

# Course Descriptions

Courses approved at the time of publication are listed in this bulletin. Not all courses are offered every term. Refer to the "Registration Schedule" published each term for listed offerings.

## Definitions

Course descriptions frequently include additional information about enrollment. Students are responsible for complying with restrictions or expectations related to course enrollment listed herein or in any supplementary information.

**Course credits:** Credits are stated in semester units as defined in the Academic Policies section in this bulletin.

**Course prerequisites (Prereq):** Prerequisites indicate the academic background, academic level, or other requirements considered necessary for enrollment in the course. Most prerequisites are specific courses, however, equivalent preparation is usually acceptable.

**Course corequisites (Coreq):** Corequisites indicate courses to be taken concurrently with the course described.

**Cross-listed courses:** A cross-listed course means the same course is offered by two or more departments or under another course prefix. Cross-listed departments are noted and the full description appears under the department responsible for the course. Credit may only be earned for the course under one of the prefixes.

**Dual-listed courses:** Dual-listed courses with 400- and 600-level course numbers permit undergraduate and graduate students in the same class. The same amount of credit for the course is earned by all students, but additional work is required of students enrolled under the graduate-level number. Credit may only be earned for the course at one of the levels.

## Designators

• **(CCN)** - This abbreviation indicates the course has a common number, title, and description throughout ND University System institutions. Common courses offered at NDSU are listed in the Appendix.

• **(ND:\_\_\_)** - This designator has various abbreviations following the colon to indicate the general education category for which the course has been approved by the ND University System for transfer to other System institutions. Other General Education Requirement Transfer Agreement (GERTA) designators are the following: (ND:CompSc) computer science, (ND:Engl) English composition, (ND:FA) fine arts activities, (ND:Hist) history, (ND:Hum)

humanities, (ND:LabSc) laboratory science, (ND:Math) mathematics, (ND:Sci) science and technology, (ND:Comm) speech, and (ND:SS) social science. For more GERTA information, refer to the Academic Policies section in this bulletin.

*Note:* NDSU general education requirements and approved courses are listed in the Appendix. Also refer to the centerfold of the "Registration Schedule" each term for approved updates.

## Format of Course Listings

All University course offerings, listed alphabetically by areas of study, are described on the following pages. This bulletin is published biennially and in the interim certain courses may be deleted from or added to departmental offerings. Course change information is available from the specific departments.

The heading, which precedes the brief description of each course, includes the current course number; former course number, if any, in brackets; course title; a CCN indicator, if any; and the number of semester credit hours, fixed or variable. Enrollment information, such as prerequisites and corequisites follows. The frequency the course is offered appears at the end of the description. F = Fall, S = Spring, SS = Summer Session

## Course Numbers

Course numbers indicate the student classification for which the course is primarily intended. Some course numbers end with a letter suffix: H - honors course; L - laboratory course. The number system is as follows:

001-099 - non-degree credit courses\*  
 100 series courses - open to freshmen  
 200 series courses - primarily for sophomores  
 300 series courses - primarily for juniors  
 400 series courses - primarily for seniors  
 500-599 series courses - post-baccalaureate professional courses  
 600 numbered courses - Continuing Education post-baccalaureate courses, not applicable toward graduate degrees  
 601-699 series courses - graduate courses taught concurrently in the same classroom with advanced undergraduates at the 400 level  
 700-799 series courses - open to graduate students

\*Any 100-level course offered for non-degree credit is noted in the course description.

*Note:* A bracketed course number [] indicates the former number of the same course. Double credit cannot be earned by repeating a course unless the course description indicates otherwise.

## Uniform Course Numbers

The following courses may be offered by departments but are described here because of their uniform numbers and descriptions.

### **(Prefix) 291, 391, 491, 590, 690, 790 Seminar (CCN) 1-3**

A group of students engaged, under a professor or professors, in research or criticism and in presentation of reports pertaining thereto.

### **(Prefix) 292, 392, 492 Study Abroad (CCN) 1-15**

Pre-arranged study at accredited foreign institutions or in approved study abroad programs. Prereq: Sophomore standing and prior approval by major department. Graded P or F.

### **(Prefix) 194, 294, 394, 494 Individual Study (CCN) 1-3**

Individual student work on research or criticism under the supervision of a professor.

### **(Prefix) 196, 296, 396, 496, 595, 695, 795 Field Experience (CCN) 1-15**

Field-oriented supervised learning activities outside the college classroom that include a preplanned assessment of the experience and post evaluation with the instructor. Departmental approval.

### **(Prefix) 297, 397, 497 Cooperative Education (CCN) 1-4**

Practical application of classroom learning through employment in supervised career-related positions. Students are granted full-time student status by the University regardless of the actual credit hours. Requires departmental approval and Co-op Program application.

### **(Prefix) 199, 299, 399, 499, 596, 696, 796 Special Topics (CCN) 1-5**

A group study of the known and established literature of a field, or other evidence, for purposes of scholarly development.

### **(Prefix) 379 Study Tour Abroad 1-6**

NDSU faculty directed, part-term experience or field study in a foreign country. Conducted in English for residence credit. Prereq: Prior approval by the Office of International Programs and major department. May be repeated. Graded P or F.

### **(Prefix) 592, 692, 792 Case Studies 1-3**

Critical review, analysis, and evaluation of selected topics by individual presentations and group discussions. Case study topics are indicated by title on the student's transcript. Graded S or U.

### **(Prefix) 593, 793 Individual Study/Tutorial 1-5**

Directed study allowing an individual student under faculty supervision to undertake selected, independent work in topics of special interest or a limited experience in research. Requires departmental approval.

**(Prefix) 594, 794****Practicum/Internship 1-8**

Course designed to provide practical participation under professional supervision in selected situations to gain experience in the application of concepts, principles, and theories related to the student's area of specialization. Requires approved program and consent of instructor. Graded S or U.

**(Prefix) 791****Temporary/Trial Topics 1-5**

University-wide course focused on group study involving critical examination and discussion of subject matter selected for proposal as a temporary or trial course.

**(Prefix) 797****Master's Paper 1-3**

Literature review, research, and preparation for paper required for the comprehensive study option. Graded S or U.

**(Prefix) 798****Master's Thesis 1-15**

Original investigation under the supervision of a major adviser and a supervisory committee. Graded S or U.

**(Prefix) 798s****Specialist Field Study 1-6****(Prefix) 799****Doctoral Dissertation 1-15**

Original investigation under the supervision of a major adviser and an advisory committee. Graded S or U.

**ACCOUNTING (Acct)**

Harter, Chair; Brown, Buckhoff, Clifton, Dietz, Glatt, Hansen, Klamm, Knoepfle

**COURSES****102 Fundamentals of Accounting (CCN) 3**

Includes elements of financial statements and the full accounting cycle. Not available to majors and accounting minors in the College of Business Administration.

**200, 201 Elements****of Accounting I, II (CCN) 3 each**

200: Basic principles of the complete accounting cycle. 201: Special emphasis on corporate accounting and the uses of accounting information by managers. Prereq: Sophomore standing. Coreq: CSci 116 or departmental approval.

**311, 312 Intermediate****Accounting I, II 4 each**

Intensive study of accounting theories, corporate accounting problems, financial statements and disclosures, problems in income determination, and other evolving problems in accounting. Prereq: Acct 201.

**318 Taxation in Management****Decisions 3**

Study of the fundamental concepts of federal income tax implications that result from common business transactions. Prereq: Acct 102 or 201, junior standing. Cross-listed with Busn.

