reproductive systems.

N 357 Medical-Surgical Nursing II
A,W,S. 6 cr. Lect. 3; Lab. 3. PREREQUISITES: Junior standing and satisfactory completion of required lower division courses. Nursing care of adult patients with common dysfunctions of the respiratory, cardiovascular, gastrointestinal and urinary systems.

N 366 Maternal-Infant Nursing
A,W,S. 6 cr. Lect. 2; Lab. 3; Sem. 1. PREREQUISITES: Junior standing and satisfactory completion of required lower division courses. Nursing process in meeting the needs of the well family in various stages of the childbearing cycle; also issues related to women of reproductive age, menopausal and postmenopausal age.

N 367 Family Child Nursing
A,W,S. 6 cr. Lect. 3; Lab. 3. PREREQUISITES: Junior standing and satisfactory completion of required lower division courses. Care of families with children having preventive or acute health care needs; norms of childrearing, pathophysiologic and psychosocial bases of common needs exhibited by the child-family system.

N 378 Community Health Nursing
A,W,S. 5 cr. Lect. 3; Lab. 2. PREREQUISITES: Junior standing and satisfactory completion of required lower division courses. Nursing care of clients in a community; community health nursing theory in general nursing practice.

N 386 Psychiatric Nursing
A,W,S. 6 cr. Lect. 5; Lab. 3. PREREQUISITES: Junior standing and satisfactory completion of required lower division courses. Nursing care for clients with psychiatric or learning disabilities; development of concepts in clinical nursing specialty.

N 391 Introduction to the Research Process
A,W,S. 2 cr. Lect. PREREQUISITES: Junior standing or R.N. and satisfactory completion of required lower division courses. Research process as it applies to nursing; identification of researchable nursing problems and actual inquiries into current nursing practices.

N 392 Utilization of Research Findings
A,W,S. 2 cr. Lect. PREREQUISITE: N 391. Beginning ability to read and interpret research studies in a critical manner and to explore their relevance to nursing practice.

N 393 Research Project

N 400 Seminar
A,W,S. 1 cr. Sem. Areas of concern in movement from student role to a professional nursing role.

N 402 Oncology Nursing
On demand. 3 cr. Lect. 2; Ind. St. 1. PREREQUISITES: N 356 and 357, or R.N. and consent of instructor. Current concepts in cancer control, current modalities of therapy employed in treating patients with cancer and the role of the nurse in promoting the health outcomes of patients/clients with cancer.

N 403 Death and Dying: A Human Experience
On demand. 3 cr. lect. PREREQUISITES: Senior level standing in nursing, or R.N. and consent of instructor. Current theories and attitudes toward death and the application of these theories for nursing intervention for the dying and their families.

N 405 Nursing and the Handicapped
S. 2 cr. Rec.-Dis. PREREQUISITE: Upper-level placement in nursing. Focuses on the magnitude of handicapping conditions and the problems and needs of the handicapped of any age; emphasis on the role of the professional nurse in relation to the handicapped person and on the effect of a handicapping condition on the family unit.

N 414 Directing Patient Care
A,W,S. 2 cr. Lect. 1; Rec.-Dis. 1. PREREQUISITES: Satisfactory completion of junior course requirements. Practical and theoretical approaches to management of patient care for both individuals and groups; systems and change theories.

N 419 Organizing Health Care Delivery
A,W,S. 2 cr. Lect. PREREQUISITES: Satisfactory completion of junior course requirements. Analysis of organizational structure and its impact upon health care delivery; political process strategies and issues of access as factors influencing health care delivery.

N 456 Advanced Medical-Surgical Nursing I
A,W,S. 6 cr. Lect. 2; Lab. 4 PREREQUISITES: Senior standing and satisfactory completion of junior clinical nursing courses. Nursing care of adults with complex health problems; nursing measures in prevention treatment and rehabilitation of health problems resulting from interferences in neurological and chemical regulatory mechanisms, psychodynamics of human behavior and psychopathology.

N 457 Advanced Medical-Surgical Nursing II
A,W,S. 6 cr. Lect. 2; Lab. 4 PREREQUISITES: Senior standing and satisfactory completion of junior clinical nursing courses. Nursing care for clients with chronic or life-threatening disturbances of biological, psychological and sociocultural norms during childhood.

N 470 Individual Problems
On demand. 1-4 cr. Ind. St. Maximum 6 cr. PREREQUISITES: Consent of instructor and Dean of Nursing.

Student initiated, faculty directed research and study on an individual basis in subject areas not included in the courses offered by the College of Nursing.

N 476 Clinical Preceptorship
Su. 5 cr. Lab. PREREQUISITES: Satisfactory completion of all junior-level clinical courses. Placements subject to availability. This elective course is designed to increase competence and confidence in previously learned clinical skills. The student works with a bachelor's-prepared R.N. in a cooperating clinical agency for a period of four-and-a-half weeks during the summer.

N 486 Advanced Psychiatric Nursing
A,W,S. 5 cr. Lect. 2; Lab. 3. PREREQUISITES: Senior standing and satisfactory completion of junior clinical nursing courses. Nursing care for clients with psychiatric mental health needs, including families and groups in a variety of community settings; clinical application of knowledge and skills in giving care to clients in the community.

Graduate Courses in Nursing
There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

N 500 Seminar
On demand. 1 cr. Sem. Maximum 6 cr. PREREQUISITE: Graduate standing. Group discussions of topics of special interest to graduate students.

N 510 Seminar on Clinical Nursing Problems

N 511 Health Care Delivery Systems
On demand. 3 cr. Lect. 2; Lab. 1. PREREQUISITE: Graduate standing. Focuses on use of systems analysis in identifying the health needs and perceptions in rural communities. Survey methodologies, used in identifying community groups, are discussed and applied to gather data for analysis of a selected rural health care system.

N 513 Organization and Management of Rural Health Care
On demand. 3 cr. Lect. 2; Lab. 1. PREREQUISITE: Graduate standing, N 511. Focuses on organization and management of rural health care systems. Network analysis is employed to identify the linkages and supports existing within and outside the community.
A,W,S,Su. 1-6 cr. Maximum 15 cr.

N 525 Advanced Nursing I
On demand. 8 cr. Lect. 2; Rec.-Dis. 1; Lab. 5.
PREREQUISITES: Graduate standing, N 513, 514, 538, 539, 591.
Theoretical concepts applicable to nursing practice. Opportunity to test additional nursing hypotheses in clinical area.

N 526 Advanced Nursing II
On demand. 7 cr. Lect. 2; Rec.-Dis. 1; Lab. 4.
PREREQUISITES: Graduate standing, N 513, 514, 538, 539, 591.
Final preparation of the clinical specialist. Opportunity to function independently as clinical specialist in various clinical settings.

N 537 Ethnographic Approach to Rural Health Nursing
On demand. 3 cr. Lect. 2; Lab. 1.
PREREQUISITE: Graduate standing.
Emphasizes discovery of the health perceptions of identifiable populations in sparsely populated areas. Focus is on preparing for the provision of care which is relevant to consumer needs. Theoretical perspectives related to the planning of care for rural consumers are considered. Nursing theories provide for the development of theoretical or conceptual contexts for the care of individuals and groups.

N 538 Assessment of Health Needs of the Rural Family Unit
On demand. 4 cr. Lect. 2; Lab. 2.
PREREQUISITES: Graduate standing, N 557 and 526.
Provides the student with opportunity to develop skill in assessing physical and psychosocial needs of the rural family. Emphasis is on the maintenance of health, prevention of disease and early detection of health problems. Chronic health problems are examined within the context of long-term management and development of an optimal level of functioning.

N 539 Management of Acute Care Needs in Rural Areas
On demand. 3 cr. Lect. 2; Lab. 1.
PREREQUISITES: Graduate standing, N 538.
Assists the student in examining the occurrence and management of acute care needs among rural families. Clinical experience includes continuation of a supportive relationship with a rural family and/or development of a new relationship with a client. An investigation of acute care systems and resources supplements the client-centered experience.

N 570 Individual Problems
PREREQUISITES: Graduate standing, N 537 and 526.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

N 579 Graduate Consultation
A,W,S,Su. 3 cr. Tut.
PREREQUISITES: Graduate standing and approval of the Dean of Graduate Studies.
This course may be repeated only by students who have completed all of their course work (and thesis, if on a thesis plan) for a master's degree but who need additional faculty help or time.

N 590 Master's Thesis
A,W,S,Su. 1-12 cr. Ind. St. May be repeated.
PREREQUISITE: Master's standing.

N 591 Nursing Research I
On demand. 5 cr. Lect.
PREREQUISITES: Graduate standing, a basic statistics course.
Provides an overview of the nursing research process. The student identifies the steps of the nursing research process, investigates the interrelationship of these steps, and analyzes current nursing theories as they relate to nursing research.

N 592 Nursing Research II
On demand. 3 cr. Lect.
PREREQUISITES: Graduate standing, N 591.
Focuses on issues related to research designs, data production, data management, data analysis, and protection of subjects. The student critiques selected nursing studies.

Philosophy

Department of History and Philosophy
994-4395

Head of Department: E.E. Barry.
Professor: G.G. Brittain, Jr.
Associate Professor: J.W. Allard.
Assistant Professors: S.S. Leyzy, N.A. Marshall.

Phil 211F Introduction to Philosophy
A,W,S,Su alternate years, will be offered Su 1987. 4 cr. Lect.
Basic issues concerning the nature of knowledge and reality.

Phil 212F Introduction to Philosophy
A,W,S,Su alternate years, will be offered Su 1988. 4 cr. Lect.
Basic philosophical issues concerning human values in ethics and/or politics and/or art.

Phil 214 Philosophy of Human Nature
W, 4 cr. Lect.
Various concepts of human nature which have been influential in Western civilization: philosophical materials, movements in art, religion and politics; different theories which have informed our cultural heritage.

Phil 220 Oriental Philosophy
S, 4 cr. Lect.
Major philosophies of China and Japan including Confucianism, Taoism, and Buddhism.

Phil 231 Introduction to Logic
A,W, 4 cr. Lect.
Traditional and modern forms of valid inference with emphasis on their philosophical presuppositions and implications.

Phil 232 Intermediate Logic
5 alternate years, will be offered S 1988. 4 cr. Lect.
Continuation of Philosophy 231. Topics include propositional and predicate logic, singular terms, nonstandard logics, axiomatics, empirical applications.
Phil 352 Metaphysics
A alternate years, will be offered A 1986. 4 cr. Lect.
PREREQUISITE: One course in philosophy.

The most basic questions human beings raise in reflecting on their world, themselves, and their place in the world. Sample questions concern the nature of being, and the possibility of freedom.

Phil 356F American Thought and Culture, Puritans-Civil War
A alternate years, will be offered 1986. 4 cr. Lect.

The fundamental purpose of this course is to show the interconnectedness of science, philosophy and religion in shaping the American intellectual tradition from the Puritan founding to the eve of the Civil War.

Phil 357F American Thought and Culture, 1865-Present
A alternate years, will be offered 1987. 4 cr. Lect.

The fundamental purpose of this course is to show the interconnectedness of science, philosophy and religion in shaping the American intellectual tradition from the Civil War through the present.

Phil 360 Existentialism and Phenomenology
S alternate years, will be offered S 1987. 4 cr. Lect.
PREREQUISITE: One course in philosophy.

The sources of existentialism in Kierkegaard and Nietzsche and contemporary philosophers such as Heidegger, Husserl and Sartre.

Phil 364 Contemporary Philosophy
S alternate years, will be offered S 1988. 4 cr. Lect.
PREREQUISITE: One course in philosophy.

Major trends in twentieth century British and American philosophy with particular emphasis on Wittgenstein, Russell and Quine.

Phil 368 Philosophy of Language
S alternate years, will be offered S 1987. 4 cr. Lect.
PREREQUISITE: One course in philosophy.

Theories of meaning from Mill to Wittgenstein, including the strengths and weaknesses of each and how the acceptance of these various theories affects the classic questions of philosophy in ethics, epistemology and metaphysics.

Phil 378 Philosophy of Science
W. 4 cr. Lect.
PREREQUISITES: One year of science, Phil 211 and 251.

Presuppositions of scientific knowledge as discussed in a selection of philosophical and scientific writings.

Phil 390 Marxism
A alternate years, will be offered A 1986. 4 cr. Lect.
PREREQUISITE: One course in philosophy.

The philosophical and economic theories of Karl Marx and their role in contemporary Marxist thought.

Phil 400 Seminar in Philosophy
PREREQUISITE: Junior standing.

Each quarter is given over to the detailed study of a major figure or problem in philosophy. Since the figures or problems studied vary from quarter to quarter, the course may be repeated for credit. Three quarters of Phil 400 required for all philosophy majors.

Phil 470 Individual Problems
A,W,Su. 1-3 cr. Ind. St. Maximum 6 cr.
PREREQUISITES: Consent of instructor and department head.

Directed research and study on an individual basis.

Phil 480 Special Topics
On demand. 3-5 cr. Maximum of Phil 280 plus 480, 16 cr.
PREREQUISITE: One course in philosophy.

Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Graduate Courses in Philosophy

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

Phil 500 Seminar
On demand. 1 cr. Sem. Maximum 6 cr.
Methods of analysis and research entailed in advanced study of philosophy. Frequent papers and reports together with independent research into specific problems make up the major tasks in this course.

Phil 570 Individual Problems
PREREQUISITES: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies.

Directed research and study on an individual basis.

Phil 580 Special Topics
On demand. 2-5 cr.
PREREQUISITE: Graduate standing.

Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Physical Education
Department of Health, Physical Education and Recreation
994-4001

Head of Department: Dr. A.W. McNeill.


Assistant Professors: N. Colton, G. Olson, C. Shriver, C. Stuart.

Instructors: R. Pitcher.

Adjunct Professor: V. Hunt.

Adjunct Assistant Professors: D. Gerhardt, C. Karop, R. McCullough.

Professor Emeritus: M. Hossaeus.

Associate Professor Emeritus: D. Kennemer, K.L. Lambert.


Professional Courses

PE 105 Foundations of Physical Education
A,S. 2 cr. Lect.

The development, purposes and concepts of physical education.

PE 107 Introduction to Recreation
A. 2 cr. Lect.

Development, purposes, scope and concepts of recreation.

PE 110 Basic Movement
A. 2 cr. Lect.

Identification and analysis of the commonalities associated with human movement with emphasis on sports, games, dance and recreational activities.

PE 111 Badminton Skills
W. 1 cr. Lab.

Badminton skills for physical education majors and minors.

PE 133 Tennis Skills
A.S. 1 cr. Lab.

Basic tennis skills for physical education majors and minors.

PE 149 Gymnastic Skills
S. 2 cr. Lab.

PREREQUISITE: HPER major or minor.

The learning and teaching of basic skill progressions on men's and women's competitive gymnastic apparatus for physical education majors and minors.

PE 185 Volleyball Skills
W. 1 cr. Lab.

Basic skills and team play of power volleyball.

PE 204 Dance as Cultural Expression
4 cr.

Dance in a variety of cultures will be identified and examined taking into consideration some of the factors that have influenced its development (geography, climate, music, sociological values, customs).

PE 205 Dance Appreciation
3 cr.

Dance as a performing art, its historical development, the way dance makes statements about man and his environment through the use of music, art, movement, literature and theater.

PE 210 Professional Activities Block
A. 2 cr. Lect. 1; Lab. 1.

PREREQUISITES: PE 110 and any two of the required PE skill courses. A series of activity classes for majors and minors in Physical Education.

PE 219 Advanced Life Saving
A,W,S. 2 cr. Lab.

PREREQUISITES: PE-C 170, Hlth 221, 222.

Personal safety and life saving water tactics. Students able to meet American Red Cross standards will receive the American Red Cross Advanced Life Saving Certificate.

PE 220 Leisure/Recreation Trends and Issues
A. 2 cr. Lect.

Contemporary philosophical, social, historical and administrative issues in leisure and recreation.

PE 224 Teaching of Rhythms
W,S. 3 cr. Lect. 1; Lab. 2.

PREREQUISITES: PE-C 125, PE 105 or 107.

Practice skills in music fundamentals; teaching and learning folk, square, social and various types of rhythmic activities.

PE 226 Motor Development and Learning
S. 3 cr. Lect.

PREREQUISITE: PE 110.

Basic theoretical and practical issues in the study of motor development and motor performance.

PE 230 Recreation Leadership
A,W. 4 cr. Lect. 2; Lab. 2.

PREREQUISITES: PE 107 and sophomore standing.

Survey of professional recreation; emphasis on philosophy and school and community recreation. Laboratory assignments arranged through Bozeman Recreation Department and public schools.

PE 270 Individual Problems
A,W,S. 1-3 cr. Ind. St. PE 270 plus 470, maximum 6 cr.

PREREQUISITES: Underclass student, consent of instructor and approval of department head.

Directed study on an individual basis.

PE 280 Special Topics
On demand. 1-5 cr. Lect. Maximum 8 cr.

Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.
PE 300 Paraprofessional Experience
A.W.S. 1-6 cr. Ind. St.
Students will observe teaching strategies and serve as teacher aides under supervision of University personnel.

PE 310 Education Movement Experiences
A.W.S. 3 cr. Lect.
PREREQUISITE: PE 224 for PE majors/minors or junior standing.
Educational gymnastics, educational dance and educational games. The why and how of teaching these areas to children.

PE 314 Physical Education for the Exceptional Child
W,S,Su on demand. 3 cr. Lect.
PREREQUISITE: Junior standing.
A survey of orthopedic and cognitive handicapping conditions. Practical teaching strategies will be presented that enable the educator to provide humanistic experiences for these students.