**320 Cost Management Systems 3**

Cost management encompasses the activities of managers in the planning and control of costs. Discussion of proper design and implementation of cost management systems along with their motivational effects on organizational members. Prereq: Acct 201.

**321 Government and Not-for-Profit Accounting 3**

Introduction to the accounting standards and procedures applicable to government and not-for-profit institutions. Prereq: Acct 201.

**410/610 Fraud Examination 3**

Study of the pervasiveness of and causes of fraud in society; exploration of methods of fraud detection, investigation, and prevention; and detection of financial statement fraud. Prereq: Acct 102 or 201.

**413 Accounting Internship 3**

Supervised professional experience in public, industrial, or government accounting. Students must meet standards established by the employer and the College of Business Administration.

**415/615 Advanced Accounting 3**

Study of special problems in accounting including consolidated statements, international operations, partnerships, corporate liquidations, corporate reorganizations, estates, and trusts. Prereq: Acct 312.

**418/618, 419/619 Tax Accounting I, II 3 each**

Study of the theory and principles related to the determination of taxable income and computation of federal income taxes for individuals, partnerships, corporations, trusts and estates, and other specialized tax issues. Prereq: Acct 201.

**420/620 Accounting Information Systems 3**

Examination of accounting information systems with emphasis on systems planning and design and on application of appropriate software and hardware technology. Prereq: Acct 201, MIS 370.

**421/621, 422/622 Auditing I, II 3 each**

Study of audit objectives and procedures, auditing standards, legal liability, ethics, internal controls, and report writing. Prereq: Acct 312.

**430 Tax Practice and Research 3**

Supervised, practical experience applying knowledge and skill in areas of tax practice and research. Students prepare a variety of income tax returns and develop a basic understanding of tax research methods. Prereq: Acct 418, departmental approval.

**440 Management Control Systems 3**

Management control systems involve the accumulation and use of information to facilitate the process of making planning and control decisions throughout the organization and to guide the behavior of its managers and employees. Prereq: Acct 201.

**720 Advanced Managerial Accounting 3**

Study of various forms of control in business organizations with emphasis on accounting controls such as budgets, variances, and performance measurement. Prereq: Departmental approval.

**AEROSPACE STUDIES (AS)****(AIR FORCE ROTC)**

Keating, Chair; Bibeau, Staley, Welter

**COURSES****110 Air Force ROTC Fitness 1**

Physical Training classes are designed to make students aware of the benefits of being physically fit and participating in lifetime fitness programs. F, S

**111 The Air Force Today I 1**

Introduces students to the United State Air Force and provides an overview of the basic character, Missions, and organization of the Air Force. F

**112 The Air Force Today II 1**

Continuation of AS 111; provides an overview of the basic characteristics, missions and organization of the Air Force. S

**210 Leadership Laboratory 1**

Introduction to Air Force customs and courtesies, drill and ceremonies, and military commands. F, S

**211 Evolution of USAF Air and Space Power I 1**

Introduction to Air Force heritage and leaders, quality Air Force concepts, ethics and values, leadership, group leadership problems, and the application of communication skills. F

**212 Evolution of USAF Air and Space Power II 1**

Continuation of AS 211, includes an introduction to Air Force heritage and leaders, Air Force concepts, ethics and values, leadership, group leadership problems, and the application of communication skills. Prepares cadet for Field Training. S

**Field Training**

Students in the four-year program participate in four weeks of field training during the summer after their sophomore year. Students applying for entry into the two-year program must successfully complete six weeks of field training prior to enrolling in AFROTC.

The major areas of study in the four-week field training program include junior officer training, aircraft and aircrew indoctrination survival training, base functions, the Air Force environment, and physical training.

The six-week field training course covers the same areas of study as the four-week program and includes an additional two weeks of academic instruction in general military courses.

**Professional Officer Course (POC)**

The Professional Officer Course (POC), taken during the student's junior and senior years, concentrates on four main themes: Communication skills, national security forces in contemporary American society, the principles and practices of management, and leadership in the USA Air Force.

**321 Air Force Leadership/Management I**

3

Introduction to management within the USAF, emphasizing communication skills (in both oral and written Air Force formats) and interpersonal skills. F

**322 Air Force Leadership/Management II**

3

Study of leadership from the military perspective emphasizing situational leadership and contemporary issues including change management and professional ethics. Case studies are used to illustrate leadership concepts. Officer professional development topics are discussed. S

**410 Leadership Laboratory**

1

Development of leadership skills in a practical, supervised laboratory. Students must instruct, supervise, and lead junior cadets participating in AS 210, and perform high level management functions with the cadet corps organization. F, S

**441 Preparation doe Active Duty I**

3

A study of the national security process, regional studies, advanced leadership ethics and Air Force doctrine. Topics include the military as a profession, officership, military justice, civilian control of the military, and current issues. Application of communication skills is included. F

**442 Preparation for Active Duty II**

3

A continuation of AS 441. Topics include the military as a profession, officership, military justice, civilian control of the military, and current issues. Continued application of communication skills and preparation for a new officer's first active duty assignment. S

## AGRICULTURAL AND BIOSYSTEMS ENGINEERING (ABEn)

Stegman, Chair; Backer, Bon, Disrud, Lindley, Panigrahi, Schwarz, Solseng, Steele, Wiesenborn

**COURSES****110 Introduction to Agricultural and Biosystems Engineering**

2

Introduction to the agricultural and biosystems engineering profession with emphasis on engineering problem solving. 2 lectures. F

**189 Skills for Academic Success**

1

See University Interdisciplinary Studies for description. F

**255 Computer-Aided Analysis and Design**

3

Application and use of software for engineering design, analysis, and graphical communication. 3 lectures. F

**263 Biological Materials Processing**

3

Processing equipment design and physical properties of biological materials that influence their harvesting, handling, processing, storage, marketing, and quality evaluation. 2 lectures, 1 three-hour laboratory. Prereq: ABEn 255 or equivalent. S

**358 Electric Energy Application in Agriculture**

3

Electrical distribution/services. Electrical control units, solid state and digital electronics, electromagnetic sensors, and sensing techniques with applications to food, agricultural, and biological systems. 2 lectures, 1 three-hour laboratory. Prereq: Phys 252. F

**377 Numerical Modeling in Agricultural and Biosystems Engineering**

3

Numerical modeling using finite element and other techniques. Engineering applications include modeling of stress/strain, heat, and mass transfer in physical, natural resource, and biological systems such as grain and food products. 3 lectures. Prereq: Math 266, ME 223. S

**383 Structural Design for Biosystems**

3

Study of framing systems, building materials, and load requirements. Analysis and design of structures for biosystems. 3 lectures. Prereq: ME 223. F

**452/652 Bioenvironmental Systems Design**

3

Study of psychrometrics, heat and mass transfer, and physiological requirements for livestock and bioproducts. Design of environmental modification and control systems. 3 lectures. Prereq: CE 309, ME 350. F

**458/658 Food Process Engineering**

3

Analysis and design of food processing equipment and plants. Emphasis is on application of fluid flow, thermodynamics, and heat and mass transfer principles. 3 lectures. Prereq: Junior standing. F

**464/664 Resource Conservation and Irrigation Engineering**

4

Engineering principles and design of systems for soil and water resource management and environmental protection. 3 lectures. 1 three-hour laboratory. Prereq: CE 309. S

**473/673 Agricultural Power**

3

Theory, analysis, and testing of internal combustion engines, traction, power trains, hydraulic systems, vehicle dynamics, stability, and ergonomics in tractor design. Electrical power units including motors. Alternative energy systems. 2 lectures, 1 three hour laboratory. Prereq: ME 350. F