PE 316 Achievement Measurement
S. 2 cr. Lect. 1; Lab. 1.
PREREQUISITE: Junior standing.
Measurement procedures to be used in a physical education testing program with emphasis on construction, analysis, interpretation and evaluation of various tests.

PE 319 Mechanical Kinesiology Lab
A.W. 1 cr. Lab.
PREREQUISITES: Biol 212 and concurrent enrollment in PE 320.
Practical application of knowledge of musculoskeletal anatomy to exercise, sports and sports medicine.

PE 320 Mechanical Kinesiology
A.W. 3 cr. Lect.
PREREQUISITES: Biol 212 and concurrent enrollment in PE 319.
The study of human movement from a functional anatomical perspective with particular emphasis on sport and physical therapy applications.

PE 321 Biomechanics
S. 2 cr. Lect.
PREREQUISITES: PE 110 and concurrent enrollment in PE 322.
Application of anthropometric, force and motion factors that influence the effectiveness of human movement. Individual emphasis given to sport or physical therapy application.

PE 322 Biomechanics Lab
S. 1 cr. Lab.
PREREQUISITES: PE 110 and concurrent enrollment in PE 321.
Application of the mechanical principles of physics to sports activities for physical education majors, and to the mechanics of normal and pathological human movement for pre-physical therapists.

PE 323 Ski Instructor Training
A. 2 cr. Lect. 1; Lab. 1.
PREREQUISITE: Advanced proficiency in skiing.
Preparation toward certification of ski instructors.

PE 324 Techniques of Teaching Handicapped to Ski
A. 2 cr. Lect. 1; Lab. 1.
PREREQUISITE: PE 314 or 323 or PE-C 161.
A prerequisite for teaching skiing to the handicapped, this course covers the PS.I.A. teaching progression and how it can be adapted to teaching the handicapped.

PE 327 Camp Leadership
S. 3 cr. Lect. 2; Lab. 1.
Organization and administration of various types of camp programs, with practical application in laboratory periods.

PE 329 Commercial, Private and Industrial Recreation
W. 3 cr. Lect.
PREREQUISITE: PE 107.
The philosophy, operations, management and employment opportunities.

PE 335 Intramural Sports
A. 2 cr. Lect.
PREREQUISITE: PE 105 or 107.
Introducing physical education students to the mechanics of setting up and operating an intramural program.

PE 340 History of Dance
S. 2 cr. Lect.
History of dance from the primitive through Greek, medieval and Renaissance periods into the theatrical dance forms, ballet and modern dance.

PE 353 Advanced Aquatics
A. 3 cr. Lect. 1; Lab. 1.
PREREQUISITE: PE 219 or current American Red Cross Advanced Life Certificate.
A variety of teaching methods is explored. Students able to meet American Red Cross standards will receive American Red Cross Safety Instructor's Certificate.

PE 366 Practicum
A.W. 1-2 cr. Lab. Maximum 6 cr.
May be taken concurrently or after EdSd 365. The instructor of EdSd 365 will make assignments and advise PE 366. To be done within HPER Department or secondary education agency.

PE 407 Outdoor Recreation Education
W. 3 cr. Lect.
PREREQUISITE: Biol 105.
The integration and relationships of environmental education in outdoor recreation programs.

PE 412 Teaching Practicum
A.W. 2 cr. Lect. 1; Lab. 1.
PREREQUISITE: PE 224 and/or EdSd 365.
Participation in teaching physical education activity classes on campus; construction of lesson plans; classification, evaluation and development of one's teaching style.

PE 415 Administration and Curriculum
W. 4 cr. Lect.
PREREQUISITE: PE 224 or EdSd 365.
Administration of physical education programs, including: legal liability; public relations; budget and finance; supplies and equipment; and principles of designing curricula.

PE 420 Sports Equipment Design
W. 3 cr. Lect.
PREREQUISITE: Junior or senior standing.
Designed to help students become familiar with factors relevant to the selection and use of different models and types of sports and athletic clothing; impact protection equipment; clubs, balls, rackets, skis. Each topic is discussed from the point of view of the designer or engineer, manufacturer, salesperson and user.

PE 422 Physiology of Exercise
A. 4 cr. Lect.
The effects of exercise on physiologic systems, and variables that can alter exercise performance.

PE 423 Physiology of Exercise Lab
A. 1 cr. Lab.
PREREQUISITE: Concurrent enrollment in PE 422.
Laboratory to accompany lectures in PE 422. Experiments to be performed by students and demonstrations to illustrate concepts discussed in lecture.

PE 470 Individual Problems
A.W,S,Su. 1-3 cr. Ind. St. Maximum 6 cr.
PREREQUISITE: Consent of instructor and approval of department head.
Directed research and study on an individual basis.

PE 476 Internship
A.W,S,Su. 1-4 cr. Ind. St.
PREREQUISITES: Junior standing or consent of adviser. PE 107, 230 for recreation majors. PE 105 for PE majors.
Individualized field experience in an educational or business organization.

PE 480 Special Topics
On demand. 1-5 cr. Lect. Maximum 12 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Graduate Courses

In Physical Education

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

PE 500 Seminar
On demand. 1 cr. Sem. Maximum 6 cr.
Current and future problems.

PE 501 Trends and Issues
S,Su alternate years, will be offered Su 1986. 3 cr. Lect.
PREREQUISITE: Graduation from teacher training undergraduate program.
Contemporary problems, trends and issues including recent innovations and directions in the profession.

PE 506 Physical Education for Exceptional Child
Su alternate years, will be offered Su 1987. 3 cr. Lect.
PREREQUISITE: PE 314.
The importance of activity to physical, social and mental development of the handicapped and selection of appropriate programs.

PE 507 Assessment and Programming in Physical Education for the Handicapped
S. 5 cr. Lect.
PREREQUISITE: PE 506.
Theoretical and practical introduction and application of assessment-based program development.

PE 508 Motor Learning
Su. 3 cr. Lect.
PREREQUISITES: PE 321, 322.
Behaviors that influence the ability to move efficiently. Factors that affect permanent change in motor performance due to practice rather than maturation.

PE 510 Community Recreation
S. 3 cr. Lect.
PREREQUISITE: PE 415.
Organization and importance of national, state and local programs and their relationship to the community.

PE 512 Research Design in Physical Education
A.Su. 4 cr. Lect.
PREREQUISITE: PE 316.
Techniques and procedures dealing with experimental and library research, and evaluation of research projects.

PE 515 Children in Sport
S,Su. 3 cr. Lect.
PREREQUISITE: Graduation from teacher training undergraduate program.
The significance of youth sports programs in children's, parents' and coaches' lives.
Class No ______ Title ______ Qtr/Yr ______

Signed ______ Date ______


Special activity classes offered as needed using the unique skills of the instructional faculty in any given quarter.

A,W,S,Su. 1 cr. Lab. Maximum 2 cr. 

The fundamentals of Japanese Aikido as taught by the World Aikido Federation will be explored.

A,W. 1 cr. Lab. 

Skills for beginners.

A,W,S. 1 cr. Lab. 

Elementary skills and basic team play.

W,S. 1 cr. Lab. 

Elementary skills and basic team play.

A,S. 1 cr. Lab. 

Touring, maintenance and care.

A,W,S,Su. 1 cr. Lab. 

Skills for beginners.

A,W,S,Su. 1 cr. Lab. 

Intermediate and advanced bowling skills.

A,W,S. 1 cr. Lab. Maximum 2 cr. 

Fundamentals of classic ballet.

W,S. 1 cr. Lab. Maximum 2 cr. 

Continuation of fundamentals of classic ballet.

W,S. 1 cr. Lab. Maximum 3 cr. 

Intermediate skills of classic ballet.

A,W. 1 cr. Lab. 

Fundamentals of representative dances of many nations.

A,W,S. 1 cr. Lab. 

Basic skills and dance movements of contemporary dance.

W,S. 1 cr. Lab. 

Techniques of intermediate modern and beginning composition.

W,S. 2 cr. Lab. Maximum 8 cr. 

Problems in composition and staging; participation in performance required.

A,W. 1 cr. Lab. 

Traditional and popular styles of ballroom dancing, including jitterbug, polka, waltz, cha cha, fox trot and disco.
PE-C 129 Dance, Square
On demand. 1 cr. Lab.
American square dance fundamentals.

PE-C 130 Dance, Modern III
A. 1 cr. Lab. Maximum 2 cr.
Extensive work on advanced level.

PE-C 131 Dance, Jazz I
A,W,S. 1 cr. Lab. Maximum 2 cr.
Basic skills and movements.

PE-C 132 Dance, Jazz III
A,W,S. 1 cr. Lab. Maximum 2 cr.
PREREQUISITE: PE-C 131.
Intermediate skills, stressing technique.

PE-C 133 Dance, Tap I
A,W,S. 1 cr. Lab. Maximum 2 cr.
Basic skills and movements.

PE-C 134 Dance, Tap II
A,W,S. 1 cr. Lab. Maximum 2 cr.
Continuation of basic skills, stressing technique and originality.

PE-C 135 Diving, Beginning
A,W,S. 1 cr. Lab. Maximum 2 cr.
Instruction in fundamental diving.

PE-C 136 Diving, SCUBA
A,W,S. 3 cr. Lect. 2; Lab. 1.
PREREQUISITE: PE-C 135.
Basic skill and knowledge leading to P.A.D.I. open water certification.

PE-C 137 Fencing Fundamentals
A,W,S. 1 cr. Lab.
Skills for beginner, foil only.

PE-C 138 Fencing, Intermediate
A,W,S. 1 cr. Lab.
PREREQUISITE: PE-C 137.
Improvement of foil skills. Introduction of saber.

PE-C 139 Field Hockey
A. 1 cr. Lab.
Skills and team play.

PE-C 140 Conditioning
A,W,S. 1 cr. Lab.
Exercise program for improving muscle tone.

PE-C 141 Fitness Improvement
A,W,Su. 2 cr. Lect. 1; Lab. 1.
Instruction in the theory and practice of improving personal fitness.

PE-C 142 Aerobic Dance
A,W,Su. 1 cr. Lab. Maximum 4 cr.
Rhythmic activity performed to music, designed to improve personal fitness and physical appearance.

PE-C 143 Dance, Jazz II
A. 1 cr. Lab.
Continuation of basic skills stressing technique.

PE-C 144 Fly Casting
A,W,Su. 2 cr. Lect. 1; Lab. 1.
Basic skills and knowledge.

PE-C 147 Golf Fundamentals
A,W,Su. 1 cr. Lab.
Skills for beginners.

PE-C 148 Golf, Intermediate
A,W,Su. 1 cr. Lab.
Skills for intermediate players.

PE-C 152 Gymnastics, Intermediate
On demand. 1 cr. Lab.
Intermediate skills performed on apparatus for men and women.

PE-C 153 Handball
On demand. 1 cr. Lab.
Basic skills and strategy.

PE-C 154 Juggling
On demand. 1 cr. Lab. Maximum 4 cr.
Principles of conditioning through juggling.

PE-C 155 Judo I
A,W,S. 1 cr. Lab.
Instruction in fundamentals of Kodokan Judo.

PE-C 156 Judo II
A,W,S. 1 cr. Lab.
Continuation of fundamentals and introduction of contest skills.

PE-C 158 Rifle Marksmanship, Prone
A,W,S. 1 cr. Lab.
Handling, care and safety of weapons; marksmanship.

PE-C 159 Rifle Marksmanship, Competition
W,S. 1 cr. Lab. Maximum 4 cr.
Sitting, kneeling and standing.

PE-C 160 Ski Conditioning
A. 1 cr. Lab. Maximum 4 cr.
Exercises preparatory to skiing.

PE-C 161 Skiing
A. 1 cr. Lab. Maximum 4 cr.
Classes will be divided into beginners, sub-intermediate, intermediate and advanced skiers.

PE-C 162 Swimming, Beginning
A,W,S. 1 cr. Lab. Maximum 2 cr.
Basic skills for non-swimmers. Elementary back and front crawl strokes.

PE-C 163 Swimming, Sub-Intermediate
A,W,S. 1 cr. Lab. Maximum 4 cr.
Learning and improving elementary backstroke, side stroke, front crawl stroke and standing front dive from deck.

PE-C 164 Swimming, Intermediate
A,W,Su. 1 cr. Lab.
Improving basic strokes; learning back crawl and breast stroke.

PE-C 165 Swimming, Advanced
A,W,Su. 1 cr. Lab.
Improvement of basic swimming techniques and advanced swimming skills.

PE-C 166 Swimming, Synchronized
On demand. 1 cr. Lab.
Water stunts in basic strokes and hybrid swimming to music.

PE-C 167 Tennis, Fundamentals
A,W,Su. 1 cr. Lab.
Forehand and backhand drives and serves; basic fundamentals.

PE-C 168 Tennis, Intermediate
A,W,Su. 1 cr. Lab.
PREREQUISITE: Basic proficiency in playing tennis.
Continuation of drives, serves and advanced strokes.

PE-C 170 Track and Field
On demand. 1 cr. Lab.
Fundamentals of running, jumping and throwing events.

PE-C 185 Recreational Volleyball
A,W,Su. 1 cr. Lab.
Basic skills and team play.

PE-C 187 Weight Training
A,W,Su. 1 cr. Lab. Maximum 2 cr.
Using weight for physical conditioning.

PE-C 188 Wrestling
A. 1 cr. Lab.
Basic holds and releases.

PE-C 192 Karate
A,W,S. 1 cr. Lab. Maximum 2 cr.
Instruction in basic Japanese Karate.

PE-C 193 Racquetball
A,W,S. 1 cr. Lab. Maximum 2 cr.
Skills and strategy.

PE-C 202 Backpacking
A.Su. 1 cr. Lect.
Lectures to prepare the novice for safe, knowledgeable participation.

PE-C 204 Basic Climbing
A,Su. 1 cr. Lab.
Competitive mapcompass skills. Some emphasis on meet organization and teaching procedures.

PE-C 225 Dance, Modern Technique
A. 3 cr. Lect.
Advanced techniques, teaching methods and composition in modern dance.

PE-C 224 Japanese Karate
A. 1 cr. Lab.
Skills and strategy.

PE-C 253 Handball, Intermediate
On demand. 1 cr. Lab.
PREREQUISITE: PE-C 153.
Continuation and improvement of skills and strategy.

PE-C 261 Cross-Country Skiing
W. 1 cr. Lab. Maximum 4 cr.
Skills of cross-country skiing.

PE-C 280 Special Topics
On demand. 1-3 cr. Maximum 12 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Athletic Coaching

PEAC 120 Basic Athletic Training
S. 3 cr. Lect. 2; Lab. 1.
Physical care of athletes including treatment of injuries, methods of taping and bandaging.

PEAC 157 Physical Conditioning
A,W,S. 1 cr. Lab. Maximum 4 cr.
Improving and maintaining physical fitness.

PEAC 184 Varsity Athletics
A,W,S. 1 cr. Lab. May be repeated for credit.