**478/678 Machinery Analysis and Design**

2

Principles of design, development, and testing of agricultural machines and machine systems. Applications of computer aided design and FMEA. 2 lectures. Prereq: ME 223. S

**482/682 Instrumentation and Measurements**

3

Application of instrumentation and sensor concepts to measurement and control of environmental, biological, and mechanical parameters. Includes sensor principles, signal conditioning, data collection, and data analysis methods. 2 lectures. 1 three-hour laboratory. Prereq: ME 223, Phys 252. S

**486 Design Project I**

1

Capstone learning experience involving principles of design, project management, and evaluation. Student teams define a capstone project in their area of interest. 1 lecture/laboratory. Prereq: Senior standing. F

**487 Design Project II**

2

Continuation and completion of the capstone learning experience begun in ABEn 486. Communication in oral, written, and graphic forms is emphasized. 2 lectures/laboratories. Prereq: ABEn 486. S

**758 Electrical and Electronic Applications**

3

Sensors and non-destructive sensing principles (e.g., computer vision, spectroscopy, imaging, fiber optic sensing) for bioproduction and processing applications. Data/signal acquisition, signal conditioning/analysis techniques, signal interpretation and pattern recognition using statistical, neural networks, and fuzzy logic techniques. 3 lectures. Graduate standing. S

**763 Theory of Drying Biological Products**

3

Theory used to describe the drying processes of biological products. 3 lectures. Graduate standing. F

**765 Small Watershed Hydrology and Modeling**

3

Study and representation of hydrologic processes on small watersheds. Application of hydrologic models for surface flow, subsurface flow, nutrient and sediment transport, and water quality. Prereq: ABEn 464/664. F

**773 Advanced Agricultural Power and Machinery**

3

Theory and design of agricultural power units and field machines. 3 lectures. Prereq: ABEn 473/673. F

**783 Advanced Structures and Environmental Systems**

3

Detailed analysis of building components and advanced design problems relating to agricultural and environmental systems. 3 lectures. Prereq: ABEn 383. S

## AGRICULTURAL ECONOMICS (AgEc)

Lambert, Chair; Aakre, C. DeVuyst, E. DeVuyst, Flakerud, Gustafson, Hearne, Koo, Leistriz, B. Leitch, Mack, Nelson, Nganje, Petry, Rathge, Sarmiento, Shultz, Swenson, Tweeten, Wachenheim, Wilson

### COURSES

**150 Quantitative Economics** 2  
Application of algebra and calculus to price theory. 2 lectures. Prereq: AgEc 201 and Math 103 or 104.

**201 Principles of Microeconomics (CCN)** 3  
Nature, method, and scope of economic analysis; economic scarcity, resources, specialization of labor; supply-demand analysis; production and cost analysis; product and resource market structures; distribution of income; international trade. Cross-listed with Econ (CCN).

**202 Principles of Macroeconomics** 3  
Aggregate income and employment analysis; business cycles, unemployment, inflation and economic growth; fiscal policy; money and monetary policy; the U.S. economy and the world economy. Cross-listed with Econ (CCN).

**220 World Agricultural Development** 3  
Introduction to theories, policies, and practices to increase food production and agricultural development in developing countries. 2 lectures.

**242 Introduction to Agricultural Management (CCN)** 4  
Economic and managerial concepts related to farm or agribusiness production process, development of cost data, enterprise analysis, organization and management of production inputs. 3 lectures, 1 laboratory.

**244 Agricultural Marketing (CCN)** 3  
Study of the agricultural marketing system to include cash marketing, commodity futures trading, branded products merchandising and the interrelationship of the government and international trade. 3 lectures.

**246 Introduction to Agricultural Finance I (CCN)** 4  
Introduction to agricultural finance; provides background in farm and agribusiness credit use and evaluation. Discussion of specific financial conditions on farms and in agribusiness. 3 lectures, 1 laboratory.

**339 Quantitative Methods and Decision Making** 3  
Application of basic probability concepts to decision analysis, introduction to linear programming models, and decision-free analysis. 3 lectures Prereq: AgEc 150 or Math 146.

**342 Farm and Agribusiness Management II** 3  
Application of production economics principles to farm and agribusiness operations. Economic input-output principles and profit maximization. 2 lectures, 1 laboratory. Prereq: AgEc 242.

**344 Agriculture Price Analysis** 3  
Introduction to price analysis in agricultural markets. 3 lectures. Prereq: AgEc 244.

**346 Agricultural Finance II** 3  
Development of tools to analyze financial and credit use problems unique to farms, ranches, and agribusinesses. For agricultural economics majors. 3 lectures. Prereq: AgEc 246.

**347 Principles of Real Estate** 3  
Principles and techniques of real estate appraisals, practical application of appraisal principles, and techniques to real property evaluation. 2 lectures, 1 laboratory. Prereq: AgEc 201. Cross-listed with Busn.

**350 AgriSales** 3  
The principles of salesmanship applied to the agricultural business. Topics include attitudes and value systems, basic behavioral patterns, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, and closing sales. 3 lectures.

**355 Negotiation** 3  
Principled negotiation (interests, options, legitimacy, working relationships, and agreement) in resolving conflicts and joint problem solving; sales negotiations; and responding to unscrupulous tactics.

**374 Cooperatives** 3  
Theory, practice, and evaluation of cooperatives including principles, management, marketing, finance, taxes, legal issues, and adjusting to change. 2 lectures. Prereq: AgEc 201. Cross-listed with Busn.

**375 Applied Agricultural Law (CCN)** 3  
Study of laws affecting agriculture and agribusiness including property ownership, financial relations, and environmental regulation. 2 lectures. Prereq: Junior standing.

**378 Introduction to Transportation and Logistics** 3  
Presents the role and importance of transportation, with detailed discussion of the various modes and their specific characteristics. Covers basic logistics concepts in addition to transportation, including inventory, warehousing, and location decisions. Prereq: Econ 201, Junior standing.

**420 Integrated Farm and Ranch Management** 3  
Intended for persons who will advise or manage farm and ranch operations. Application of all phases of management (including marketing, finance) to crop and livestock production practice. 2 lectures, 1 laboratory. Prereq: AgEc 242 or 244 or 246, Senior standing.

**444/644 Crops Marketing** 3  
Capstone course for commodity marketing option. Advanced work on topics related to marketing of crops. 2 lectures. Prereq: AgEc 344.

**445 Agribusiness Industrial Strategy** 3  
The course integrates industrial organization topics with specific applications to agribusiness strategy problems. Focus is on industry analysis and issues in competition, strategy, and rivalry from an agribusiness perspective.

**446/646 Agribusiness Finance** 3  
Application of financial theory to investment and liability management problems of agribusiness and farm firms. Characteristics, operations, and management of agricultural financial institutions. 3 lectures. Prereq: AgEc 346.

**450 National AgriMarketing Association (NAMA) I** 1  
Learn the components of an agribusiness marketing plan and apply this knowledge in the development of a marketing plan for a selected product. 1 lecture.

**451 National AgriMarketing Association (NAMA) II** 2  
Review the components of an agribusiness marketing plan. Work in teams to prepare written and oral marketing plans for the National NAMA student chapter competition in April. 2 lectures. Prereq: AgEc 450.

**452/652 Food Laws and Regulations** 3  
See CFS 452/652 for description.

**470/670 Agricultural Trade** 2  
Introduction to trade theory and policies and their applications to agricultural product trade. 2 lectures. Prereq: AgEc 201, 202, Senior standing.