PEAC 201 Football Fundamentals
A. 3 cr. Lect. 2; Lab. 1.
Preparation in all technical phases of football.
<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Type</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEAC 214 Men's Basketball Fundamentals</td>
<td>2</td>
<td>Lect, Lab</td>
<td>PE-C 114 or intermediate skill level. Instruction in individual and team basketball fundamentals, techniques and concepts.</td>
</tr>
<tr>
<td>PEAC 215 Women's Basketball Fundamentals</td>
<td>2</td>
<td>Lect, Lab</td>
<td>PE-C 115 or intermediate skill level. Instruction in individual and team basketball fundamentals, techniques and concepts.</td>
</tr>
<tr>
<td>PEAC 217 Basketball Officiating</td>
<td>W</td>
<td>Lect, Lab</td>
<td>PEAC 214. Know the rules, techniques and concepts.</td>
</tr>
<tr>
<td>PEAC 245 Wrestling Fundamentals</td>
<td>A</td>
<td>Lect, Lab</td>
<td>PE-C 188 or intermediate skill level. A systematic development of wrestling fundamentals.</td>
</tr>
<tr>
<td>PEAC 280 Special Topics</td>
<td>A</td>
<td>Lab</td>
<td>Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.</td>
</tr>
<tr>
<td>PEAC 300 Athletic Medicine Practicum</td>
<td>S</td>
<td>Lect, Lab</td>
<td>Practical experience in the use of modern athletic training principles and methods.</td>
</tr>
<tr>
<td>PEAC 316 Basketball Coaching Techniques</td>
<td>A</td>
<td>Lect, Lab</td>
<td>PEAC 214 or 215, PE major/minor. Philosophies, theories and techniques used in the coaching of basketball.</td>
</tr>
<tr>
<td>PEAC 331 Gymnastic Coaching Techniques</td>
<td>S</td>
<td>Lect, Lab</td>
<td>PE 149. Advanced teaching and teaching methods in tumbling, balance beam, uneven parallel bars and vaulting. Lectures to include advanced theory of coaching techniques with emphasis on competitive team programs.</td>
</tr>
<tr>
<td>PEAC 362 Track and Field Theory</td>
<td>S</td>
<td>Lect, Lab</td>
<td>PE-C 179. Fundamentals of all standard track and field events with emphasis on proper methods of aiding a competitor to develop maximum skill.</td>
</tr>
<tr>
<td>PEAC 366 Coaching Practicum</td>
<td>A,W</td>
<td>Lect, Lab</td>
<td>PEAC 366. A 1 cr. Lect. Pass-Fail only. For all freshmen and transfer students who are interested in physics as a profession. Strongly advised for physics majors.</td>
</tr>
<tr>
<td>PEAC 401 Athletic Medicine</td>
<td>S</td>
<td>Lect, Lab</td>
<td>Biol 212, Hlth 221 and 222, and PEAC 120. An advanced course in the modern principles and methods which should be practiced in varied sports environments.</td>
</tr>
<tr>
<td>PEAC 432 Principles and Problems of Athletics</td>
<td>S,Su</td>
<td>Lect, Lab</td>
<td>Any of the following: PEAC 302, 316, 331, 366. Problems and standards connected with the administration of interscholastic athletics.</td>
</tr>
<tr>
<td>Phys 207N College Physics III</td>
<td>A</td>
<td>Lect, Lab</td>
<td>Continuation of sequence. PREREQUISITE: Phys 205. Phys 206 is recommended. The mathematical study of electricity and magnetism, DC circuits and electromagnetic induction. Topics include potential, magnetic field, Faraday's Law and Maxwell's equations.</td>
</tr>
<tr>
<td>Phys 227N General and Modern Physics I</td>
<td>A,W,S,Su</td>
<td>Lect, Lab</td>
<td>Continuation of sequence. PREREQUISITE: Phys 227 or EM 251. Math 183. This is the first quarter of a four-quarter sequence and students should be advised to take the entire sequence. It serves as introductory sequence primarily for engineering and physical science students. This quarter covers topics in mechanics such as motion, Newton's Laws, conservation laws, work, energy, systems of particles and rigid body rotational motion. Students may not receive credit for more than one of the introductory sequences: 205-206-207 or 227-228-229-230.</td>
</tr>
<tr>
<td>Phys 228N General and Modern Physics II</td>
<td>A,W,S,Su</td>
<td>Lect, Lab</td>
<td>Continuation of sequence. PREREQUISITE: Phys 228 or Math 183. This quarter covers topics in electricity and magnetism such as Coulomb's Law, Gauss' Law, electric potential, circuits, magnetic field, Faraday's Law and Maxwell's equations.</td>
</tr>
<tr>
<td>Phys 230N General and Modern Physics IV</td>
<td>A,W,S,Su</td>
<td>Lect, Lab</td>
<td>Continuation of sequence. PREREQUISITE: Phys 229. This quarter covers topics in modern physics such as special relativity, quantization, model of the atom, electron waves, Schrodinger equation, atomic physics, molecular structure properties of solids and nuclear physics.</td>
</tr>
<tr>
<td>Phys 231 Introduction to Theoretical Physics</td>
<td>S</td>
<td>Lect</td>
<td>Phys 230. Mathematical concepts essential to the understanding of theoretical physics such as matrices, vectors, tensors and elementary differential equations and application to examples from mechanics and electromagnetism.</td>
</tr>
<tr>
<td>Phys 251N Physics of Sound</td>
<td>S alternate years, will be offered S 1988. Su on demand. 4 cr. Lect.</td>
<td>Lab. 1. Continuation of sequence. PHYSICS Course Notes. Physics 151 and 152, and 251 are integrated courses for an introductory sequence in physics. Students may not receive credit for more than one of the introductory sequences: 205-206-207 or 227-228-229-230.</td>
<td></td>
</tr>
</tbody>
</table>
### Phys 253N Physics of Photography
- W. 3 cr. Lect.
- **PREREQUISITE:** High school algebra.
- Improvement of photographic skills through an understanding of the basic principles of photography. The nature of light and color and the physical principles involved in the operation of a camera will be presented. Unusual effects and recent developments will be discussed. Numerous demonstrations, photographs, slides, etc., will be used to illustrate the principles.
- **COREQUISITE:** Phys 229.

### Phys 261 Physical Measurements
- S. 4 cr. Lect. 5; Lab. 1.
- **PREREQUISITE:** Phys 229.
- Fundamentals of electronics with laboratory in electronics, and electrical measurements emphasizing analog circuits.

### Phys 280 Special Topics
- On demand. 1-5 cr. Maximum of Phys 280 plus 480, 15 cr.
- Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

### Phys 301 Classical Mechanics I
- A. 4 cr. Lect.
- **PREREQUISITES:** Phys 231.
- **COREQUISITE:** Math 226.
- First quarter of the two-quarter sequence. Students should be advised to take both quarters. Sequence covers principles of classical (Newtonian) mechanics, selected problems and areas for detailed illustration, introduction to generalized coordinates, Lagrangian and Hamiltonian mechanics.

### Phys 302 Classical Mechanics II
- W. 4 cr. Lect. Continuation of sequence.
- **PREREQUISITE:** Phys 301.
- See course description for Phys 301.

### Phys 311N General Astronomy I
- A.Su. 3 cr. Lect.
- **PREREQUISITES:** High school trigonometry and high school physics or Phys 103, 205 or 227.
- First of two quarters of introductory astronomy. Includes many of the exciting discoveries being made in the solar system. For those interested in laboratory and viewing experiences, see Phys 314.

### Phys 312N General Astronomy II
- W.Su. 3 cr. Lect.
- **PREREQUISITES:** High school trigonometry and high school physics or Phys 103, 205 or 227.
- Second of two quarters of introductory astronomy. This course concentrates on stars, stellar systems, cosmology and new and strange astrophysical objects. Phys 311 would be helpful but is not a prerequisite.

### Phys 314N General Astronomy Laboratory
- A.Su. 1 cr. Lab.
- **COREQUISITE:** Phys 311.
- Optional laboratory to accompany lectures in Phys 311. Laboratory will operate in a project mode and will include experiments and work with models that can be done indoors as well as the use of telescopes.

### Phys 317 Electricity and Magnetism I
- A. 4 cr. Lect.
- **PREREQUISITES:** Phys 231 or Math 348.
- First quarter of a three-quarter sequence. Sequence covers electrostatics, dielectric behavior, magnetic fields, material properties, induction, Maxwell's equations, radiation, propagation, interference, diffraction and polarization.

### Phys 318 Electricity and Magnetism II
- W. 4 cr. Lect. Continuation of sequence.
- **PREREQUISITE:** Phys 317.
- See course description of Phys 317.

### Phys 319 Electricity and Magnetism III
- S. 4 cr. Lect. Continuation of sequence.
- **PREREQUISITE:** Phys 318.
- See course description of Phys 317. Includes some discussion of general wave phenomena in addition to electromagnetic waves.

### Phys 321T Our Technological Society
- W. 4 cr. Lect.
- Develop an understanding of the character of technology and its underlying science base, how it forms and is controlled, and its direction of evolution. The basic science input into selected public policy issues will be explored. As a model the technology of nuclear warfare will be studied.

### Phys 327 Laser Applications
- A alternate years, will be offered A 1986. 3 cr. Lect.
- **PREREQUISITE:** Phys 230.
- A survey of laser types and properties and of applications for scientists and engineers who wish to use lasers in research or technology. Many demonstrations will be used to illustrate the principles.

### Phys 333 Holography
- A. 4 cr. Lect.
- **PREREQUISITE:** Math 226.
- **COREQUISITE:** Junior standing.
- No background in math or physics is necessary. Pictorial and geometric interpretations are given for interference, coherence, and holography. A descriptive explanation is given for the helium-neon laser. Students are expected to make their own holograms in lab. Lectures are given several times a week early in the quarter so that the theory is explained before serious lab work begins.

### Phys 362 Physical Measurements I
- W. 2 cr. Lab.
- **PREREQUISITE:** Phys 261.
- Experimental methods of classical physics, emphasizing digital circuits.

### Phys 363 Physical Measurements II
- S. 2 cr. Lab.
- **PREREQUISITE:** Phys 362.
- Experimental methods of classical physics, emphasizing microwaves.

### Phys 400 Seminar
- Topics selected from material not covered in regular courses. Students participate in preparing and presenting lectures.

### Phys 411 Introduction to Quantum Mechanics I
- A. 4 cr. Lect.
- **PREREQUISITES:** Phys 301.
- First of two-quarter sequence. Sequence covers introduction to quantum mechanics and Schroedinger's equation with applications to atomic and molecular physics. Provides a basis for applying quantum theory to a variety of problems. Order of topics covered depends upon the chosen textbook.

### Phys 412 Introduction to Quantum Mechanics II
- W. 4 cr. Lect. Continuation of sequence.
- **PREREQUISITE:** Phys 411.
- See Phys 411 for course description.

### Phys 425 Thermodynamics
- S alternate years, will be offered S 1987. 4 cr. Lect.
- **PREREQUISITE:** Phys 362.
- Experiments chosen from physical optics and atomic, solid-state and nuclear physics.

### Phys 434 Relativity
- A. 2 cr. Lect.
- **PREREQUISITE:** Phys 230.
- Kinematical and dynamical effects of special relativity.

### Phys 435 Astrophysics I
- W alternate years, will be offered W 1987. 3 cr. Lect.
- **PREREQUISITE:** Phys 230 and Math 226.
- First of two-quarter sequence. Sequence covers survey of observational astronomy, physical state of stellar interiors, nuclear reactions and energy generation, chemical composition, stellar evolution and recent developments.

### Phys 451 Nuclear Physics
- S. 4 cr. Lect.
- **PREREQUISITE:** Phys 412.
- Radioactivity, nuclear structure, nuclear reactions and elementary particles with emphasis on the problems of nuclear forces and models.

### Phys 461 Senior Laboratory I
- A. 2 cr. Lab.
- **PREREQUISITE:** Phys 362.
- Modern computer data acquisition techniques applied to physics experiments.

### Phys 462 Senior Laboratory II
- W. 2 cr. Lab.
- **PREREQUISITE:** Phys 562.
- Experiments chosen from physical optics and atomic, solid-state and nuclear physics.

### Phys 463 Senior Laboratory III
- S. 2 cr. Lab.
- **PREREQUISITE:** Phys 562.
- Experiments chosen from physical optics and atomic, solid-state and nuclear physics.

### Phys 470 Individual Problems
- On demand. 1-4 cr. Ind. St. Maximum 6 cr.
- **PREREQUISITE:** Consent of department head.
- Directed research and study on an individual basis.

### Phys 480 Special Topics
- On demand. 1-5 cr. Maximum of Phys 280 plus 480, 15 cr.
- Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

### Phys 490 Undergraduate Research
- A,W,S,Su. 1-4 cr. Ind. St. May be repeated.
- **PREREQUISITE:** Junior standing and consent of department head.
- Directed undergraduate research.
Graduate Courses in Physics

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

Phys 500 Seminar
AWS, Su. 1 cr. Sem.
PREREQUISITE: Graduate standing.

Phys 501 Lagrangian and Hamiltonian Mechanics
A alternate years, will be offered A 1987. 3 cr. Lect.

Phys 502 Continuum Mechanics
W alternate years, will be offered W 1988. 3 cr. Lect.
PREREQUISITE: Phys 501.
A survey of the physics of continuous media. Topics include elasticity, viscosity, acoustics, surface waves and shocks.

Phys 506 Intermediate Quantum Mechanics
A. 3 cr. Lect.

Phys 507 Quantum Mechanical Scattering and Perturbation Theory
W. 3 cr. Lect.

Phys 508 Quantum Field Theory
S. 3 cr. Lect.

Phys 513 Physical Applications of Group Theory
Su alternate years, will be offered Su 1987. 3 cr. Lect.
PREREQUISITE: Phys 412. Theory of discrete and continuous groups and their representations. Emphasis on practical applications to various areas of physics, which may include atoms and molecules, crystalline solids, and elementary particles.

Phys 515 Frontiers of Physics
S. 3 cr. Lect.
PREREQUISITE: Phys 411. Contemporary subjects in physics are presented as they develop.

Phys 516 Methods of Experimental Physics
S. 3 cr. Lect.
PREREQUISITE: Phys 411. Laboratory techniques in different areas of physics are presented to prepare graduate students to work on experimental thesis projects.

Phys 519 Maxwell's Equations
A alternate years, will be offered A 1986. 3 cr. Lect.

Phys 520 Electromagnetic Wave Propagation
W alternate years, will be offered W 1987. 3 cr. Lect.

Phys 521 Plasma Physics
$ alternate years, will be offered $ 1987. 3 cr. Lect.

Phys 523 Einstein's Equations
A alternate years, will be offered A 1987. 3 cr. Lect.

Phys 524 Static Solutions in Relativity
W alternate years, will be offered W 1988. 3 cr. Lect.

Phys 525 Dynamic Solutions in Relativity
S alternate years, will be offered S 1988. 3 cr. Lect.

Phys 531 Atomic and Molecular Structure
A alternate years, will be offered A 1987. 3 cr. Lect.
PREREQUISITE: Phys 508. Atomic and molecular structure and spectroscopy and topics of current interest such as laser materials.

Phys 532 Quantum Electronics and Nonlinear Optics
W alternate years, will be offered W 1988. 3 cr. Lect.
PREREQUISITE: Phys 508. Laser phenomena, nonlinear optics and spectroscopy, and topics of current interest.

Phys 533 Statistical Mechanics
A alternate years, will be offered A 1986. 3 cr. Lect.
PREREQUISITE: Phys 425. Basic concepts of equilibrium statistical mechanics, with application to simple classical and quantum mechanical systems.

Phys 536 Phase Transition and Critical Phenomena
W alternate years, will be offered W 1987. 3 cr. Lect.

Phys 544 Electrons and Phonons In Solids
A alternate years, will be offered A 1986. 3 cr. Lect.
PREREQUISITE: Phys 506. Elements of the theory of solids, including crystal structure, Brillouin zones, lattice vibrations and an introduction to energy band theory.

Phys 545 Electric and Magnetic Properties of Solids
W alternate years, will be offered W 1987. 3 cr. Lect.

Phys 546 Topics in Solid State Physics
S alternate years, will be offered S 1987. 3 cr. Lect.
PREREQUISITE: Phys 545. Special problems of modern interest such as surface physics, photomission, laser materials and low temperature physics.

Phys 551 Nuclear Physics
$ alternate years, will be offered $ 1988. 3 cr. Lect.

Phys 555 Relativistic Quantum Mechanics
A alternate years, will be offered A 1987. 3 cr. Lect.
PREREQUISITE: Phys 508. The Dirac equation, relativistic hydrogen atom, introduction to quantum electrodynamics.

Phys 556 Elementary Particle Physics
W alternate years, will be offered W 1988. 3 cr. Lect.
PREREQUISITE: Phys 555. Particles and resonances, strong and weak interactions, the quark model, gauge theories, and grand unification schemes.

Phys 557 Partial Differential Equations in Physics
W. 3 cr. Lect.

Phys 558 Approximation Methods of Physics
S. 3 cr. Lect.
PREREQUISITES: Math 349 and 449. WKB approximation, perturbation methods, asymptotic expansions, numerical methods.

Phys 560 Special Topics
On demand. 1-5 cr. Maximum 15 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Phys 561 Graduate Consultation
AWS, Su. 3 cr. Tut.
PREREQUISITES: Master's standing and approval of the Dean of Graduate Studies. This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) for a master's degree but who need an additional faculty help or time.

Phys 567 Individual Problems
AWS, Su. 3-12 cr. Ind. St. Maximum 9 cr.
PREREQUISITE: Graduate standing, consent of instructor, approval of department head and Graduate Dean. Directed research and study on an individual basis.

Phys 568 Doctoral Thesis
W alternate years, will be offered W 1987. 3 cr. Lect.
PREREQUISITE: Phys 567. The thesis is to be based upon the results of approved research.

Phys 569 Reading and Research
On demand. 3-5 cr. Ind. St. May be repeated.
PREREQUISITE: Master's standing. Thesis based upon the results of approved research.

Phys 570 Doctoral Thesis
AWS, Su. 3 cr. Ind. St. May be repeated.
PREREQUISITE: Doctoral standing. Thesis based upon the results of approved research.
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Plant Pathology

994-4832

Head of Department: Dr. E.L. Sharp.
Associate Professors: D.C. Sands, M. Sun (Ext. MPIA), J. Kieselman (Ext.).

PIP 301 Plant Pathology
A. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: Biol 124.
Principles of plant pathology illustrated by diseases of greatest importance in Montana and the nation.

PIP 403 Diseases of Horticultural Crops
S alternate years, will be offered S 1988. 3 cr. Lect.
PREREQUISITE: PIP 301.
Diseases of vegetables, trees, flowers, turf and fruits. Life cycles, occurrences, seriousness and control.

PIP 405 Field Crop Diseases
S alternate years, will be offered S 1987. 5 cr. Lect.
PREREQUISITE: PIP 301.
Diseases of wheat, barley, alfalfa and other field crops. Life cycles, occurrence, seriousness and control.

PIP 470 Individual Problems
A,W,S,Su. 1-5 cr. Ind. St. Maximum 6 cr.
PREREQUISITES: Consent of instructor and department head.
Directed research and study on an individual basis. Guidelines and procedures must be approved by instructor prior to registration.

PIP 480 Special Topics
A,W,S,Su. 1-5 cr. Maximum 15 cr.
Courses not required in any curriculum for which there is a particular need or given on a trial basis to determine demand.

Graduate Courses
In Plant Pathology

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

PIP 500 Seminar

PIP 520 Biological Electron Microscopy
S. 4 cr. Lect. 1; Lab. 2; Sem. 1.
PREREQUISITES: Biol 121 and graduate standing.
Principles of electron microscopy and applications of the transmission electron microscope to research in biology.

PIP 523 Advanced Plant Pathology—Soil Borne Diseases
S alternate years, will be offered S 1987. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: PIP 301.
Major diseases of plants caused by soil-borne fungi will be covered, including taxonomy and etiology of the pathogen plus control concepts.

PIP 530 Plant Virology
W alternate years, will be offered W 1988. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: PIP 301.
Viruses, virusoids and viroids causing diseases in plants. Their structure, replication, biology, pathology and control. Exercises on the identification of viruses by host range and symptoms, light and electron microscopy, transmissibility, serology and UV spectroscopy.

PIP 531 Physiology and Biochemistry of Plant Disease
A alternate years, will be offered A 1986. 3 cr. Lect.
PREREQUISITE: PIP 301.
Bacterial and fungal diseases of plants with emphasis on pathogen physiology.

PIP 532 Genetics of Resistance and Pathogenicity for Diseases Caused by Fungi
W alternate years, will be offered W 1987. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: PIP 301.
The higher fungal causing diseases among crop plants with emphasis on host resistance and genetics of pathogenicity.

PIP 550 Plant Biochemistry
S alternate years, will be offered S 1988. 5 cr. Lect. 1; Lab. 4.
PREREQUISITES: Chem 441, 442, 443 and/or Biol 303.
Methods and techniques used in modern plant biochemical research. Exercises in compound identification, enzymology, buffers, unstable and heavy isotopes, polarography, chromatography and various types of spectroscopy.

PIP 569 Plant Bacteriology
A alternate years, will be offered A 1986. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: PIP 301.
Major bacterial diseases of plants will be covered in terms of taxonomy, physiology, control and evolution.

PIP 570 Individual Problems
A,W,S,Su. 1-5 cr. Ind. St. Maximum 9 cr.
PREREQUISITES: Graduate standing, consent of instructor, approval of department head and Graduate Dean.
Directed research and study on an individual basis.

PIP 580 Special Topics
A,W,S,Su. 1-5 cr. Maximum 9 cr.
Courses not required in any curriculum for which there is a particular need or given on a trial basis to determine demand.

PIP 589 Graduate Consultation
PREREQUISITES: Master standing and approval of the Dean of Graduate Studies.
This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) for a master's degree but who need additional faculty help or time.

PIP 590 Master's Thesis
A,W,S. 3-12 cr. Ind. St. May be repeated.
PREREQUISITE: Master's standing.

PIP 690 Doctoral Thesis
A,W,S,Su. 3-12 cr. Ind. St. May be repeated.
PREREQUISITE: Doctoral standing.

Plant and Soil Science

994-4601

Head of Department: D.G. Miller.
Adjunct Professors: P.O. Kresge, J.C. Scheetz.

P&S 102 Plant Science in Agriculture
W. 3 cr. Lect.
Plant related agricultural systems. Open to all students.

P&S 105 Agricultural Physiology and Systems
W. 1 cr. Lab.
Crop plant structures, functions and systems related to the principles of crop growth, management and production.

P&S 201 The Soil Resource
A,S. 4 cr. Lect. 3; Lab. 1.
PREREQUISITES: Chem 121 and Math 140.
Origin, composition and properties of soils as related to plant growth, urban development, industrial uses and environmental quality.

P&S 202 Career Opportunities
A. 1 cr. Rec. Dis.
Professional opportunities and current affairs in plant and soil science. Intended for freshmen, sophomores and transfer students.

P&S 203 Site Inventory, Analysis and Design
A. 4 cr. Lect. 2; Lab. 2.
Design process as it applies to site planning and land use decision-making.

P&S 208 Crop Identification
A. 2 cr. Lect. 1; Lab. 1.
Recognition and identification of seeds, vegetative parts, and floral structure of the major species of cereals, forage legumes and grasses.

P&S 209 Weed Biology and Identification
A. 2 cr. Lect. 1; Lab. 1.
The biology and identification of annual and perennial weeds found on cropland, rangeland, pastures and gardens.

P&S 211 Herbaceous and Woody Ornamentals I
S. 4 cr. Lect. 2; Lab. 2.
Identification, culture and uses of ornamentals in Montana.

P&S 280 Special Topics
On demand. 1-5 cr. Maximum 8 cr. Maximum of P&S 280 plus 280, 16 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

P&S 300 Seminar
Individual student reviews and presentations of concepts and current issues in plant and soil science.
P&S 301 International Agriculture
W. 4 cr. Lect.
Discussion and comparison of international agricultural systems for developed and developing countries as related to the world food supply.

P&S 302 Field Trip
A,Su. 1-2 cr. Lab. Maximum 6 cr.
Preparation and participation in a multidisciplinary field trip covering many aspects of plant and soil science.

P&S 303 Seed Production and Cleaning
W. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: P&S 208.
Seed production and processing including physiology and morphology of seed development.

P&S 307 Row and Oil Seed Crops
W. 3 cr. Lect.
PREREQUISITES: P&S 102 and 208.
Cultural practices, management systems and utilization of field crops not closed seeded: sugar and fiber crops, large seeded legumes, and oil seed crops.

P&S 308 Grain Crops
S. 4 cr. Lect. 3; Lab. 1.
PREREQUISITES: P&S 208; Biol 121 recommended.
Grain crop production systems, distribution, processing, utilization, and marketing with emphasis on Montana grown cereals.

P&S 310 Plant Propagation
A alternate years, will be offered A 1987. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: Biol 124.
Principles and techniques of plant propagation.

P&S 311 Herbaceous and Woody Ornamentals II
A alternate years, will be offered A 1987. 4 cr. Lect. 2; Lab. 2.
PREREQUISITE: P&S 211.
Advanced study of ornamental plant material identification, culture and use.

P&S 314 Soil Conservation
W. 4 cr. Lect.
PREREQUISITE: P&S 201.
Managing lands for environmental quality, sustained food production, erosion control and control of point and non-point sources of water pollution.

P&S 316 Soil Fertility and Fertilizers
W. 4 cr. Lect. 3; Lab. 1.
PREREQUISITES: P&S 201 and Chem 152.
Relations between soils and nutrient elements and control of nutrient availability through fertilizer management. Laboratory involves use of microcomputers to illustrate management concepts.

P&S 320 Forage and Pasture Crops
A. 4 cr. Lect. 3; Rec-Disc. 1.
PREREQUISITES: Junior standing; P&S 208 or RaS 203.
Classification, production, management systems and preservation of forage crops with emphasis on cultivated grasses and legumes.

P&S 323 Plant Growth and Development
W alternate years, will be offered W 1987. 4 cr. Lect.
PREREQUISITE: Biol 124.
Physiological plant processes that regulate growth and development of horticultural and agronomic crops.

P&S 324 Fruit and Vegetable Production
W alternate years, will be offered W 1988. 3 cr. Lect.
Fruit and vegetable crop culture, processing and utilization for commercial and home grower.

P&S 325 Field Crop Quality
S. 4 cr. Lect. 3; Lab. 1.
Cereal grain and oil seed crop quality as related to end product use or product enhancement.

P&S 331 Introductory Landscape Design
S. 2 cr. Lect.
PREREQUISITE: Junior standing.
Residential landscape design principles.

P&S 332 Landscape Design Laboratory
S. 3 cr. Lab.
PREREQUISITE: P&S 211.
Graphic expression, site evaluation, design application and plant material selection for residential landscapes.

P&S 400 Seminar
A.W.S. 1 cr. Sem. Maximum 3 cr.
PREREQUISITE: Senior standing.
Student preparation and presentation of technical papers stressing effective communications and literature review.

P&S 403 Soil Science Field Course
S. 2 cr. Lab.
PREREQUISITE: P&S 412.
Field description, classification and interpretation of soils and their landscape sites.

P&S 404 Plant Breeding
S. 4 cr. Lect.
PREREQUISITE: An S 314 or Biol 324.
Genetic principles as applied to the improvement of crop and horticulture plants.

P&S 405 Principles of Crop Growth
W. 4 cr. Lect. 3; Lab. 1.
Effects of environment, plant design, water and nutrient availability and cultural practices on crop plant growth and production.

P&S 407 Nursery Crop Productions
S alternate years, will be offered S 1988. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: Junior standing.
Culture, production, handling and utilization of nursery products.

P&S 408 Grounds Maintenance
S. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: Junior standing.
Maintenance of plant materials on public grounds, athletic fields, golf courses and commercial property.

P&S 409 Chemistry of Soil Materials
A. 4 cr. Lect. 3; Lab. 1.
PREREQUISITES: P&S 201 and junior standing.
Chemical properties and changes in soil materials.

P&S 410 Soil Physics
S. 4 cr. Lect. 3; Lab. 1.
PREREQUISITE: Senior standing.
Physical properties of soils and their measurements.

P&S 411 Soil Management
Su every six years, will be offered Su 1987. 3 cr. Lect.
PREREQUISITE: P&S 201. Not open to students majoring in soils.
Conservation needs, fertility maintenance and management requirements of the soil resource.

P&S 412 Soil Classification and Survey
S. 4 cr. Lect. 3; Lab. 1.
PREREQUISITES: P&S 201 and junior standing.
Soils in their natural settings; their morphology, properties and classification; interpretations for use and management of soil bodies portrayed on soil maps.

P&S 416 Advanced Landscape Design
A. 4 cr. Lect. 1; Lab. 3.
PREREQUISITES: P&S 331 and 332.
Landscape design and site planning for the built environment.

P&S 417 Aerial Photo Interpretation and Remote Sensing
W. 3 cr. Lab.
PREREQUISITE: Junior standing.
Obtaining airphotos; stereo viewing; image processing equipment; aerial reconnaissance for land management and land use decision-making. Remote sensing, earth resources satellites, infrared, multispectral remote sensing, and color enhancement.

P&S 418 Agricultural Biometrics
A. 4 cr. Lect.
PREREQUISITE: Senior standing.
Interpretation of biological data. Analysis of frequency data, hypothesis testing, comparison of sample means, a one- and two-way analysis of variance, linear regression and correlation.

P&S 419 Landscape Construction
W. 4 cr. Lect. 2; Lab. 3.
PREREQUISITE: P&S 332.
Specification of hard materials in the landscape. Graphic communication and construction technology of grading, surfacing, walls, fences and small structures.

P&S 420 Microclimatology
W. 3 cr. Lect.
Climate near ground. Constitution and physical properties of lower atmosphere. Heat and moisture exchange in the microlayer. Relation of microclimate to topography, type of soil and ground cover.

P&S 423 Turf Management
A. 4 cr. Lect. 3; Lab. 1.
Identification, culture and maintenance of turfgrass for landscape and sports use.

P&S 425 Principles of Weed Science
A. 4 cr. Lect. 2; Lab. 2.
Importance and ecology of weeds; principles and methods of mechanical, cultural and chemical control.

P&S 426 Agricultural Climatology
S. 3 cr. Lect.
Effects of climate on plant and animal life. Techniques of bioclimatic research including microclimatic and biotic measurements.

P&S 428 Cropping Systems
W. 3 cr. Lect.
Emerging management systems to integrate cropping sequences and strategies for optimum production and profit.

P&S 470 Individual Problems
PREREQUISITE: Senior standing.
Directed research and study on an individual basis. Guidelines and procedures must be approved by instructor prior to registration.

P&S 476 Internship
A,W,Su. 2-6 cr. Ind. St.
PREREQUISITES: Junior standing and consent of department head.
Work experience which expands the student's knowledge and skills. Guidelines and procedures must be approved by instructor and department prior to registration.

P&S 480 Special Topics
On demand. 1-5 cr. Lect. Maximum 16 cr.
Courses not required in any curriculum for which there is a particular need or given on a trial basis to determine demand.
Graduate Courses in Plant and Soil Science

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

P&S 500 Seminar
PREREQUISITE: Graduate standing. Student presentation, discussion and literature review of current research topics.

P&S 505 Cyto genetics
S on demand. 5 cr. Lect.; Lab. 2.
PREREQUISITES: Biol 409 and either AnS 314 or Biol 324.
Chromosome structure, function, transmission, continuity and variations. Cyto genetics of sex determination and of man.

P&S 506 Advanced Plant Genetics
A on demand. 3 cr. Lect.
PREREQUISITE: An upper-division genetics course, graduate standing.
Theories of classical and modern plant genetics. Open to graduate students and advanced undergraduates.

P&S 507 Breeding Cross Pollinated Crops
W alternate years, will be offered W 1988. 3 cr. Lect.
PREREQUISITE: P&S 404.
Concepts of gene action, genetic advance and phenotypic evaluation as the basis of plant breeding science.

P&S 508 Biometrical Plant Breeding
S on demand. 4 cr. Lect.; Lab. 1.
Quantitative inheritance in plants and application of statistical analysis of quantitative genetic systems and their use in plant breeding.

P&S 509 Crop Physiology
S alternate years, will be offered S 1988. 4 cr. Lect.; Lab. 1.
PREREQUISITE: Biol 303.
Basic physiological mechanisms governing the response of crop plants to environment.

P&S 510 Soil Science and Plant Nutrition
A alternate years, will be offered A 1987. 4 cr. Lect.; Rec-Dia. 1.
PREREQUISITES: P&S 316 and Biol 303.
Chemical, physical and biological influences on soil nutrient availability and effects on plant nutrition.

P&S 511 Soil Genesis and Morphology
W alternate years, will be offered W 1987. 3 cr. Lect.
PREREQUISITE: P&S 412.
Processes of soil formation. Relationships of soil characteristics and environment. Major soil groups and landscapes of the world; their use and potentials.

P&S 513 Field Methods in Plant Climate Research
S alternate years, will be offered S 1987. 2 cr. Lect.; Lab. 1.
PREREQUISITE: P&S 420.
Instrumentation and analytical procedures in plant-climate research including logging, processing and interpretation of crop and microclimatic data.

P&S 514 Seed and Seedling Physiology
S alternate years, will be offered S 1987. 4 cr. Lect.; Lab. 1.
PREREQUISITE: Biol 303.
Basic and applied physiological principles of seed development, dormancy, germination and seedling growth.

P&S 515 Soil Physics
W alternate years, will be offered W 1988. 3 cr. Lect.
PREREQUISITE: Graduate standing.
To develop an understanding of and an ability to work quantitatively with the soil-plant system.

P&S 516 Field Plot Techniques
W. 4 cr. Lect.; Lab. 1.
PREREQUISITE: P&S 418.
Planning, analysis and interpretation of biological experiments, including choice of design, selection of treatments, and methods for comparing treatment means.

P&S 518 Soil Analysis
A alternate years, will be offered A 1987. 4 cr. Lect.; Lab. 2.
Theories, methods, interpretations and applications of soil characterization processes.

P&S 520 Clay Mineralogy
S alternate years, will be offered S 1988. 4 cr. Lect.; Lab. 3.
PREREQUISITES: Chem 132 and graduate standing.
Classification of properties of clay minerals and methods for their separation and identification.

P&S 525 Weed and Herbicide Physiology
W alternate years, will be offered W 1988. 4 cr. Lect.
Physiology and biochemistry of undesirable plants and the uptake, translocation and metabolism of selected herbicides.

P&S 526 Weed Physiology Laboratory
W alternate years, will be offered W 1988. 5 cr. Lab.
PREREQUISITES: Chem 212, Biol 303.
Experiences in plant physiology and weed science laboratory research.

P&S 530 Soil Chemistry
S alternate years, will be offered S 1987. 4 cr. Lect.; Lab. 1.
PREREQUISITES: Chem 302, P&S 409.
Dynamic role of soil in vital cyclical processes of nature, with emphasis on colloids and chemical processes.

P&S 570 Individual Problems
A,W,Su. 1-5 cr. Ind. St. Maximum 9 cr.
PREREQUISITES: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies.
Directed research and study on an individual basis.

P&S 580 Special Topics
On demand. 1-5 cr. Maximum 9 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

P&S 589 Graduate Consultation
A,W,Su. 3 cr. Tut.
PREREQUISITES: Master's standing and approval of the Dean of Graduate Studies.
This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) for a master's degree but who need additional faculty help or time.

P&S 590 Master's Thesis
A,W,Su. 3-12 cr. Ind. St. May be repeated.
PREREQUISITE: Master's standing.

P&S 690 Doctoral Thesis
A,W,Su. 3-12 cr. Ind. St. May be repeated.
PREREQUISITE: Doctoral standing.

Political Science
994-4141

Head of Department: Dr. K.L. Weaver
Lecturers: D.L. Clark, J.H. Goetz.

PolS 105 Current Domestic Problems
A,W,S. 4 cr. Lect.; Rec-Dia. 1.
Contemporary problems and the process of problem solving in the public sector. Topics include, but are not limited to, minority rights, sexism, pollution, energy and political responses to problems in the economy.

PolS 206 American National Government
A,W,S. 4 cr. Lect.
Major governmental institutions and the effect of institutional arrangements and practices on political behavior and the allocation of values. Special emphasis on the constitutional system and the role of political parties and interest groups in the policy process.

PolS 207 American Public Policy
A,W. 4 cr. Lect.
Theories of public policymaking in the U.S. Case studies illuminate the relationships among participants and the ways these affect policy outcomes.

PolS 208 State and Local Government and Politics
A,W,S. 4 cr. Lect.
Analysis of institutional and political behavior at the state and local levels. Special emphasis placed on Montana's political system.

PolS 214S Principles of Political Science
A,S. 4 cr. Lect.
Major concepts and approaches to the discipline, including democratic theory, comparative and behavioral concepts, methodology.

PolS 2145 Introduction to International Relations
A. 4 cr. Lect.
Politics among nations emphasizing the concepts of national power and influence and methods of selecting the ends and means of such influence through the decision-making process.

PolS 280 Special Topics
PREREQUISITE: Below junior standing.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

PolS 301 Political Parties and Elections
A. 4 cr. Lect.
Structure and functions of political parties in democratic environments and the role of the electorate under various democratic political systems.

PolS 302 Citizen Participation
W. 4 cr. Lect.
Survey research findings, attitude and personality research, political socialization studies and biographies dealing with "self-generated" activism.