**472/672 Advanced Logistical Analysis** 3  
Presents major analytical tools and methods used in analyzing logistical strategies. Course emphasis is on application of analytical tools used in quantifying logistical problems by manufacturing, trading, and shipping firms. Prereq: AgEc 339 and/or Busn 352, AgEc 378.

**484 Agricultural Policy** 3  
Analysis of the evolution and development of federal food, natural resource, and trade policies and their consequences on the agricultural sector. Exploration of how microeconomic forces influence formulation of macroeconomic agricultural policy. Prereq: Econ 341 and 343.

**701 Research Philosophy** 1  
Role of the scientist, reasoning, values, and decisions. Problem formulation, literature review, hypothesis development, data collection, analysis, and interpretation. 1 lecture.

**710 Econometrics** 3  
Applications of statistical methods to specification, estimation, and forecasting of linear economic models including multiple regression models, cross-section data analysis, time-series data analysis, and qualitative dependent variable models. 4 lectures for first half of semester.

- 711 Advanced Topics in Econometrics** 1-3  
Advanced econometric methods appropriate to a variety of research areas in economics and agribusiness will be offered. Analytical methods covered will vary by semester. Repeated enrollment allowed. Prereq: AgEc 710 or consent of instructor.
- 720 Food Safety Costs and Benefits Analysis** 3  
Theoretical and empirical impacts of food safety costs and benefits. Prereq: SAFE 470/670, AgEc 741.
- 725 Food Policy** 3  
See SAFE 725 for description.
- 739 Analytical Methods for Applied Economics** 3  
Study and application of operations research techniques and other decision methods to problems in agriculture, transportation, and resource management. 3 lectures.
- 741 Advanced Microeconomics** 3  
Advanced analysis of demand, production, and costs; pricing output and resource allocation under various market structures. Prereq: Econ 341, Math 146 or equivalent.
- 743 Advanced Macroeconomics** 3  
Advanced analysis of macroeconomic theories; economic growth, business fluctuations, and inflation. Prereq: Econ 343, Math 146 or equivalent.
- 744 Agribusiness I: Agricultural Product Marketing and Agribusiness Strategy** 3  
Conceptual foundations of agribusiness strategy, food product marketing, and strategic planning are presented. Emphasis is placed on quantitative strategic decision making for the agribusiness firm.
- 746 Agribusiness II: Agrifinance and Commodity Trading** 3  
Conceptual foundations of agribusiness finance, trading, and strategy are presented. Emphasis is placed on financial instruments and planning for agribusiness firms and trading and risk management in agricultural commodities.
- 771 Economics of Transportation Systems** 3  
The course will provide an understanding of transportation economics and policy issues facing society. Topics include transportation demand, model costs, transportation competition and market power, transportation regulation, transportation investment, and the economics of transportation safety. Prereq: Math 146, Stat 331, Econ 341. Cross-listed with CE.
- 772 Rural Logistics and Distribution Management** 3  
Logistical systems and concepts, distribution management, management of railroads and motor carriers, and location of facilities. Includes agribusiness and natural resource case studies. Cross-listed with CE.
- 791 System of Equations Estimation** 1  
See Department for course description.
- AGRICULTURAL SYSTEMS MANAGEMENT (ASM)**  
Stegman, Chair; Backer, Bon, Disrud, Lindley, Panigrahi, Schwarz, Solseng, Steele, Wiesenborn
- COURSES**
- 115 Fundamentals of Agricultural Systems Management (CCN)** 3  
Overview of agricultural systems management; engines, machinery, structures, electricity, processing, and conservation. 3 lectures. Prereq or coreq: Math 103, 104, or higher.
- 125 Fabrication and Construction Technology (CCN)** 3  
Introduction to materials, methods, and tools used in fabrication, installation, and maintenance of agricultural production and processing facilities. 2 lectures, 1 three-hour laboratory.
- 225 Computer Applications in Agricultural Systems Management** 3  
Application and use of software for problem solving, reporting, and graphical communication. 3 lectures. Prereq: CSci 114 or 116.
- 259 Measurements in Natural Resource Systems** 1  
Surveying, data acquisition, area and volume determinations, and other measurement calculation techniques in planning and management of natural resource systems.
- 264 Natural Resource Management Systems** 3  
General principles of management of natural resource systems including hydrology, soil erosion, irrigation, drainage, and water quality. 2 lectures, 1 three-hour laboratory. Prereq: Math 103 or 104. Cross-listed with NRM.
- 323 Post-Harvest Technology** 3  
Principles and management of crop and feed storage, handling, drying, processing, and crop/feed systems siting, planning, and development. 3 lectures. Prereq: Math 103 or 104.
- 354 Electricity and Electronic Applications (CCN)** 3  
Fundamentals and applications of electricity, power distribution, controls, motors, and solid state electronics. For non-engineering majors. 2 lectures, 1 three-hour laboratory. Prereq: Math 103 or 104, Junior standing.
- 368 Structures and Environment Systems** 3  
Study of environmental needs of animals and bioproducts, control of building environments, construction materials, framing systems, and functional planning for biosystem structures. 3 lectures. Prereq: Math 103 or 104.
- 373 Tractors and Power Units (CCN)** 3  
Theory and principles of operation, use, maintenance, repair, and selection of tractors and power systems. Includes engines, transmissions, fuel, lubrication, hydraulics, traction, and electrical systems. 3 lectures. Prereq: Math 103 or 104.
- 374 Power Units Laboratory (CCN)** 1  
Laboratory to complement concepts introduced in ASM 373. Topics include engine systems, operation, adjustment, maintenance, repair, measurement, and testing. 1 three-hour laboratory. Prereq: Math 103 or 104.
- 378 Machinery Principles and Management (CCN)** 3  
Principles of agricultural machinery manufacture, sales, operation, and management. Topics include selection, replacement, operation, application, and maintenance. 2 lectures, 1 three-hour laboratory. Prereq: Math 103 or 104.
- 427/627 Unit Operations in Food Manufacturing** 3  
Principles of basic processes in food manufacturing: conveying, size reduction, separations, mixing, heat transfer, concentration, drying, and extrusion. 3 lectures. Prereq: Math 105.
- 454 Principles of Site Specific Agriculture** 3  
Principles and practices of site-specific farming, including data acquisition, data management, modeling, equipment management, GPS, and GIS. Two lectures, one three hour laboratory. Prereq: Math 103 or 104.
- 475/675 Management of Agricultural Systems** 2  
Capstone learning experience involving team solution to problems in agricultural systems management. Oral and written communications are emphasized. 2 lectures. Prereq: Senior standing.
- AGRICULTURE (Agri)**  
Jensen, Dean
- COURSES**
- 150 Agriculture Orientation** 1  
Introduction to opportunities and professional advancement in agricultural careers. Overview of majors offered in the College of Agriculture, activities, and support services.
- 189 Skills for Academic Success** 1  
See University Interdisciplinary Studies for description.

## ANIMAL AND RANGE SCIENCES (ARSc)

Kirby, Chair; Barker, Bauer, Berg, Berryhill, Biondini, Blanchetot, Caton, Colville, Danielson, Grazul-Bilska, Grygiel, Harrold, Haugen, Lardy, Marchello, Moore, Park, Redmer, Reynolds, Schroeder, Sedivec, Socha, Stoltenow, Tilton, Turner

### COURSES

#### 114 Introduction to Animal Sciences (CCN) 3

General principles of the livestock industry and relationships to mankind. 2 lectures, 1 two-hour laboratory.