PolS 304 The Presidency
W alternate years, will be offered W 1988. 4 cr. Lect.
The American presidency as a governmental institution. Examination of the legal, political, administrative and policy making roles of the president. Emphasis on recent issues of responsiveness to national needs and public accountability.
Pols 306 Legislative Process
W. 4 cr. Lect.
The impact of legislative decision-making, the distribution of influence, recruitment, and conflict resolution in the major types of legislative systems.

Pols 310 Legislative and Public Affairs Intern Program
A.W.S. 12-16 cr. Ind. St.
PREREQUISITES: Pols 208 and junior standing. Interns are selected by the political science faculty to work in an administrative agency, for other political organizations such as interest groups, for political parties, or with the legislature. Once assigned, interns are given significant assignments and direct experience in the policy process under the supervision of sponsoring body and the departmental intern director.

Pols 316 Conducting Political Inquiry
W. 4 cr. Lect.
Research design and measurement of political behavior at the level of the individual and the political unit. Techniques of gathering and analyzing attitudinal data, voting records, policy outputs and other political variables. Use of non-parametric statistics.

Pols 321 Classical Political Thought
S. 4 cr. Lect.
Classic or "epic" thinkers in the Western political tradition emphasizing their approaches to common problems in political thought. Includes Plato, Aristotle, Machiavelli, Hobbes, Locke, Rousseau and J.S. Mill.

Pols 322 Modern Political Thought
W. 4 cr. Lect.
Significant modern thinkers, ideologies and movements. Includes varieties of liberalism, Marx and the Marxist, anarchism, feminism, fascism and political ecology.

Pols 324 American Political Thought
A alternate years, will be offered A 1986. 4 cr. Lect.
Major writers and documents in the American political tradition. Both historical and contemporary emphases with stress on the relevance of earlier political thought to present day policies.

Pols 330 Comparative Political Analysis
A. 4 cr. Lect.
PREREQUISITE: Pols 214.
Methods and concepts for cross-national comparative analysis of government and politics, including political structures and functions, socialization, elite recruitment, political culture, parties and interest groups.

Pols 332 Comparative Democratic Systems
W. 4 cr. Lect.
Alternative theoretical conceptions concerning the nature of and justification for democracy. Combines attention to interaction of economic and political forces with inquiry into forces contributing to disintegration of democratic systems.

Pols 334 Revolution and Political Change
S alternate years, will be offered S 1988. 4 cr. Lect.
Comparative analysis of theoretical approaches and leading social science analyses of political movements, protest and change in selected pre- and post-industrial societies. Societal vulnerability to change and factors predisposing individuals toward behavior in mass movements, cults, terrorism, confrontation politics and rebellion.

Pols 341 American Foreign Policy
S. 4 cr. Lect.
The process of making U.S. foreign policy with the focus upon Presidential-Congressional relations and emphasis on the role of politics, public opinion, the media, interest groups, political parties and economic factors such as multinational corporations.

Pols 350 Energy and Environmental Policy
A. 4 cr. Lect.
The emergence of energy development and environmental protection as political issues, the governmental, land use, social security, income maintenance, health care, transportation and others.

Pols 352 Comparative Public Policy
S alternate years, will be offered S 1988. 4 cr. Lect.
PREREQUISITE: Pols 214.
Comparative analysis of public policy analysis to questions of how, why, and to what extent public policies toward certain common issues are developed in differing national contexts. Topics may include energy, environment, land use, social security, income maintenance, health care, transportation and others.

Pols 355 Principles of Public Administration
A. 4 cr. Lect.
The administrative problems of public management including personnel, budgeting, planning, innovation, and public accountability.

Pols 400 Seminar
A.W.S. 2 cr. Sem.
PREREQUISITE: Junior or senior standing. An upper level research seminar to provide students an opportunity for intensive research in areas of special faculty interest and expertise.

Pols 401 American Constitutional Law I
A. 4 cr. Lect.
PREREQUISITE: Junior standing. Major issues in contemporary constitutional law and the role of the Supreme Court. Emphasis on the commerce clause, civil rights, equal protection and minority discrimination.

Pols 402 American Constitutional Law II
W. 4 cr. Lect.
PREREQUISITE: Junior standing and Pols 401. Major issues in contemporary constitutional law and the role of the Supreme Court. Emphasis on the criminal procedure clause, search and seizure, exclusionary rule, arrest, brutality and unusual punishment and free speech cases.

Pols 406 Methodology of Environmental Impact Assessment
W. 4 cr. Lect.

Pols 410 Environmental Law
S. 4 cr. Lect.
PREREQUISITE: Junior standing. State and federal laws and litigation which deal with environmental problems. Course systems will be treated as well as procedural doctrines such as standing and sovereign immunity. Emphasis will be placed on substantive issues such as wilderness designation, strip mining, and land reclamation.

Pols 415 Montana Politics
A alternate years, will be offered A 1986. 4 cr. Lect.
Montana politics with stress on the process, the interaction of political decision makers and the policies currently addressing state problems. Examination of Montana's place in the American federalism, its part in the western states region and its changing role in the international arena.

Pols 416 Canadian-American Relations
A. 4 cr. Lect.
PREREQUISITE: Pols 241.
Contemporary USSR, its people, economy, government and political forces, the reasons behind Soviet foreign policy decisions and actions.

Pols 452 Comparative Administrative Systems
S. 4 cr. Lect.
PREREQUISITE: Junior standing. Comparative analysis of governmental and administrative systems as a key to understanding the government and politics of developing nations. Comparative study of public administration in Asia, Latin America, Africa and the Middle East and comparison to American and British theory and practice. Particular emphasis on the cultural and demographic context of administrative processes.

Pols 456 Administrative Law and Regulation
S alternate years, will be offered S 1987. 4 cr. Lect.
PREREQUISITE: Junior standing. The implementation of domestic public policy through administrative law and regulation.

Pols 459 Intergovernmental Relations
A. 4 cr. Lect.
Federalism as practiced in the United States. Fiscal and programmatic relationships among governmental units on the federal, state and local levels, with particular emphasis on the state of Montana.

Pols 470 Individual Problems
A.W.Su. 1-5 cr. Ind. St. Maximum 6 cr.
PREREQUISITE: Consent of instructor and department head. Directed research and study on an individual basis.

Pols 476 Career Internship
W.Su. 6-12 cr. Ind. St.
PREREQUISITE: Junior standing. Interns are selected by departmental faculty to work in governmental, public service or corporate positions during one academic quarter. Selected interns are given significant assignments at the management level to broaden their understanding of professional expectations in the chosen field. Credits do not count toward completion of departmental curriculum requirements.

Pols 480 Special Topics
On demand. 1-5 cr. Maximum of Pols 280 plus Pols 480, 16 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.
Graduate Courses in Political Science

There are certain implicit prerequisites for 600- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

**PolS 551 Research Methods**
S. 4 cr. Lec.
PREREQUISITES: Graduate standing and a minimum of 8 graduate credits in public administration.

The research process as a means of acquiring knowledge that is reliable and relevant to the making of public management decisions. Students will prepare and submit a research design that meets scientific standards.

**PolS 554 Public Administration and Public Policy**
A. 4 cr. Lec.
PREREQUISITE: Graduate standing.

How public policy is implemented by public administrative governments and the bureaucratic imperatives of public management and their human consequences.

**PolS 555 American Public Service**
A. 4 cr. Lec.
PREREQUISITE: Graduate standing.

The development of the concept of "public service" in the United States, focusing on various systems of public employment. Topics include position classification, recruitment, selection, equal opportunity, affirmative action, collective bargaining.

**PolS 557 Public Budgeting**
W. 4 cr. Lec.
PREREQUISITE: PolS 554.

The budgetary process as policy prescription, including discussion of the roles of participants and other political and economic aspects. Also includes financial administration, fiscal and monetary policies, and auditing.

**PolS 558 Program Planning and Evaluation**
S. 4 cr. Lec.
PREREQUISITE: PolS 557.

Methods of program development and evaluation.

**PolS 562 Local Government Administration**
S. 4 cr. Lec.
PREREQUISITES: PolS 555, 557.

Training in the administration of municipal and county government agencies. Programs focus on local governments.

**PolS 570 Individual Problems**
A.W,Su. 1-5 cr. Ind. St. Maximum 9 cr.
PREREQUISITES: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies.

Directed research and study on an individual basis.

**PolS 575 Professional Paper**
A.W,Su. 1-6 cr. Ind. St. Maximum 6 cr.
PREREQUISITE: Graduate standing.

A professional paper required for all MPA degree candidates, including on an administrative or policy topic mutually agreed upon by the student and his or her examining committee.

**PolS 576 Internship**
A.W,Su. 1-10 cr. Ind. St. Maximum 10 cr.
PREREQUISITES: Graduate standing, PolS 559, and consent of both the instructor and the MPA program director.

Supervised internship for MPA candidates with a public or quasi-public agency. Presumes substantial course background in the field to be brought to bear on practical experience in a public administrative context. Credit cannot be earned for previous work experience, or for work in a student's present regular employment.

**PolS 580 Special Topics**
On demand. 2-5 cr. Maximum 15 cr.

Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

**PolS 589 Graduate Consultation**
A.W,Su. 5 cr. Tut.
PREREQUISITES: Master's standing and approval of the Dean of Graduate Studies.

This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) for a master's degree but who need additional faculty help or time.

**Psychology**

994-3801


Associate Professors: W.D. Shontz.

Assistant Professors: B.Q. Fernandez, W.C. Lynch.

**Psy 1035 General Psychology**
A.W,Su. 5 cr. Lec. 3; Rec.-Dis. 1.

Survey of psychology including problems in the areas of learning, perception, personality, behavior disorders, social psychology and child psychology.

**Psy 2015 Contemporary Issues**
A.S. 4 cr. Rec-Disc.

PREREQUISITE: Psy 103.

Major issues and research strategies. Original and future questions of a broad nature, such as behavioral and nonbehavioral approaches, consciousness, behavioral control, human nature, future of psychology.

**Psy 2025 Thinking Skills**
W. 4 cr. Lec. 2; Rec-Disc. 2.

Improvement of general thinking skills through an understanding of psychological factors involved. Practical strategies are taught in the areas of problem solving and creativity, hypothesis formation and evaluation, decision making, reasoning, and memory. Applications are emphasized.

**Psy 203 Psychological Statistics**
A.S. 4 cr. Lec.

PREREQUISITES: Psy 103 and Math 140.

Concepts and problems with emphasis on inferential statistics. Topics include: frequency distributions, percentiles, central tendency, variability, standard scores, normal curve, correlation and regression analysis, sampling distributions, t-tests, chi-square tests, analysis of variance.

**Psy 206 Experimental Psychology I: Introduction**
A.W 4 cr. Lec. 2; Lab. 2.

PREREQUISITE: Psy 203 or Stat 216.

Logic and philosophy of experimentation, identifying research problems, controlling extraneous variables in psychological experiments. Basic experimental designs and techniques. Preparation and critique of research proposals.

**Psy 207 Experimental Psychology II: Methodology**
W. 4 cr. Lec. 2; Lab. 2.

PREREQUISITE: Psy 206.

Conduct of an experimental investigation which involves research design, data collection, data analysis and the writing of a final report.

**Psy 230 Psychology of Adjustment**
W. 4 cr. Lec.

PREREQUISITE: Psy 103.

A humanistic psychological approach to realizing the potential within the person. An experiential course including exercises designed to clarify self-concept, ego defenses and strengths through fantasy exploration, body movement, non-verbal communications and symbolic individual meanings.

**Psy 280 Special Topics**
On demand. 1-5 cr. Maximum 8 cr. Maximum of Psy 280 plus Psy 480, 16 cr.

PREREQUISITE: Psy 103 or Soc 101, and junior standing.

Continuation of the study of the dynamics of small groups. An experiential approach including an introduction to techniques of bioenergetics, Gestalt and psychodramatic theories and applications.

**Psy 303 Human Learning**
S. 4 cr. Lec.

PREREQUISITE: Psy 103.

Principles of learning as applied to human behavior, development of learning capacities, verbal and social learning, and current issues.

**Psy 310 Perceptual Processes**
W alternate years, will be offered W 1988. 4 cr. Lec. 3; Lab. 1.

PREREQUISITES: Psy 206 and junior standing.

Basic principles of sensory system operation with emphasis on the visual system. Contemporary psycho-physical procedures.

**Psy 311 Psychological Measurement**
W. 4 cr. Lec.

PREREQUISITE: Psy 203 or Stat 216.

Principles of psychological testing related to intelligence, aptitudes, occupations, personality, clinical diagnosis, interests, etc. The nature of psychological tests, their implications and assumptions, and methods of analyzing their reliability and validity.

**Psy 312 Physiological Psychology**
A. 4 cr. Lec.

PREREQUISITES: Psy 103 and Biol 121.

General introduction to the biological foundations of behavior, a brief review of anatomy and physiology and such topics as sensation, movement, motivation, emotion, sleep, learning and memory.

**Psy 313 Child Psychology**
A.S. 4 cr. Lec.

PREREQUISITE: Junior standing.

Examination of behavioral, social, and intellectual development of the child including review of research methods.
Psy 314 Physiological Psychology Laboratory
A. 1 cr. Lab.
PREREQUISITES: Psy 103, Biol 212 and junior standing.
COURSE: Psy 312
Hands-on experience in the study of brain-behavior relationships including a practical experiment on the brain's regulation of hunger and feeding behavior.

Psy 316 Cognitive Processes
S. 4 cr. Lect.; Lab. 1.
PREREQUISITE: Psy 103.
Theories and evidence concerning the processing of sensory information, attention, memory and thought, problem solving and decision making, and related topics.

Psy 317 Biofeedback
S. 4 cr. Lect.
PREREQUISITES: Psy 312 or Biol 211 and 212.
The application of operant conditioning techniques to autonomic nervous system function and psychosomatic problems.

Psy 320 Abnormal Psychology
A.W. 4 cr. Lect.
PREREQUISITES: Psy 103 and junior standing.
Historical and current views of psychopathology (including approaches of the medical, psychodynamic, behavioristic and humanistic-existential models). Traditional and recent innovations in approaches to therapy and diagnosis are considered with current diagnostic categories emphasized.

Psy 321 Behavior Change
S. 4 cr. Lect.
PREREQUISITE: Psy 103.
Human behavior change, with emphasis on practical techniques for changing individual and group behavior in real situations.

Psy 326 Social Behavior
A. 4 cr. Lect.
PREREQUISITE: Psy 103.
Experiential research and theoretical viewpoints in social psychology including interpersonal attraction, person perception, aggression attitudes and attitude change, altruism, group behavior and social influence.

Psy 335 Psychology of Women
On demand. 5 cr. Lect.
PREREQUISITE: Upper division standing.
Examination of methodologies and findings in the areas of developmental, personality and social psychology; and how these methodologies and findings relate to women. Comparison of traditional psychological literature and current literatures as they relate to women.

Psy 336 Sexual Behavior
On demand. 4 cr. Lect.
PREREQUISITE: Psy 103.
Theory and research related to human sexual attraction and gender-linked differences in behavior including human sexual response, causes and treatment of sexual inadequacy, romantic attraction, sexual deviation, and sex roles.

Psy 404 Motivation and Learning
On demand. 4 cr. Lect.; Lab. 1.
PREREQUISITE: Psy 206.
Basic principles and theories of animal learning and motivation. Classical and operant conditioning, discrimination learning, incentive motivation, reward and punishment.

Psy 409 Comparative Psychology
S. 4 cr. Lect.
PREREQUISITES: Psy 103 and junior standing.
Similarities and differences in behavior of animals and humans; the logical and experimental techniques used in comparative analysis.

Psy 411 History of Psychology
A. 4 cr. Lect.
PREREQUISITE: Psy 103.
The development of psychological theories and research interests with special emphasis on the role played by behaviorism and psychological materialism.

Psy 412 Systems of Psychology
On demand. 4 cr. Lect.
PREREQUISITE: Senior standing.
Comprehensive treatment of various systems of psychology.

Psy 417 Consciousness
A. 4 cr. Lect.; Lab. 2.
PREREQUISITE: Psy 103.
Theories and evidence concerning the consciousness and altered states of consciousness, including dreaming, meditation, hypnosis, sensory deprivation, psychoactive drugs, fantasy and mind games, temporal psychology, psychic phenomena and transpersonal psychology. Includes experiential learning and discussion.

Psy 418 Personality Theory
W. 4 cr. Lect.
PREREQUISITES: Psy 520 and senior standing.
Major theories of personality and current implications. Includes psychoanalytic, field, learning and existential psychology. Theories of Freud, Jung, Reich, Sullivan, Adler, Maslow, Rogers, Lowen, Skinner, Lorenz and others may be included.

Psy 419 Small Group Facilitation
S. 4 cr. Lect.; Lab. 1; Rec.-Dis. 2.
PREREQUISITE: Senior standing, Psy 301 and 302.
Supervised experience in leading small groups and in observing and promoting the flow of group processes. This includes practice with a small group and a weekly two-hour critique and training session in addition to the group class hours.

Psy 431 Behavioral Research Methods I
A. 4 cr. Lect.; Lab. 2.
PREREQUISITE: Psy 206.

Psy 432 Behavioral Research Methods II
W. 4 cr. Lect.; Lab. 2.
PREREQUISITE: Psy 431.
Treatment of advanced topics. Multivariate methods and applications beyond the laboratory setting.

Psy 433 Engineering Psychology
S alternate years, will be offered S 1987. 4 cr. Lect.
PREREQUISITE: Psy 103 or junior standing.
Methodological considerations and application of data in the design of human/machine systems. Emphasis on system analysis and problems of system design.

Psy 434 Environmental Psychology
On demand. 4 cr. Lect.
PREREQUISITES: Psy 103 and junior standing.
Concepts and methods of environmental psychology. Analysis of interactions between two complex systems; the environment and the behavior human.