#### 123 Feeds and Feeding (CCN) 3

Principles of feeding livestock including digestive systems, nutrient requirements, nutrient characteristics, and sources utilized in the formulation of balanced rations. 2 lectures, 1 two-hour laboratory.

#### 220 Livestock Production (CCN) 3

General production and management of major meat and dairy animal species. Topics include production systems, feeding, facilities, health, economics, and marketing. 2 lectures, 1 two-hour laboratory.

#### 222 Meat Animal Evaluation (CCN) 2

Relationship between live animal characteristics and structure to product value. 2 two-hour laboratories. F

#### 225 Natural Resource and Ago-ecosystems (CCN) 3

Introduction to scientific theories and their relation to natural resources and agriculture. Influence of these theories on current perspectives toward the environment. 3 lectures. Cross-listed with NRM.

#### 260 Introduction to Equine Studies 2

A review of the evolution, historical role of the horse, breeds, and the modern day equine industry. Introduction to anatomy, physiology, selection, nutrition, healthcare, and stable design/management. 2 one-hour lectures per week. F

#### 260L Equine Care and Management Practicum 1

A laboratory course designed to supplement lecture material covered in ARSc 260. Students will learn management and husbandry skills relevant to modern horse care practices. 1 three-hour laboratory. Prereq or Coreq: ARSc 260. F

#### 261 Basic Equitation and Horsemanship 1

Grooming, saddling, bridling, mounting, balanced seat, and coordination of the riding aids will be addressed. One two-hour laboratory. Lab fee required. Enrollment priority will be given to Equine Studies Major/Minor/Certificate students.

#### 263 Introduction to Animal Biotechnology 3

Basic aspects of animal biotechnology, biotechnology in health, biotechnology in reproduction, biotechniques. 3 lectures. Prereq: Biol 115 or 150. S

#### 320 Dairy Cattle Selection 1-2

Visual appraisal, selection, and evaluation of dairy cattle. Type classification of dairy cattle. 2 three-hour labs. May be repeated. Prereq: Departmental approval.

#### 323 Fundamentals of Nutrition 3

Fundamentals of nutrition emphasizing digestion, metabolism, function, requirements, and sources of specific nutrients. 3 lectures. Prereq: ARSc 123, Bioc 260, or departmental approval. F

#### 326 Modeling of Range and Agroecosystems 3

Introduction and applications of systems analysis and simulation modeling to agriculture, biology, range ecology, and natural resources management. 2 lectures, 1 two-hour laboratory. Offered even years.

#### 330 Meat Selection, Grading, and Judging 1-2

Evaluation and grading of carcasses and wholesale cuts of beef, pork, and lamb. Written explanation of decisions and comparisons. 2 three-hour laboratories. May be repeated. Prereq: ARSc 222 or departmental approval.

#### 331 Livestock Selection (CCN) 1-2

Visual and performance evaluation of breeding and slaughter classes of the major meat producing livestock. 2-3 three-hour laboratories. May be repeated. Prereq: ARSc 222 or departmental approval.

#### 336 Introduction to Range Management (CCN) 3

Principles of range management which include plant identification, range evaluation, and range improvement. 3 lectures. F

#### 340 Meat Science and Technology 3

Introduction to meat science. Chemical, physical, and structural properties of meat and meat products. Identification, nutritive analysis, preservation, cooking, and packaging technology. 2 lectures, 1 two-hour laboratory. Prereq: Chem 260.

#### 344 Fundamentals of Meat Processing 2

Chemical and physical relationships in meat preservation, sausage production, and other meat product preparation. 1 lecture, 1 three-hour laboratory.

#### 357 Animal Genetics 3

Genetic and statistical principles applied to livestock improvement. 2 lectures, 1 two-hour laboratory. Prereq: PlSc 315, Stat 330. S

#### 361 Intermediate Horsemanship 1

A continuation of ARSc 261. Further emphasis will be placed on development of the balanced seat and coordinated aids necessary to complete more

advanced maneuvers. One two-hour laboratory. Lab fee required. Prereq: ARSc 261. Enrollment priority will be given to Equine Studies Major/Minor/Certificate students.

#### 363 Equine Nutrition and Physiology 3

Discussion of basic biological processes and their application to management of equine nutrition, exercise and conditioning, and reproduction. 3 lectures. Prereq: VetS 135, ARSc 123, 260, 323. F

#### 365 Equine Evaluation 2

Detailed study of horse conformation, selection criteria, and judging standards for equine competitions. Emphasis will be placed on development of critical-thinking, decision-making, and oral presentation skills. 2 three-hour laboratories. Prereq: ARSc 260. F, S

#### 435/635 Nutrition Laboratory Techniques 3

Theory and basic laboratory techniques associated with nutritional research and current information regarding advanced techniques and developments. 2 lectures, laboratory by arrangement. Prereq: Chem 260. F (even years)

#### 450/650 Range Plants 3

Identification, distribution, and forage value of important U.S. range plants. 1 lecture, 2 two-hour laboratories. Prereq: Bot 314. Cross-listed with Bot. F

#### 452/652 Geographic Information Systems in Range Survey 3

Analysis of methods for determining range composition, condition, and productivity. Emphasis will be given to the use of Geographic Information Systems. 3 lectures. Prereq: ARSc 336. F (odd years)

#### 456/656s Range Habitat Management 3

Capstone course to include specific techniques and systems approaches to maintenance and improvement of rangeland ecosystems. 3 lectures. Prereq: ARSc 336. S (odd years)

#### 458/658 Grazing Ecology 3

Grazing processes and systems and their effects on plants and herbivores. 3 lectures. Prereq: ARSc 336. S (even years)

#### 460/660 Plant Ecology 3

See Botany for description.

#### 463/663 Physiology of Reproduction 4

Anatomy, physiology, and endocrinology of reproduction in mammals. 3 lectures, 1 two-hour laboratory. Cross-listed with Zoo. S

#### 464 Reproductive Management Procedures 2

Demonstration and utilization of the new technology in large animal reproductive management including embryo and semen collection, pregnancy diagnosis, and estrous control. 1 lecture, 1 three-hour laboratory. Prereq: ARSc 463. F

- 470 Applied Nutrition** 4  
Application of nutrition principles in feed-management systems for livestock with emphasis on energy and protein (ruminants) and energy and amino acids (non-ruminants). 4 lectures. Prereq: ARSc 323. S
- 480 Equine Industry and Production Systems** 3  
A capstone course that incorporates genetics, nutrition, exercise physiology, reproduction, health care, and industry practices into management of the equine enterprise. 2 lectures, 1 two-hour laboratory. Prereq: ARSc 363 and 463. S
- 482 Sheep Industry and Systems Production** 2  
Capstone course to include the management, systems, selection, record keeping, merchandising, and production testing of sheep. 3 lectures, 1 two-hour laboratory. Half semester. Prereq: ARSc 220, 336, 357, 463, 470, or departmental approval.
- 484 Swine Industry and Production Systems** 2  
Capstone course includes breeding systems, disease control, applied economics, housing, marketing, and nutrition in a systems approach. 3 lectures, 1 two-hour laboratory. Half semester. Prereq: ARSc 220, 357, 463, 470, or departmental approval.
- 486 Beef Industry and Production Systems** 2  
Capstone course includes the management, systems, selection, record keeping, merchandising, and production testing of beef. 3 lectures, 1 two-hour laboratory. Half semester. Prereq: ARSc 220, 336, 357, 463, 470, or departmental approval.
- 488 Dairy Industry and Production Systems** 2  
Capstone course includes the management, selection, record keeping, merchandising, and production testing of dairy and dairy products. 2 lectures, 1 two-hour laboratory. Prereq: ARSc 220, 357, 463, 470, or departmental approval. S
- 710 Range Communities and Watersheds** 3  
Study of grazing reaction, forage value, and watershed characteristics of major range plant communities. 3 lectures. Prereq: ARSc 336. F (even years)
- 716 Agrostology** 3  
Identification and description of U.S. grasses and grass-like plants. 2 lectures, 2 two-hour laboratories. Prereq: Bot 314. Cross-listed with Bot. F (even years)
- 717 Aquatic Vascular Plants** 2  
Identification and description of aquatic vascular plants. 1 lecture, 2 two-hour laboratories. Prereq: Bot 314. Cross-listed with Bot. F (odd years)
- 721 Biology of Lactation** 2  
Mammary gland development and mechanisms controlling lactation. 2 lectures. Prereq: Bioc 460.
- 728 Advanced Reproductive Biology** 3  
Discussion of reproductive physiology research with emphasis on current topics in cellular and molecular biology. 3 lectures. Prereq: ARSc 463, Bioc 460. S (odd years)
- 730 Growth Biology** 2  
Regulation of growth at the cell/tissue, organ systems, and whole animal levels. 2 lectures. Prereq: ARSc 463, Bioc 460. S (even years)
- 732 Reproductive Endocrinology** 3  
Reproductive endocrinology with emphasis on molecular, biochemical, and endocrinological mechanisms. 3 lectures. Prereq: ARSc 463, Bioc 460.
- 736 Experimental Nutrition Methods** 1  
Design, conductance, analysis, and reporting of experiments taken in conjunction with ARSc 773, 774, 775, or 776. Prereq: ARSc 470, Bioc 460.
- 740 Data Analyses and Designs of Experiments** 3  
Experimental design principles, introductory statistical theory, and commonly used data analyses of animal and range science data are taught and practiced with practical applications using the computer. 3 lectures. Prereq: Stat 725.
- 755 Advanced Meat Science** 2  
Physical, chemical, and structural characteristics of the postmortem meat animal. 2 lectures. Prereq: ARSc 340, Bioc 460. (even years)
- 765 Analysis of Ecosystems** 3  
Introduction to advanced statistical techniques to evaluate plant communities, plant-animal interactions, and plant-soil relationships. Emphasis on multivariate analysis. 2 lectures, 1 two-hour laboratory. Prereq: Stat 330. S (even years)
- 773 Energy Metabolism** 3  
Methods of measuring energy values and the metabolic processes involved in the production of useful biological energy from organic compounds. 3 lectures. Prereq: ARSc 470, Bioc 701. F (odd years)
- 774 Nitrogen Metabolism** 3  
Detailed overview of nitrogenous compounds including metabolism and function. Considerable emphasis on current research from the literature. 3 lectures. Prereq: ARSc 470, Bioc 701. S (even years)
- 775 Vitamins and Minerals** 3  
Metabolism of vitamins and minerals and their application in animal nutrition and the feed industry. 3 lectures. Prereq: ARSc 470, Bioc 701. F (even years)
- 776 Digestive Physiology** 3  
Investigation of digestive and absorptive events occurring within farm animals. Emphasis on enzyme action, nutrient transport, gut motility, gastro-intestinal endocrinology, and current research. 3 lectures. Prereq: ARSc 470, Bioc 701. F (odd years)
- ANTHROPOLOGY (Anth)**  
Brandt, Clark, Klobberdanz, Riley
- COURSES**
- 111 Introduction to Anthropology (CCN)** 3  
Introductory overview of the major divisions of anthropology: cultural and physical anthropology, archaeology, and linguistics. (ND:SS)
- 204 Archaeology and Prehistory** 3  
Introduction to archaeological methods, followed by a survey of world prehistory.
- 205 Human Origins** 3  
Examination of the evolution of humans through the investigation of fundamental principles of evolution, human variation, comparative primate behavior, and the fossil record.
- 206 Peoples of the World** 3  
General survey of cultural anthropology and cultures of various regions of the world.
- 208 Folklore and Culture** 3  
Examination of folk traditions (oral, customary, and material) within their cultural context.
- 444/644 Peoples of the Pacific Islands** 3  
General survey of cultures, past and present, in Melanesia, Polynesia, and Micronesia.
- 450/650 Cultural Anthropology** 3  
Examination of the nature of culture, the dynamics of culture, cultural subsystems, and cultural data collection and analysis. Prereq: Anth III or departmental approval.
- 451/651 Anthropological Linguistics** 3  
Anthropological uses of linguistic data, methods, and theory. Includes phonetic transcription and phonemic, morphemic, and synthetic analysis.
- 452/652 North American Indians** 3  
General survey of native North American Indian cultures. Focuses on cultural systems as anthropologists have reconstructed them for the precontact period.
- 453/653 Magic and Religion** 3  
Comparative religion, religious concepts, practices, and practitioners. In-depth study of selected religious systems with a focus on shamanic religions. Prereq: Anth III or departmental approval. Cross-listed with RelS.
- 458/658 Indians of the Plains** 3  
Ethnographic/ethnohistorical survey of major Indian tribes in the Great American Plains region from ancient times to the present.
- 461/661 Germans from Russia** 3  
Study of the cultural and historical background of an important ethnic group in the Great American Plains region—German-speaking people from Russia.
- 462/662 Cultural Ecology** 3  
Analysis of the systematic relationship between human populations and their ecological surroundings. Prereq: Any Anth course.