Psy 435 Industrial Psychology
S alternate years, will be offered S 1988. 4 cr. Lect.
PREREQUISITE: Psy 103 and junior standing.
Basic concepts and theoretical frameworks for the fundamental areas of industrial psychology. Topics include: selection techniques, performance appraisal, training, and the implications of equal opportunity legislation. Background in elementary correlational statistics desirable.

Ps 441 Field Practicum
A.W.S. 1-6 cr. Ind. St.
PREREQUISITES: Junior or senior standing. Psy 203, 207, 320 plus appropriate GPA and sufficient background skills.
Residential experience at an appropriate institution. Exposure to the various roles and demands at a practicing institution, including specialization in one of the following areas: research, behavior modification, psychological testing or group facilitation.

Psy 460 Counseling and Psychotherapy
On demand. 4 cr. Lect.; Lab. 1.
PREREQUISITES: Psy 418.
Definitions and goals of psychotherapy, representative theories and attitudes, interview methods and models, critical therapist variables and related conditions for behavior change, beginning psychotherapy, concluding therapy and problems in evaluating psychotherapy.

Psy 470 Individual Problems
A.W.S.Su. 1-5 cr. Ind. St. Maximum 6 cr.
PREREQUISITE: Written consent of instructor and department head.
Directed research and study on an individual basis.

Psy 480 Special Topics
On demand. 1-5 cr. Lect. Maximum of Psy 280 plus Psy 480, 16 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Psy 490 Undergraduate Research
A.W.S. 1-5 cr. Ind. St. May be repeated.
PREREQUISITE: Junior standing.
Directed undergraduate research. Student must have written agreement on the nature of the research with the faculty member responsible for supervision.

Graduate Courses in Psychology

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

Psy 527 Human Factors Psychology
On demand. 4 cr. Lect.
PREREQUISITE: Graduate standing.
Theoretical and practical considerations relative to the applications of psychology to complex social, political, economic, transportation, military and engineering systems. Emphasis on the application of psychological research techniques to the study of complex systems and the influence of system characteristics on contemporary psychological theories.

Psy 530 General/Social Systems
W. 4 cr. Lect.
PREREQUISITE: Graduate standing.
General systems theory and its application to social and behavioral system design, analysis and management from a variety of professional perspectives which must consider human behavior as an integral part of the system.

Psy 536 Human Factors Seminar
S. 2 cr. Sem.
PREREQUISITE: Graduate standing.
A variety of contemporary topics in applied research.

Psy 553 Physiological Processes
A. 2 cr. Lect.; Rec.-Dis. 1.
PREREQUISITES: Graduate standing and consent of instructor.
Overview of methods in the field and relevant aspects of neurophysiology, neuroanatomy and neuropharmacology. Applications of prior work to the problem of discovery in biopsychology.
Psy 540 Sensory-Perceptual Processes
A. 2 cr. Lect. 1; Rec-Dia. 1.
PREREQUISITES: Graduate standing and consent of instructor.

Overview of theories and methods of psychophysics and selected content areas within perception. Application of research design skills to specific problems in perception.

Psy 541 Cognitive Processes
W. 2 cr. Lect. 1; Rec-Dia. 1.
PREREQUISITES: Graduate standing and consent of instructor.

Theories, methods and findings concerning memory and cognitive processes, especially relating to the assessment and acquisition of cognitive skills.

Psy 542 Learning
W. 2 cr. Lect. 1; Rec-Dia. 1.
PREREQUISITES: Graduate standing and consent of instructor.

Emphasis on the constraints of learning, such as intelligence, general variance, perceptual and cognitive limitations, brain dysfunctions and abnormal motivation due to inadequate imprinting.

Psy 543 Personality Development
S. 2 cr. Lect. 1; Rec-Dia. 1.
PREREQUISITES: Graduate standing and consent of instructor.

Representative theories of personality with focus on research techniques and emphasis. Evidence relevant to the therapeutic values of these theories is noted. Theories often explored are those of Jung, Reich, Berne, Ellis, Perls and Maslow.

Psy 544 Social Psychology
S. 2 cr. Lect. 1; Rec-Dia. 1.
PREREQUISITES: Graduate standing and consent of instructor.

An overview of current methodology and theory in social psychology.

Psy 570 Individual Problems
A. W. S. Su. 1-6 cr. Ind. St. Maximum 9 cr.
PREREQUISITES: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies.

Directed research and study on an individual basis.

Psy 580 Special Topics
On demand. 1-6 cr. Maximum 15 cr.
PREREQUISITE: Graduate standing.

Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Psy 589 Graduate Consultation
A.W.S. Su. 3 cr. Tut.
PREREQUISITES: Master's standing and approval of the Dean of Graduate Studies.

This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) for a master's degree but who need additional faculty help or time.

Psy 590 Master's Thesis
A.W.S. Su. 3-12 cr. Ind. St. Maximum 15 cr.
PREREQUISITE: Master's standing.

Improvement and restoration of deteriorated or damaged range ecosystems. Emphasis on range reseeding, mechanical renovation, plant control, prescribed burning and watershed stabilization. Term project involves range improvement planning for a Montana ranch.

Psy 546 Western Range Ecosystems
A alternate years, will be offered A 1987. 3 cr. Lab.
PREREQUISITES: RaS 505, 504 and P&S 412.

Extended field trip to important range types of the western United States. Emphasis on ecology and total resource management planning of diverse range types.

RaS 409 Grazing Influences and Management
A. 4 cr. Lect.
PREREQUISITES: RaS 306; Biol 313 or AnS 327.

Factors which influence red meat production from rangeland forages, including nutrient requirements, foraging patterns, forage quality cycles, and diet quantity and quality of the grazing ruminate.

RaS 414 Range Analysis
A. 5 cr. Lect.; Lab. 2.
PREREQUISITES: RaS 306; Biol 313; Stat 216 or P&S 418.

Theory and practice of livestock and game range analysis; sampling and processing data on range condition and trend, productivity and utilization.

RaS 420 Range-Wildlife Relationships
W. 3 cr. Lect.
PREREQUISITES: Biol 304; RaS 304 or Biol 313.

Integration of range science principles with the basic life requirements of wildlife populations (emphasis on game species) and the synthesis of plant and animal ecological relationships with management alternatives.

RaS 454 Resource Policy and Administration
W. 3 cr. Lect.
U.S. land use policy as shaped by public interest and the resulting effect on natural resource legislation; general planning processes in natural resource management.

RaS 470 Individual Problems
On demand. 1-4 cr. Ind. St. Maximum 6 cr.
PREREQUISITES: Consent of instructor and department head.

Directed research and study on an individual basis.

RaS 476 Natural Resources Internship
A. W. S. Su. 1-6 cr. Ind. St.
PREREQUISITES: 90 credits in curriculum with 2.5 or higher GPA; Biol 107, P&S 412, RaS 203 and departmental approval.

The internship is available to students who can develop a suitable program of experience and study while off the campus. The program must have approval of the range science staff, include structured supervision by the employer, provide periodic detailed reports of progress and a final report.

RaS 480 Special Topics
On demand. 1-5 cr. Maximum 16 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Range Science

Department of Animal and Range Science
994-3721

Head of Department: Dr. A.C. Linton.
Associate Professors: J.E. Taylor, C.L. Wambolt, K. M. Haavind.
Assistant Professors: J.R. Lacey (Ext.), C.B. Marlou, B.W. Sindelar.

RaS 200 Sophomore Seminar
A. 1 cr. Sem.
Discussion of range science as a profession.

RaS 203 Principles of Range Science
A. S. 3 cr. Lect.

Ecology and management of rangelands including discussions of range site, condition and trend, and the principles of proper use.

RaS 204 Principles of Range Science Laboratory
S. 2 cr. Lab.
PREREQUISITE: RaS 203 (RaS 203 may be taken concurrently).
Field studies of topics pertaining to the principles of range management such as range site, condition and trend analyses, vegetation manipulation and methods of grazing management.

RaS 280 Special Topics
On demand. 1-5 cr. Maximum 8 cr. Maximum of RaS 280 plus 8 cr. 480, 16 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

RaS 300 Junior Seminar
W. 1 cr. Sem.
PREREQUISITE: Junior standing.

Review and discussion of current literature and problems in range resource management. Emphasis on effective communications.

RaS 303 Range Vegetation
S. 3 cr. Lect. 2; Lab. 1.
PREREQUISITES: RaS 204 and Biol 107. To be taken concurrently with RaS 304.
Identification, indicator values, grazing values and site relationships of major plants of the western ranges.

RaS 304 Range Biomes
S. 3 cr. Lect.
PREREQUISITES: RaS 204 and Biol 107. To be taken concurrently with RaS 303.
Physical features, environments, function and biotic interactions of the rangeland biomes of North America.

RaS 306 Range Ecosystem Function
A. 4 cr. Lect.
PREREQUISITES: RaS 203 and junior standing.

Management of physical and biological components of rangeland ecosystems. Emphasis on ecosystem function, range dynamics, plant morphology and physiology, grazing influences and other environmental factors.

RaS 400 Senior Seminar
S. 1 cr. Sem.
PREREQUISITE: Senior standing.

Review and discussion of current literature and problems in range resource management.

RaS 404 Range Improvement Practices
W. 4 cr. Lect. 3; Rec-Dia. 1.
PREREQUISITES: RaS 306, P&S 201, Biol 313 and senior standing.
Graduate Courses
In Range Science

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

RaS 500 Seminar
PREREQUISITE: Graduate standing.
Open only to qualified graduate students.

RaS 501 Range Ecosystems Measurements
A. 4 cr. Lect.
PREREQUISITES: RaS 414 and one course in statistics.
Quantitative and qualitative techniques of rangeland measurements; synthetic methods of community analysis; dynamic modeling in range resource evaluation.

RaS 503 Advanced Range Animal Nutrition
A. 3 cr. Lect.
PREREQUISITE: AnS 309.
Examination of specific topics in range animal nutrition, including specialized research techniques, regulation of forage intake, and aspects of foraging behavior.

RaS 504 Range Ecophysiology
W. 4 cr. Lect. 3; Lab. 1.
PREREQUISITES: Biol 303 and 315, and RaS 409.
Ecological and physiological responses of vegetation and animals to changes in temperature, wind speed and available soil moisture.

RaS 506 Range Ecology
W. 4 cr. Lect. 3; Rec-Dia. 1.
PREREQUISITES: Biol 315 and RaS 306.
Range community ecology, plant succession, vegetation classification, and management influences. Ecosystem responses to grazing, browsing, mining, pollution and other impacts are considered.

RaS 570 Individual Problems
PREREQUISITES: Graduate standing, approval of department head and Dean of Graduate Studies. Directed research and study on an individual basis.

RaS 575 Professional Paper
PREREQUISITE: Graduate standing. A professional paper written on a range science topic mutually agreeable to the student and his or her graduate committee.

RaS 580 Special Topics
On demand. 1-4 cr. Maximum 15 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

RaS 589 Graduate Consultation
A,W,Su. 3 cr. Thru.
PREREQUISITE: Master's standing and approval of the Dean of Graduate Studies. This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) for a master's degree but who need additional faculty help or time.

RaS 590 Master's Thesis
A,W,Su. 3-12 cr. Ind. St. May be repeated.
PREREQUISITE: Master's standing.

Religious Studies

Department of History and Philosophy
994-4395

Head of Department: E.E. Barry.
Professor: M.C. Shaw.
Lecturers: L. Season.

Religious Studies courses are not sequenced. All 200-level courses are introductory and may be taken without prior preparation.

Rel 105F Introduction to the Study of Religion
A. 4 cr. Lect.
The great themes of the world's religions and the basic approaches involved in the academic study of religion and culture.

Rel 202F Oriental Religions
S alternate years, will be offered S 1987. 4 cr. Lect. 3; Rec-Dia. 1.
The historical forms of religious thought and practice in the traditions of India, China and Japan.

Rel 204F Old Testament
A. 4 cr. Lect.
An introduction by means of modern critical methods to the history, literature and religion of ancient Israel.

Rel 205F New Testament
W. 4 cr. Lect.
An introduction by means of modern critical methods to the history, literature and religion of Christianity in the first century.

Rel 216F Judeo-Christian Tradition
S. 4 cr. Lect.
The major figures and themes of the Judeo-Christian tradition from the biblical period through the 19th century.

Rel 220 Women and Religion
W alternate years, will be offered W 1987. 4 cr. Lect.
Images of the feminine and lives of women in the analyses of world views.

Rel 280 Special Topics
On demand. 1-5 cr. Maximum of RelS 280 plus 480, 16 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Rel 309 Contemporary Religious Thought
W. 4 cr. Lect. 3; Rec-Dia. 1.
Current thinking about religion among theologians, philosophers and social scientists.

Rel 314 Existentialism and Religion
A alternate years, will be offered A 1987. 4 cr. Lect.
PREREQUISITE: One course in philosophy or religious studies.
The bearing of existentialism as a literary and philosophic movement on religious ideas in the 20th century, including Jewish, Christian and atheist writers such as Buber, Rosenzweig, Tillich, Bultmann, Jaspers, Unamuno, Marcel, Sartre and Heidegger.

Rel 315 Process Theology
A alternate years, will be offered A 1986. 4 cr. Lect.
PREREQUISITE: One course in philosophy or religious studies.
The contemporary attempt by both non-Christian and Christian thinkers to synthesize evolutionary thought, field theory, quantum theory and other aspects of contemporary science into a vision of nature as dynamic organism, including the work of Bergson, Alexander, Whitehead, Hartshorne, Teilhard and Wieman.

Rel 316 Psychology and Religion
S alternate years, will be offered S 1987. 4 cr. Lect. 3; Rec-Dia. 1.
Models of psychological forms of religious practice: the shaman, the gnostic, the dreamer, the poet; with modern theories of psychology as they have influenced the study of the humanities.

Rel 320 (Phil 320) Philosophy of Religion
S. 4 cr. Lect. 3; Rec-Dia. 1.
PREREQUISITE: One course in philosophy.
The concepts of God, revealed truth, and immortality; the nature of religious emotion and experience; and of religious language, the relation of faith to reason; traditional proofs of God's existence; the problem of evil.

Rel 470 Individual Problems
A,W,Su. 1-3 cr. Ind. St. Maximum 6 cr.
PREREQUISITE: Consent of instructor and department head.
Directed research and study on an individual basis.

Rel 480 Special Topics
On demand. 1-5 cr. Maximum of RelS 280 plus 480, 16 cr.

Social and Criminal Justice

Department of Sociology
994-4201

Director: S.A. Harvie.
Associate Professors: D.S. Eaves, E. Lawton.

S&CJ 101S Introduction to the Criminal Justice System
A,W,S. 4 cr. Lect.
Police, judiciary and correctional components of the criminal justice systems, and issues and problems in the fulfillment of its functions.

S&CJ 111 Current Issues in Social Justice
W. 4 cr. Lect.
An analysis of selected contemporary issues and problems related to criminal and social justice, such as capital punishment, gun control, and domestic violence.

S&CJ 220 Contemporary Correctional Thought
S. 4 cr. Lect.
PREREQUISITE: S&CJ 101 or 111.
The administration of correctional institutions with emphasis on social organization and current social problems associated with incarceration and other correctional services.

S&CJ 221 Probation and Parole
W. 4 cr. Lect.
PREREQUISITE: S&CJ 101 or 111.
Problems and principles of probation, parole and correctional services, including their development, organization, administration and results.

S&CJ 280 Special Topics
On demand. 1-6 cr. Maximum of S&CJ 280 plus 480, 16 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.
emphasis is placed on how social units define and in-

S&CJ 305 Military Justice
S alternate years, will be offered S 1987. 4 cr. Lect. PREREQUISITES: S&CJ 101 or 111, or junior standing. The study of military justice, military discipline, and the notion of justice and morality within a military context.

S&CJ 310 Police Organization and Management
A. 4 cr. Lect. PREREQUISITES: S&CJ 101, 111 and junior standing. The study of the organization and management principles of the law enforcement institution including resource allocation, political interests and decision-making processes.

S&CJ 311 Police Behavior
W. 3 cr. Lect. PREREQUISITE: S&CJ 101 or 111. Consideration of social and personality variables as they affect police behavior.

S&CJ 318 Criminal Law
A. 4 cr. Lect. PREREQUISITES: S&CJ 101 or 111, and junior standing. The analysis of substantive criminal law by reviewing particular crimes and cases.

S&CJ 319 Law and Justice
W. 4 cr. Lect. PREREQUISITES: S&CJ 101 or 111, and junior standing. Consideration of specific issues related to law and justice in society.

S&CJ 323 Criminal Procedures
W. 4 cr. Lect. PREREQUISITE: S&CJ 318. The analysis of procedural criminal law by reviewing cases dealing with arrest, search and seizure, confessions, line-ups and plea bargaining.

S&CJ 325 Corrections Law
S alternate years, will be offered S 1988. 4 cr. Lect. PREREQUISITE: S&CJ 101 or 111. Laws governing the sentencing process, parole and probation, and the conditional rights of prisoners. Impact of case decisions on the administration of institutions will be discussed.

S&CJ 330 Traditions in Social Justice
W. 4 cr. Lect. PREREQUISITES: S&CJ 101 or 111, and junior standing. Historical analysis of institutions, concepts, and practices of social justice within society.

S&CJ 340 Comparative Justice Systems
W. 4 cr. Lect. PREREQUISITES: S&CJ 101 or 111, and junior standing. A comparison of justice systems as they appear in various social institutions and different cultures. An emphasis is placed on how social units define and interpret the concept of justice.