- 465/665 Web-based Media in Anthropology** 3  
This course focuses on the use of modern computer imaging techniques within an anthropology research context. Topics to be covered include: visual anthropology, cultural preservation, data protection, ethics, web3D, digital video, Web-design and internet dissemination.
- 480/680 Development of Anthropological Theory** 3  
Focus on major theoretical orientations in anthropology. Emphasis on the ways in which anthropological theories are used to generate explanations for multicultural phenomena. Prereq: Anth 111 or departmental approval.
- 489 Senior Capstone in Anthropology** 1  
Synthesis of social research methods, anthropological theory, and subdiscipline content material. Emphasis on integrative skills needed to interrelate the basic concepts of the discipline. Prereq: Senior standing.
- 705 Forensic Anthropology** 3  
Theory and methods in the recovery, identification, and evaluation of human skeletal remains for criminal investigation purposes.
- APPAREL, DESIGN, FACILITY AND HOSPITALITY MANAGEMENT (ADFH)**  
Bastow-Shoop, Chair; Amundsen, Bates, Manikowske, Markey, Ray-Degges, Sarabakhsh, Sunderlin, Williams, Wolfe, Woodahl
- COURSES**
- 140 Introduction to Hospitality Industry** 3  
Overview of the hospitality industry; its history, components, career opportunities, development, and future trends with application to food service, lodging, and travel. 3 lectures.
- 141 Tourism and Travel Management** 3  
Application of management principles and techniques to the tourism and resort industry with emphasis on tourism components, recreational activities, and impact of the travel and tourism industry. 3 lectures.
- 150 Design Fundamentals—Lecture** 3  
Study of the elements and principles of design. Prereq: Interior design major; Coreq: ADFH 151. F
- 151 Design Fundamentals—Studio** 3  
Study and application of elements and principles of design; two and three dimensional applications. Prereq: Interior design major; Coreq: ATID 150. F
- 155 Apparel Construction and Fit** 3  
Principles of apparel construction and analysis. Construction of a fitting sloper and two fashion garments. F
- 160 Interior Design Careers** 1  
Survey of the interior design profession, careers, licensure, and professional organizations. Half semester. F
- 161 Interior Graphics I** 3  
Fundamentals of technical and graphic communication for interior design documentation. Emphasis on lettering, sketching, and drafting. Prereq: ADFH 150, 151. S
- 171 Fashion Dynamics** 3  
Introductory course tracing the development of fashion and its industry that includes consumer demand and fashion change, the development, production and marketing of goods from concept to consumer, and their interrelationships.
- 172 Product Development** 3  
Examination of issues and management strategies necessary to produce a completely priced product. Analyze, interpret, and forecast trends for marketing products. Understand the role of technology in design, production, and marketing/sales of products. Prereq: ADFH 171.
- 241 Hospitality Accounting** 3  
Basic hospitality accounting concepts and practices; emphasis on night auditing functions. 3 lectures. Prereq: Acct 200.
- 250 Interior Design I—Lecture** 3  
Introduction of design theory and process to analyze and design residential environments; introduction to material selection. Prereq: ADFH 150, 151, 161; Coreq: ADFH 251, 261, 263. F
- 251 Interior Design I—Studio** 3  
Application of design theory and process to analyze and design residential environments. Emphasis on programming, schematics, design development, and material selection. Prereq: ADFH 150, 151, 161; Coreq: ADFH 250, 261, 263. F
- 252 Interior Design II—Lecture** 3  
Introduction of design theory and process to analyze and design commercial environments. Emphasis on materials and products developed for commercial installations. Prereq: ADFH 250, 251, 261, 263; Coreq: ATID 253, 363. S
- 253 Interior Design II—Studio** 3  
Application of design theory and process to analyze and design commercial environments. Programming, schematics, and design development are emphasized. Prereq: ADFH 250, 251, 161, 263; Coreq: ADFH 252, 363. S
- 261 Interior Graphics II** 3  
Principles and methods of drawing and sketching including perspective. Emphasis on a variety of rendering techniques and media. Prereq: ADFH 150, 151, 161; Coreq: ADFH 250. F
- 263 Interior Technology I** 3  
Fundamentals of building construction, materials, and methods for residential and commercial structures. F
- 271 Visual Merchandising and Promotion** 3  
Principles, theory, and practice in planning and executing merchandise presentation and promotion at the retail level as related to image, sales, profit, and aesthetics. Prereq: ADFH 150. S
- 281 Aesthetic Analysis in Business and Society** 3  
Analysis of aesthetics and its application to textiles and apparel products, environments, and oneself.
- 310 History of Fashion** 3  
Historic view of the relationship between costume/fashion evolution in the western world and sociological/economic change. S
- 315 History of Interiors I** 3  
Survey of historical interiors and furnishings beginning with antiquity through the 1800s. F
- 316 History of Interiors II** 3  
Survey of historical and contemporary interiors and furnishings beginning with the 1800s to the present day. S
- 350 Interior Design III—Lecture** 3  
Lecture sequence exploring interior products and materials, code issues, and client analysis. Prereq: ADFH 252, 253, program admission; Coreq: ADFH 351. F
- 351 Interior Design III—Studio** 3  
Studio sequence of projects requiring identification, analysis, program development, and presentation of a solution to interior design problems. Prereq: ADFH 252, 253, program admission; Coreq: ADFH 350. F
- 352 Interior Design IV—Lecture** 3  
Lecture sequence exploring interior products and materials, code issues, budgetary constraints, client analysis, and design theory. Prereq: ADFH 350, 351; Coreq: ADFH 353. S
- 353 Interior Design IV—Studio** 3  
Sequence of projects requiring identification, analysis, program development, concept and design development, and presentation of a solution to interior design problems. Prereq: ATID 350, 351; Coreq: ADFH 352. S
- 355 Flat Pattern Design and Draping** 3  
Developing original patterns through flat pattern techniques and draping. Individual and commercial applications. Prereq: ADFH 155.
- 356 Pattern Drafting and Grading** 3  
Developing original patterns through flat pattern design and draping. Individual and commercial applications. Prereq: ADFH 155.
- 360 Front Office Management** 3  
Front office procedures, reservations, selling strategies, and handling guest inquiries. Computer application is highlighted. Prereq: ADFH 170, 171.
- 363 Interior Technology II** 3  
Introduction to interior systems and life safety concerns. Prereq: ADFH 263. S

- 365 CADD for Interiors** 3  
Computer-aided design and drafting, emphasizing applications in interior design. Includes drawing creation, editing, layers, blocks, and attributes. Introduction to 3-D. Prereq: Interior design or facility management major, ADFH 161, 252, 253. S
- 366 Textiles** 3  
Fibers, yarns, fabric constructions, finishes, and dyestuffs related to selection, use, and maintenance of textile products. Prereq: ADFH 171 and 172, Coreq: ADFH 367. F
- 367 Textiles Laboratory** 1  
Textile product characterization through the analysis of yarn type, fabric, construction, finishes, and dyestuffs; care procedures; simple identification of fibers, yarns, and fabrics. Prereq: ADFH 171, 172; Coreq: ADFH 366. F
- 368 Quality Assurance and Maintenance of Institutional Environments** 2  
Guidelines for selecting products, supplies, and equipment. Institutional maintenance and management concerns: quality management, laundry procedures, safety regulations, waste and infection control. Prereq: Junior standing. S
- 370 Sewn-Product Manufacturing and Analysis** 3  
Analysis of apparel manufacturing processes, product development, sourcing, production, and technology applications. Focus on developing specifications relative to quality, performance, and cost. Prereq: ADFH 366 and 367.
- 372 Global Retailing** 3  
Theoretical approach to management practices and marketing policies for retail soft goods in a complex and changing world market. Prereq: ADFH 170 or Busn 360. Cross-listed with Busn.
- 380 Facility Operations and Analysis** 3  
Integrative organizational theory applied to financial structures, management procedures, support functions, and operations within a major facility. Prereq: Acct 102. F (even years)
- 381 Hospitality Marketing and Sales** 3  
Basic marketing theory and contemporary practice as adapted to the hospitality industry. Prereq: ADFH 170, 171.
- 382 Women in Management** 3  
Survey of gender issues in management. Analysis of behaviors and attitudes that affect women in the work force.
- 384 Beverage Operations** 3  
Basic principles and methods of operating a profitable bar and beverage operation in the hospitality setting. Includes analysis of equipment, layout, staffing, product inventory, pricing, and profitability.
- 385 Global Fashion Economics** 3  
Study of factors affecting production, distribution, and consumption of products in domestic and foreign textile and apparel industries. Prereq: Econ 201.
- 400 Food, Beverage, and Labor Cost Control** 3  
The use of financial techniques and systems to control food, beverage, and labor costs in hospitality food service operations. Application of principles related to procurement, production, and inventory controls.
- 401 Convention and Meeting Planning** 3  
The roles and responsibilities of professional meeting planners are examined. Planning or hosting a convention or meeting for a corporation, association, or special group. Emphasis on audio/visual equipment, room layout, and special requests.
- 402 Professional Catering Management** 3  
Study and application of advanced principles of foodservice management in the catering profession. 2 lectures and hours arranged. Prereq: ADFH 361.
- 403 Resort and Spa Operations** 3  
Analysis of the resort concept; history, master planning, environmental impact, facility design, and operational management. Emergence of spa operations and treatments as part of resort amenities.
- 404 Restaurant Operations Management** 3  
Creative experiences with regional and international foods appropriate for fine dining. Application of management principles in food preparation and service. Emphasis on ethnic foods, cultural foods, and other implications for fine dining management.
- 405 Casino Operations** 3  
Methods, procedures, and ethical principles utilized in managing a casino operation. Gaming regulations and taxes, mathematics of casino games, casino management and marketing are addressed.
- 410/610 Dress in World Cultures** 3  
Analysis of world dress as related to cultural, technological, aesthetic, and social patterns. Concepts illustrated through comparative studies of selected world cultures. Prereq: Junior standing.
- 450 Interior Design V—Lecture** 3  
Advanced exploration of design theory and process; emphasis on personal and environmental interaction. Prereq: ADFH 352, 353; Coreq: ADFH 451. F
- 451 Interior Design V—Studio** 3  
Advanced application of design theory and process. Prereq: ADFH 352 and 353; Coreq: ADFH 450. F
- 452 Comprehensive Interior Design Project** 6  
Capstone design studio. Student defined problem. Synthesis and implementation of previous course work. Prereq: Departmental approval; Coreq: ADFH 460. S
- 460 Professional Practice** 3  
Overview of professional standards and promotional activities as related to the interior design profession. Prereq: ADFH 450, 451; Coreq: ADFH 452. S
- 465/665 Textile Product Analysis** 3  
Analysis of fiber, yarn, and fabric properties that affect textile product performance. Application of analysis techniques and results to specification development for textile products. Prereq: ADFH 366 and 367.
- 467 Hospitality Law** 3  
Legal considerations of hospitality property management using systemic methodology. Exploration of important legislation. Identification of legal pitfalls before they become legal entanglements.
- 470/670 Retail Financial Management and Control** 4  
Study of retail planning, buying, control, and analysis as it relates to decision making using computer simulation packages. Prereq: ADFH 170, CSci 114 or 116, Math 104 or higher, Busn 360.
- 479 Hospitality Industry Management Strategies** 3  
Capstone course for HMR majors. Includes opportunities to analyze hospitality issues, make business decisions, and solve practical problems through case studies and real situations. Prereq: ADFH 371, 470.
- 480 Facility Design and Management** 3  
Understanding facilities and their components, mastering techniques and procedures for analyzing, planning, designing, constructing, programming, specifying furnishings, and equipping facilities. Prereq: ADFH 161, 252, and 253. F (odd years)
- 481 Apparel and Textiles Capstone Experience** 3  
Critically analyze and propose research-based solutions to problems related to apparel and textiles including production, distribution, and retailing of goods and services. S
- 482 Facility Management Capstone Course** 3  
Facility management capstone experience focusing on integrative and problem-solving skills. Key competencies applied in completing a multi-phasic project focusing on benchmarking, annual, and five year facility plans that culminates in a professional presentation. Prereq: Senior standing.
- 486/686 Dress and Human Behavior** 3  
Influence of dress and appearance on human behavior throughout the life cycle. Prereq: Psyc 111 or Soc 110.
- 696 Aging and the Environment** 3  
Lecture-discussion on the analysis of the built environment and how it impacts the aging population.