S&CJ 345 Justice and Literature
S. 4 cr. Lect. PREREQUISITES: S&CJ 101 or 111, and junior standing. The study of justice, criminality and the concept of a just society as related in fiction and non-fiction literature.

S&CJ 400 Seminar

S&CJ 415 Terrorism

S&CJ 441 Field Work Research
A,W,S,Su. 1-8 cr. Ind. St. PREREQUISITES: Junior standing and good academic standing. The preparation of a research project while engaged in field work practicum. This course must be taken with S&CJ 442.

S&CJ 470 Individual Problems
A,W,S,Su. 1-4 cr. Ind. St. Maximum 6 cr. PREREQUISITES: Senior standing, consent of instructor and department head. Directed research and study on an individual basis, including the potential applications of the research. This course must be taken with S&CJ 476.

S&CJ 476 Internship

S&CJ 480 Special Topics
On demand. 1-6 cr. Maximum of S&CJ 280 plus 480, 16 credits. Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Soc 101 Introduction to Social Theory
S. 4 cr. Lect. Introduction to major theories in sociology, both historical and contemporary. Problems of theory development and conflicting explanatory frameworks are discussed.

Soc 201 Introduction to Social Research Methods I
A,W. 4 cr. Lect. Introduction to research methods in sociology with emphasis on sample selection, hypothesis formulation and development of strategies used to test hypotheses.

Soc 235 Sociology of Everyday Life
S. 4 cr. Lect. A search for social patterns and the taken-for-granted social world. The dramaturgy of everyday interactions are explored. Impression management, props and settings are examined in order to understand everyday behavior.

Soc 280 Special Topics
On demand. 1-6 cr. Lect. Maximum of Soc 280 plus 480, 16 cr. Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Soc 301 Sociology of Education
W. 4 cr. Lect. Social processes and interaction patterns in educational organizations; relationships of such organizations to aspects of society, social class and power; social relationships within the school; formal and informal groups; school culture roles of teachers, students and administrators.

Soc 304 Social Stratification
S. 4 cr. Lect. Social differentiation and stratification, class and caste systems class and power; class and status; a review of research in American class structure.

Soc 305 Urban Sociology
A. 4 cr. Lect. Development of cities of the United States and the world; changes in the internal organization of cities, ethnic and racial groups in cities; the governing of cities; planning in old cities and building of new towns.

Soc 306 Medical Sociology
W alternate years, will be offered W 1988. 4 cr. Lect. Health, both physical and mental, as a social phenomenon; social factors in illness; and analysis of doctor-patient relationships and hospitalization as a social institution. Contribution of behavior sciences to medicine.

Soc 307 Sociology of Youth
W alternate years, will be offered W 1988. 4 cr. Lect. The institutions, policies and professionals that the young encounter during the transformation to adulthood. The ways in which modern societies define and act on young persons. Topics will include: school, work, family, juvenile justice, child abuse, day care, poverty and selected subjects.

Soc 215 Social Change
W. 4 cr. Lect. Theories and consequences of social change, including why change occurs, how long it is likely to last, the impact and effects of change, strategies to create "desired" change, and the cost of social change.

Adjunct Assistant Professor: J. Saltiel.
Associate Professor: J. Saltiel.
Adjunct Assistant Professor: A. Wilson.
Soc 308 Population Problems
W. 4 cr. Lect.
PREREQUISITE: Soc 101 or Econ 105.
Distribution, growth trends and future prospects of human population numbers in local, national and world communities including analysis of birth, death and migration changes.

Soc 309 Sociology of Deviance
W. 4 cr. Lect.
Varieties of social deviance including legal, mental, sexual, religious and other forms. Theories of general deviance, the social setting in which types of deviance take place, the relationship between forms of deviance and social organization.

Soc 311 Criminology
A. 4 cr. Lect.
PREREQUISITE: Junior standing.
Criminal behavior and its setting. A review of issues and policies associated with law enforcement, judiciary, and corrections.

Soc 314 Family and Society
A. 4 cr. Lect.
PREREQUISITE: Junior standing.
The family as a structural and functional unit in social life and organization, as a unit of social control; its status, change and associated problems.

Soc 315 Implications of Sociobiology for Sociology
W. 4 cr. Lect.
The systematic study of the biological basis of human social behavior. Examination of the scientific evidence for and against a biological explanation of human behavior, including the scientific and political implications of sociobiology.

Soc 317 Sociology of Community
S. 4 cr. Lect.
PREREQUISITE: Junior standing.
Structure and function of the community; comparative analysis of historical types and functional influences on community development, planning and population are considered.

Soc 320 Juvenile Delinquency
S. 4 cr. Lect.
PREREQUISITE: Junior standing.
The nature, extent, methods of treatment and prevention of juvenile crime in America. Also, a review of the juvenile justice system.

Soc 322 Collective Behavior
S. 4 cr. Lect.
PREREQUISITE: Junior standing.
Study of behavior of crowds, mobs, audiences and publics; social movements, fashions, facts and crazes; leadership and power structures involved in behavior.

Soc 325 Sociology of Minority Groups
A. 4 cr. Lect.
Structure, processes and distribution of power in intercultural, intersexual and inter-ethnic relations. Social psychology and ideology associated with prejudice and discrimination.

Soc 328 Environmental Sociology
A. 4 cr. Lect.

Soc 331 Sociology of Aging, Dying and Death
S. 4 cr. Lect.
PREREQUISITE: Sophomore standing.
Study of cultural meanings, social relations and social services associated with aging, death and dying in families, communities and societies; the work place and retirement; hospitals and funeral establishments.

Soc 333 Sociology of Sex Discrimination
S. 4 cr. Lect.
PREREQUISITE: Junior standing.
Examination of social and legal issues of discrimination in general and sex discrimination in particular. Specific topics include the sociological and legal definitions of discrimination, causes of discrimination, conditions under which discrimination is most likely to occur, and a review of selected sex-discrimination cases.

Soc 338 Political Sociology
W. 4 cr. Lect.
Cultural roots of models of political order; authority and power relations; pluralistic, elitist, and class models of order; social participation in politics; political development in different societies.

Soc 400 Seminar
PREREQUISITES: 12 credits of sociology.
Current literature on sociological theory and research. Routine seminar reports and discussion by students including one major paper by the student; occasional guest speakers.

Soc 401 Social Psychology
W,Su. 4 cr. Lect.
Social behavior of the individual in the group, linguistic behavior, social perception, motivation and learning, and self-focus on symbolic interaction approach.

Soc 406 Sociology of Work
W. 4 cr. Lect.
PREREQUISITE: Junior standing.
Changes in the meaning and structure of work; occupational choice, socialization and careers; types of occupations and work relations; professions and unions.

Soc 407 Sociological Thought
W alternate years, will be offered W 1987. 4 cr. Lect.
PREREQUISITE: Soc 101 and junior standing.
Sociological theory from the time of August Comte to the present. The influence of classic European and American contributions to sociological thought on contemporary sociological theories.

Soc 419 Sociology of Agriculture
S. 4 cr. Lect.
Impact of industrialized agriculture on the institutions, cultural values and agrarian lifestyles of rural America. The probable future role of small scale farming in American agriculture.

Soc 420 Small Groups
S,Su. 4 cr. Lect.
Forms of interaction among individuals in small groups. Major emphasis on the theory of role behavior and role taking; dramaturgical model of social behavior; nonverbal communication; advanced social psychology.

Soc 425 Social Research
On demand. 4 cr. Lect.
PREREQUISITES: 12 credits of social science.
Data collection and use of scientific method in research. Conceptualization of research problems including concept and hypothesis development, and collection and analysis of data.

Soc 427 Social Analysis
S alternate years, will be offered S 1987. 4 cr. Lect.
PREREQUISITES: 12 credits of social science, including one social research course.
Application of analytic tools to the analysis of sociological data.

Soc 430 Medical Social Psychology
W alternate years, will be offered W 1987. 4 cr. Lect.
PREREQUISITE: Soc 101 or Psy 103.
Illness as behavior; perception and definition of illness and care, illness roles and patient-practitioner relationships, role impairment, social stress and organic response.

Soc 440 Research Practicum
A,W,Su. Ind. St. 1-16 cr.
PREREQUISITE: Junior or senior standing in research option.
The practical application of research skills through the development of an original project, work on a project already under way, or work on an appropriate project with an outside agency. Students are supervised by a faculty member and are expected to demonstrate competency in the application of research skills.

Soc 470 Individual Problems
A,W,Su. 1-4 cr. Ind. St. Maximum 6 cr.
PREREQUISITE: Senior standing, consent of instructor and department head.
Directed research and study on an individual basis.

Soc 476 Career Internship
W,Su. 6-12 cr. Ind. St.
PREREQUISITES: Junior standing and approval of department head.
Interns are selected by departmental faculty to work in governmental, public service or corporate positions during one academic quarter. Selected interns are given significant assignments at the management level to broaden their understanding of professional expectations in the chosen field.

Soc 480 Special Topics
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Graduate Courses in Sociology
There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

Soc 500 Seminar
On demand. 1 cr. Sem. Maximum 6 cr.
PREREQUISITES: Graduate standing and 12 credits in sociology.
Current literature on theory and research. Routine seminar reports and discussion by the students including one major paper; occasional guest speakers.

Soc 570 Individual Problems
PREREQUISITE: Graduate standing.
Directed research and study on an individual basis.

Soc 580 Special Topics
On demand. 1-5 cr. Maximum 15 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Speech Communication
994-3815

Head of Department: Dr. K.D. Bryson (Acting).
Professors: K.D. Bryson, C.L. Isacson
Associate Professors: J.P. DiBerardinis, G.E. Hall, J.R. Olson, N.O. Owings, R.E. Weisenborn.
SpCm 105: Introduction to Argumentation and Debate
S. 3 cr. Lect. 1; Rec.-Dis. 2.
Study of and practice in the principles of argumentation as applied to various forms of debate.

SpCm 110C: Introduction to Public Communication
A,W,S,Su. 4 cr. Lect. 2; Rec.-Dis. 2.
Study of and practice in the fundamentals of preparation and delivery of various types of speeches and group presentations.

SpCm 130: Introduction to Manual Communication
A,W,Su. 3 cr. Lect. 2; Rec.-Dis. 1.
A beginning course in "total communication" with the deaf. Includes study of the manual alphabet and numbers, 500 basic signs, and the Signing Exact English technique.

SpCm 166: Orientation to Communication Disorders
A,W,S. 2 cr. Lect. 1; Lab. 1.
Observation and analysis of speech and hearing therapy practices of professional staff.

SpCm 177: Introduction to Speech and Hearing Science
A,W,S. 3 cr. Lect. 2; Rec.-Dis. 1.
Fundamental concepts in speech and hearing science including study of voice production, perception of speech, use of the International Phonetic Alphabet (I.P.A.), the structure of the larynx and the ear, and an analysis of voice types.

SpCm 205: Organizational and Managerial Communication
W, 3 cr. Lect. 2; Rec.-Dis. 1.
PREREQUISITE: SpCm 101.
Principles and theories of organizational behavior from a communication perspective. Basic concepts in human relations will provide a foundation for understanding the interrelationships between organizational and communication variables.

SpCm 211: Introduction to Mass Communication Theory
A, 3 cr. Rec.-Dis.
PREREQUISITE: SpCm 101.
Theories of media influence and the principles and products of various media systems.

SpCm 215: Public Relations Communication
A,W,S. 3 cr. Lect.
PREREQUISITE: Sophomore standing.
Public relations from a communication perspective, dealing extensively with applied problems in the various aspects of public relations.

SpCm 216: Communication in the Classroom
W,S. 3 cr. Lect. 2; Rec.-Dis. 1.
PREREQUISITE: Three credits of speech communication.
Study of cultural and socioeconomic influences on communication behavior of elementary students.

SpCm 231: Intermediate Manual Communication
W,S. 3 cr. Rec.-Dis.
PREREQUISITE: SpCm 130.
Review of signs and techniques. Emphasis on skill building, both receptive and expressive, and fluency.

SpCm 250: Public Speaking
A,W,S. 3 cr. Lect. 2; Rec.-Dis. 1.
PREREQUISITE: SpCm 110.
Concentrated study of and practice in common forms of public address.

SpCm 267: Small Group Communication
A,W,S. 3 cr. Lect. 2; Rec.-Dis. 1.
PREREQUISITE: SpCm 110.
Concentrated study of small group processes.

SpCm 268: Foundations of Research in Speech Communication
PREREQUISITE: SpCm 101.
An introduction to the discipline and methodologies of speech communication, and the relationships among the various areas and basic research skills.

SpCm 280: Special Topics
On demand. 2-4 cr. Maximum 8 cr. Maximum of SpCm 280 plus 480, 16 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand. Intended for lower-division students.

SpCm 301: Technical and Professional Communication
A,W,S,Su. 4 cr. Lect. 2; Rec.-Dis. 1.
PREREQUISITES: Four credits of English composition or speech communication, and junior standing.
Career-oriented study of written and oral communication.

SpCm 310: Theories of Educating the Hearing Impaired
S. 3 cr. Lect.
PREREQUISITE: Three credits of speech communication.
The study of the social and academic problems of deafness.

SpCm 315: Laboratory Experience in Communicative Disorders
A,W,S. 1 cr. Lab.
PREREQUISITES: SpCm 343, 351 and 352.
Hands-on experience with communicative-disordered children.

SpCm 317: Nonverbal Communication
W alternate years, will be offered W 1987. 4 cr. Rec.-Dis.
The theoretical nature of the many ways human beings communicate without the use of words; communication through unspoken messages.

SpCm 318: Interpersonal Communication
S. 4 cr. Lect. 2; Rec.-Dis. 2.
PREREQUISITE: SpCm 101.
The process of communication among individuals with emphasis on social, personal, linguistic and situational factors. Lecture, discussion and laboratory methods will be utilized.

SpCm 325: Psychology of the Hearing Impaired
A alternate years, will be offered A 1987. 3 cr. Lect.
PREREQUISITE: SpCm 177.
A survey course designed to give the pre-professional student an overview of the social and psychological problems associated with hearing deprivation and the adjustment of the hearing impaired to these problems.

SpCm 327: Communicative Disorders
A. 4 cr. Lect.
PREREQUISITES: SpCm 177, Psy 103 and junior standing.
Study of the causes, diagnosis and therapy of speech defects. Problems of defective speech in school and techniques for improving normal speech of pupils are studied. Handling speech defects in the home is also investigated.

SpCm 343: Principles of Audiology
W alternate years, will be offered W 1987. 3 cr. Rec.-Dis.
Survey of the field of audiology and various testing techniques.

SpCm 344: Contemporary Public Address
S alternate years, will be offered S 1987. 4 cr. Lect.
PREREQUISITE: Junior standing.
Analysis and evaluation of modern speeches, speakers, movements and issues.

SpCm 351: Voice and Articulation
W alternate years, will be offered W 1988. 3 cr. Rec.-Dis.
PREREQUISITES: SpCm 177.
The broad areas of voice and articulation for both the normal and abnormal client; methods of assessment and remediation.

SpCm 352: Diagnosis and Appraisal
S alternate years, will be offered S 1988. 3 cr. Rec.-Dis.
PREREQUISITES: SpCm 177.
Consideration of all aspects of the process of communication behavior assessment.

SpCm 360: Sex Differences in Communication
W. 3 cr. Rec.-Dis.
PREREQUISITE: Junior standing.
Survey of the theories and research about sex differences in communication and sex bias in our culture.

SpCm 400: Seminar
PREREQUISITE: Senior standing.
Although primarily for SpCm majors, open to all students. Individual and group research. Area of study will vary each quarter.

SpCm 405: Advanced Organizational Communication
A,S. 4 cr. Lect.
PREREQUISITES: SpCm 205 and Mgmt 340.
Theories applicable to the analysis of communication within organizational structures; preparation of a major research project.

SpCm 411: Issues in Mass Communication Research
S. 4 cr. Rec.-Dis.
PREREQUISITES: SpCm 211 and junior standing.
Mass communication research methodologies and analysis of mass effects and issues.

SpCm 415: Advanced Public Relations Communication
S. 4 cr. Lect.
PREREQUISITES: SpCm 215 plus 12 credits of SpCm.
Application of theoretical principles of speech communication to public relations. Examination of areas of human behavior, formation of public opinion, public information and ethics in public relations; preparation of a research project.

SpCm 417: Persuasion
W. 4 cr. Lect.
PREREQUISITES: Fifteen credits of SpCm.
Application of theories of persuasion to human communication through reading, lecture, discussion and research projects.

SpCm 430: Conversational Sign Language
S. 3 cr. Lect. 2; Rec.-Dis. 1.
PREREQUISITE: SpCm 231.
Designed for students possessing fluency in AMSLANT and/or SEE. Videotaping is employed in perfecting techniques.

SpCm 433: Communication Theory
W. 4 cr. Lect.
PREREQUISITE: Fifteen credits of SpCm.
Survey and critical analysis of prominent theories of communication, with emphasis on the theory building process and the applications of those theories.
SpCm 440 Theatre of Silence
A,W,S,Su. 3 cr. Lect.; Lab. 2.
PREREQUISITE: SpCm 231.
An analysis of stage sign technique followed by a five- to ten-day in-state tour. Limited to 20 students. Students who have been accepted into the Theatre of Silence work for three months creating a stage production.

SpCm 447 Language: Theories, Development and Disorders
W. 3 cr. Lect.
PREREQUISITE: Junior standing.
Study of the basic causes and dysfunctions of cognitive processes related to language development.

SpCm 450 Internship: Public Relations Communication
A,W,Su. 4-12 cr. Ind. St.
PREREQUISITE: Departmental consent.
Practical application of speech communication training received; progress reports, and written terminal analysis and evaluation of internship experience.

SpCm 451 Internship: Organizational/Interpersonal Communication
A,W,Su. 4-12 cr. Ind. St.
PREREQUISITE: Departmental consent.
Practical application of speech communication training received; progress reports, and written terminal analysis and evaluation of internship experience.

SpCm 452 Internship: Defac Education
A,W,S,Su. 4-12 cr. Ind. St.
PREREQUISITE: Departmental consent.
Practical application of speech communication training received; progress reports, and written terminal analysis and evaluation of internship experience.

SpCm 469 Research Methods in Speech Communication
A. 4 cr. Lect.
PREREQUISITE: SpCm 268.
The philosophy and procedures of historical and empirical research methodology applied to speech communication through intensive review and analysis of professional literature; preparation of a major research proposal.

SpCm 470 Individual Problems
A,W,Su. 1-4 cr. Ind. St. Maximum 6 cr.
PREREQUISITES: Twelve credits of speech communication and written consent of instructor and department head.
Directed research and study on an individual basis.

SpCm 476 Career Internship
A,W,Su. 6-12 cr. Ind. St.
PREREQUISITE: Junior standing and approval of class advisor.
Interns are selected by departmental faculty to work in governmental, public service or corporate positions during one academic quarter. Selected interns are given significant assignments to broaden their understanding of professional expectations in their chosen field.

SpCm 480 Special Topics
On demand. 1-4 cr. Maximum of SpCm 280 plus 480, 16 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

SpCm 490 Rhetorical Theory
S. 4 cr. Lect.
PREREQUISITES: Nine credits of SpCm at 300-400 level.
Application of theories of rhetorical criticism in appraising and analyzing speeches, writings and movements of the past and present.

SpCm 499 Senior Project
A,W,Su. 3 cr. Ind. St.
Preparation and presentation of a major speech communication research project under departmental supervision. Project is dictated by student's interests and academic preparation.

Graduate Courses In Speech Communication

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

SpCm 500 Seminar
On demand. 1 cr. Sem. Maximum 6 cr.
PREREQUISITE: Graduate standing.
Individual and group research into topics appropriate to graduate study in speech communication. Topic varies each quarter.

SpCm 520 Theory Building in Communication Studies
On demand. 4 cr. Lect.
PREREQUISITE: SpCm 433.
An investigation of the process of theory building as it relates to the study of human communication behavior.

SpCm 525 Theories of Group and Organizational Communication
S. 4 cr. Lect.
PREREQUISITES: SpCm 405.
Study of the various theoretical approaches in the analysis of group behavior, and consideration of methods of synthesizing research findings related to this aspect of communication behavior.

SpCm 530 Theories of Mass Communication
On demand. 4 cr. Lect.
PREREQUISITE: SpCm 411.
A critical examination of the prominent theories used in research in mass communication.

SpCm 540 Theories of Intercultural Communication
On demand. 4 cr. Lect.
PREREQUISITE: ICS 303.
Examination of communicative transactions among persons of diverse cultures with emphasis upon the extension of accepted theoretical constructs.

SpCm 570 Individual Problems
PREREQUISITES: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies.
Directed research and study on an individual basis.

SpCm 580 Special Topics
On demand. 2-4 cr. Maximum 15 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Statistics

Department of Mathematical Sciences 994-3601

Head of Department: Dr. K.J. Tiahrt.
Associate Professors: R.J. Boik, B.J. Collings, R.R. Chrisman.

Stat 120 Decision Making
A,W,S. 4 cr. Lect.

Stat 216 Elementary Statistics
A,W,Su. 4 cr. Lect.
PREREQUISITE: Math 140.
Presentation of data, measures of location and variability, probability, interval estimation, tests of hypothesis for normal and binomial populations. Desk or pocket calculators are used for problem solving.

Stat 230 Elementary Statistics for Business
A,W,S,Su. 4 cr. Lect.
PREREQUISITES: Math 170 and an introductory course in computing.
Presentation of data, measures of location and variability, probability, interval estimation, tests of hypothesis for normal and binomial populations. Desk or pocket calculators are used for problem solving.

Stat 280 Special Topics
On demand. 1.5 cr. Maximum 8 cr. Maximum of Stat 280 plus Stat 480, 16 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Stat 345 Statistical Computation
S. 1 cr. Lect.
PREREQUISITE: Stat 352.
Introduction to statistical computer software.

Stat 350 Statistical Methods: Sampling, Estimation and Testing
Basic statistical methods for analyzing data which include summarization of data, and statistical inference for one and two sample problems.

Stat 352 Statistical Methods: One-Way Analysis of Variance and Simple Regression
A,S. 2 cr. Lect.
PREREQUISITE: Stat 350.
Simple linear regression model: least squares estimation, inference on slope, intercept and expected response; analysis of variance table for regression; testing the model. Calculations for a single factor analysis of variance model; orthogonal contrasts; multiple comparisons; fixed vs. random effects; relationships with regression.

Stat 354 Statistical Methods: Analysis of Variance
W. 2 cr. Lect.
PREREQUISITE: Stat 352.
Multifactor studies, analysis of 2-factor experiments, main effects, simple effects, interaction; ANOVA table, F-tests, use of contrasts and multiple comparisons; completely random designs, randomized complete block designs, problems with the model, testing for block-treatment interaction, missing values; Latin square design, ANOVA; response curves, orthogonal polynomials; unequal sample sizes in two factor experiments; random effects models, mixed effects models, multi-factor studies.

Stat 356 Statistical Methods: Multiple Regression
W,Su. 2 cr. Lect.
PREREQUISITE: Stat 352.
Regression, estimation, analysis of variance and inference using matrices; partial F-tests, coefficients of determination, residual plots, data transformations, polynomial regression, indicator variables and final model selection.

Graduate Course Prerequisites, page 120.
Graduate Courses in Statistics

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

Stat 500 Seminar
On demand. 1 cr. Sem. May be repeated for a maximum of 6 cr.
Students participate in preparing and presenting lectures. Topics selected from material not covered in regular courses.

Stat 505 Linear Statistical Models I
A S 4 cr. Lect.
Projections, least squares analysis, distribution of quadratic forms, general linear models, estimation and testing for normal linear models.

Stat 506 Linear Statistical Models II
W S 5 cr. Lect.
PREREQUISITE: Stat 505.
Analysis of variance, regression analysis, analysis of covariance.

Stat 507 Linear Statistical Models III
S S 3 cr. Lect.
PREREQUISITE: Stat 506.
Residual analysis, model selection methods, collinearity, variance component estimation, mixed models.

Stat 528 Advanced Sampling Methods
S alternate years, will be offered S 1987. 3 cr. Lect.
PREREQUISITES: Stat 505.
Analysis and construction of balanced incomplete block designs, partially balanced incomplete block designs, orthogonal arrays, finite geometries, resolution designs.

Stat 570 Individual Problems
A S 6 cr. Rec. Dis.
Directed research and study on an individual basis.

Stat 577 Advanced Experimental Design
A alternate years, will be offered A 1986. 3 cr. Lect.
PREREQUISITE: Stat 527.
Design and analysis of experiments, randomization tests, confounding in symmetric and asymmetric factorial designs, partial confounding, fractional replication, Latin squares, lattice designs.

Stat 578 Response Surface Design
W alternate years, will be offered W 1987. 3 cr. Lect.
PREREQUISITE: Stat 577.
Principles of response surface methodology, evolutionary operation, first and second order designs, blocking designs, rotatable designs.

Stat 579 Combinatorial Design Problems
S alternate years, will be offered S 1987. 3 cr. Lect.
PREREQUISITE: Stat 577.
Analysis and construction of balanced incomplete block designs, partially balanced incomplete block designs, orthogonal arrays, finite geometries, resolution designs.

Stat 580 Special Topics
On demand. 1-5 cr. Maximum 15 cr.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Stat 589 Graduate Consultation
A W S 3 cr. Tut.
PREREQUISITES: Master's standing and approval of the Dean of Graduate Studies.
This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) for a master's degree but who need additional faculty help or time.

Stat 590 Master's Thesis
A W S S Su 3-12 cr. Ind. St. May be repeated.
PREREQUISITE: Master's standing.

Stat 689 Reading and Research
On demand. 3-5 cr. Ind. St. Maximum 15 cr.
PREREQUISITE: Graduate standing.

Stat 690 Doctoral Thesis
A W S S Su 3-12 cr. Ind. St. May be repeated.
PREREQUISITE: Doctoral standing.

Theatre Arts

994-3901

Head of Departments: J.B. Jablanski
Professors: J. Jones, B.L. Tone (Emeritus).
Assistant Professors: S.L. Campbell, G.B. Roe.
Adjunct Assistant Professor: M.A. White.

The Department of Theatre Arts reserves the right to retain students' work for exhibition and instructional purposes.

Thtr 101 Rehearsal and Performance
A W S 2 cr. Lab. Maximum 12 cr.
Lab credit for students performing in theatre productions. Course can only be added after role is assigned.

Thtr 114F Theatre Appreciation
A S 4 cr. Rec. Dis.
An understanding of theatre arts to provide a basis for evaluating contemporary entertainment arts through study of principles and techniques of writing and production. May include assignments to view and discuss theatre, motion pictures and television.
Thtr 120 Fundamentals of Acting I  
A.S. 4 cr. Lect. 2; Rec.-Dis. 2.  
An introduction to the basic skills of acting through acting exercises and individual projects.

Thtr 121 Fundamentals of Acting II  
W. 4 cr. Lect. 2; Rec.-Dis. 2.  
PREREQUISITE: Thtr 120.  
Continued studies in fundamental acting skills.

Thtr 122 Production Techniques  
A,W,S. 1 or 2 cr. Lab. Maximum 12 cr.  
Work as production crew member in theatre production: set construction, lighting, sound, costume, management and promotion. Specific assignments must be arranged with instructor during first two weeks of quarter.

Thtr 123 Stage Makeup  
A,W alternates years, will be offered W 1986. 4 cr. Lect. 2; Rec.-Dis. 2.  
Theory and practical experience in various aspects of theatre makeup.

Thtr 179 Freshman Projects  
A,W,S. 1-2 cr. Ind. St.  
Preparation and presentation of an appropriate project in acting, directing or technical theatre.

Thtr 200 Theatre Aesthetics  
S alternate years, will be offered S 1987. 4 cr. Sem.  
Readings, reports and/or projects on various aspects of dramatic theory and criticism.

Thtr 201 Stagecraft  
A. 4 cr. Lect. 3; Lab. 1.  
Introductory course in technical aspects of theatre. Lecture course on basic stage terminology, types and styles of scenery, tools and materials used in technical theatre practices with practical application through laboratory exercises.

Thtr 203 Scene Painting  
S. 4 cr. Lect. 2; Lab. 2.  
Beginning course in scene painting including types of paint, brushes, and tools used in theatrical production. Emphasis on mastering basic painting techniques utilizing specific workshop exercises.

Thtr 218 Costume Construction  
A alternate years, will be offered A 1986. 3 cr. Lect. 1; Lab. 2.  
Basic clothing construction methods and their applications to theatrical costumes. Hands-on experience in the costume lab.

Thtr 220 Acting Shakespeare  
A alternate years, will be offered A 1986. 4 cr. Rec.-Dis.  
PREREQUISITE: Thtr 121.  
A study of Shakespeare with an emphasis on acting through practical application and scene work.

Thtr 221 Intermediate Acting  
W. 4 cr. Lect. 2; Rec.-Dis. 2.  
PREREQUISITE: Thtr 121.  
Development of acting techniques through improvisational exercises and performing scenes from plays, with an emphasis on character and script analysis.

Thtr 240 Voice for the Theatre  
S alternate years, will be offered S 1988. 4 cr. Lect. 2; Rec.-Dis. 2.  
PREREQUISITE: Thtr 121.  
The physical mechanism of the voice and an understanding of the psychological study needed to develop the natural voice.

Thtr 250 Fundamentals of Stage Direction  
A. 4 cr. Lect. 2; Rec.-Dis. 2.  
The fundamentals of the stage director's craft: class lectures, discussions, readings and class exercises. Designed for both theatre and non-theatre majors.
Thtr 440 Advanced Stage Lighting
S alternate years, will be offered S 1988. 4 cr. Lect. 2; Lab. 2.
PREREQUISITE: Thtr 340.
Study of advanced stage lighting theory and technology with practical application through lighting projects.

Thtr 450 Advanced Stage Direction
S. 4 cr. Lect. 2; Rec.-Dis. 2.
PREREQUISITE: Thtr 350.
An examination of contemporary stage directors, directorial theory and practice; combined with practical experience in solving complexities of directing through an extensive project exercise.

Thtr 470 Individual Problems
A,W,S,Su. 1-5 cr. Ind. St. Maximum 8 cr.
PREREQUISITE: Consent of instructor and department head.
Directed research and study on an individual basis. Student must obtain instructor's consent prior to registering and subsequently file program of study with the department.

Thtr 475 Career Internship
A,W,Su, 3-12 cr. Ind. St.
PREREQUISITES: Junior standing and approval of department head.
An opportunity to earn credit while working in professional situations to broaden understanding of professional expectations in a chosen field.

VetS 305 Non-Infectious Diseases of Domestic Animals
S. 4 cr. Lect.
PREREQUISITE: Sophomore standing.
Location, description and function of various cells, tissues, organs and systems that make up entire animal organism.

VetS 307 Infectious Diseases of Domestic Animals
S. 4 cr. Lect.
PREREQUISITE: Junior standing and VetS 271.
Important infectious diseases of domestic animals and methods of prevention. Impact of infectious diseases on livestock economy and the importance of animal diseases transmissible to man.

VetS 470 Individual Problems
On demand. 1-5 cr. Ind. St. Maximum 6 cr.
PREREQUISITE: Consent of instructor and department head.
Directed research and study on an individual basis.

University Honors
994-4110
Director: Dr. S.H. Benjamin.

UH 201-202-203-204-205-206 Honors Seminar
A,W,S. 4-4-4 cr. Sem. Maximum 8;8;8 cr.
PREREQUISITE: Admission to the University Honors Program.
Honors seminars are multidisciplinary courses which emphasize class discussion, development of analytic thinking and writing skills, and encourage independent creativity/research.

UH 401-402-403-404-405-406 Honors Seminar
A,W,S. 4-4-4 cr. Sem. Maximum 8;8;8 cr.
PREREQUISITE: Admission to the University Honors Program.
Advanced Honors seminars are multidisciplinary courses which emphasize class discussion, development of analytic thinking and writing skills, and encourage independent creativity/research.

UH 450-451-452-453-454-455 Honors Tutorial
A,W,S. 8,8,8 cr.
Weekly tutorial supervision for selected Honors students. Extensive reading, analytic writing, oral argument, leading to comprehensive Honors examination. Oxbridge teaching.

UH 490 Senior Honors Thesis
A,W,S. 3-4 cr. Ind. St.
PREREQUISITE: Admission to the University Honors Program. Senior standing and a 3.5 G.P.A.
Directed undergraduate research, two/three quarter options.

Graduate Courses In Veterinary Science

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

VetS 502 Advanced Parasitology
W alternate years, will be offered W 1988. 4 cr. Lect.
PREREQUISITE: Biol 333 or Meds 510.
The biology and host-parasite relationships of representative protozoan and helminth parasites of vertebrates. Emphasis will be placed on the epizootiology, ecology and distribution of parasites of domestic animals and wildlife and their role as disease agents. Methods of identification and experimental maintenance of parasites in the laboratory.

VetS 530 Research Animal Utilization
A. 3 cr. Lect. 2; Lab. 1.
PREREQUISITE: Graduate standing.
Species selection, animal models, environmental and humane considerations and diseases of laboratory animals. Biomet hodological techniques will be demonstrated and/or practiced in the laboratory.

VetS 570 Individual Problems
A,W,Su. 1-5 cr. Ind. St. Maximum 8 cr.
PREREQUISITE: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies.
Directed research and study on an individual basis.

Graduate Courses In Theatre Arts

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

Thtr 480 Special Topics
On demand. 2-4 cr. Maximum of Thtr 280 plus 480. 16 cr.
PREREQUISITE: Junior standing.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Thtr 490 Projects In Theatre Arts
A,W,Su. 2-4 cr. Ind. St. Maximum 8 cr.
PREREQUISITES: Junior standing and consent of the department.
Preparation and presentation of an appropriate theatre project.

VetS 480 Special Topics
On demand. 1-6 cr. Maximum 16 cr.
PREREQUISITES: Junior standing or consent of instructor.
Courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine demand.

Graduate Courses In Veterinary Science

There are certain implicit prerequisites for 500- and 600-level courses; see Graduate Course Prerequisites, page 120, for details.

VetS 501 Ultrastructural Cytology
W. 5 cr. Lect.
PREREQUISITES: Graduate standing, Biol 333 or Meds 510.
The structure and function of mammalian cells as organized in tissues and organs; the interrelation of host/tissue/organism response to various physiologic and pathologic stimuli.

VetS 502 Advanced Parasitology
W alternate years, will be offered W 1988. 4 cr. Lect.
PREREQUISITE: Biol 408.
The biology and host-parasite relationships of representative protozoan and helminth parasites of vertebrates. Emphasis will be placed on the epizootiology, ecology and distribution of parasites of domestic animals and wildlife and their role as disease agents. Methods of identification and experimental maintenance of parasites in the laboratory.

VetS 590 Master's Thesis
A,W,Su. 3-12 cr. Ind. St. May be repeated.
PREREQUISITE: Master's standing.

VetS 690 Doctoral Thesis
A,W,Su. 3-12 cr. Ind. St. May be repeated.
PREREQUISITE: Doctoral standing.