## ARCHITECTURE (Arch)

Gleye, Chair; Booker, d'Anjou, Elnahas, Faulkner, Hatlen, Mahalingam, Martens, Palenzuela, Praefcke, Ramsay, Yergens

### COURSES

**132 Architectural Graphics** 2  
Introduction to free-hand and instrument-based drawing techniques used in architecture and landscape architecture. Includes graphic techniques required for rendering shades, shadows, and perspectives. Various media will be used including grayscale and color drawings. Prereq: Arch 171.

**171 Environmental Design I** 3  
Introduction to the environmental design fields of planning, urban design, landscape architecture, architecture, and interior design. Particular attention is given to basic design concepts, visualization, visual analysis, imagination, and creativity. Lecture course. Cross-listed with LA.

**172 Environmental Design II** 3  
Introduction to the vocabulary, history, theory, technology, design process, and tools used in architecture and landscape architecture. Lecture course. Prereq: Arch 171. Cross-listed with LA.

**271, 272 Architectural Design I, II** 4 each  
Studio courses focused on exercises in basic design incorporating abstract two-dimensional design, functional response to environmental determinants, the articulation of form, spatial organization, and aesthetic judgment. Prereq for 271: Arch 132, 172; Prereq for 272: Arch 271.

**321 History of Architecture I** 3  
History of architecture from ancient times through the Renaissance with attention placed on the design connections across cultures and across the globe. Lecture course.

**322 History of Architecture II** 3  
History of architecture from the Baroque to the present placing within a global perspective. Lecture course.

**326 Design Process and Methods** 2  
Study of the methodology, procedure, and theory of architectural design. Lecture course. Prereq: Arch 271 or LA 271.

**341 Architectural Structures I** 3  
Overview of the principles of statics and mechanics of materials and structural concepts relative to building members and frames. Prereq: Arch 272, two Math courses (103 and higher), Phys 120.

**342 Architectural Structures II** 3  
Basic qualitative and quantitative concepts of structural behavior of building frames. Includes methods in the design of elementary frames and member design of steel, concrete, and masonry structural systems and methods of connection. Prereq: Arch 341.

**351 Materials and Construction** 4  
Study of building materials from source through manufacture, focusing on their contribution to design and the study of the assembly processes of construction. Lecture course. Prereq: Arch 272.

**352 Environmental Control Systems I** 4  
Study of architectural design related to thermal comfort, climate, passive and active solar systems, daylighting, acoustics, and other environmental concerns. Prereq: Arch 371, two Math courses (103 and higher), Phys 120.

**371, 372 Architectural Design III, IV** 4 each  
Studio courses providing intermediate level exercises in architectural design; responding to contextual, cultural, environmental, climatic, technological, and aesthetic determinants. Prereq for 371: Arch 272; Prereq for 372: Arch 371.

**451 Environmental Control Systems II** 3  
Study of the fundamentals of illumination and basic power generation, distribution, and service; heating, ventilation, and air-conditioning systems; plumbing systems; and acoustics as they relate to building design. Prereq: Arch 352, 372, Math 105, Phys 120.

**452 Construction Detailing** 3  
Graphic study of wood, steel, masonry, and concrete construction assemblies through architectural detailing with an introduction to specifications and construction documents. Prereq: Arch 471.

**461 Urban Design** 2  
Study of urban form and urban theory, development, and processes in an historic and contemporary context. Prereq: Junior standing or departmental approval; Coreq for majors: Arch 471.

**471, 472 Advanced Architectural Design I, II** 5 each  
Studio courses involving the complex organization of architectural spaces and forms in an urban context. Prereq for 471: Arch 372; Prereq for 472: Arch 471.

**521-528 History/Theory Seminars**  
Prereq for majors: Arch 471; Prereq for non-majors: Departmental approval. These courses are offered on an occasional, rotating basis.

**521 Non-Western Traditions** 2  
Advanced seminar on the investigation of design methods and building traditions of non-western cultures and diverse geographic regions.

**522 Urbanism** 2  
Advanced seminar to explore in-depth aspects of current urban design.

**523 Preservation** 2  
Advanced seminar to explore the philosophy and techniques of architectural preservation.

**524 Technology** 2  
Advanced seminar to explore the historical and theoretical underpinnings of architectural technology.

**525 Post World War II** 2  
Advanced seminar to explore the major architectural movements and personalities in architecture and design since World War II.

**526 Current Theory** 2  
Advanced seminar focused on the work and design theory of leading living architectural practitioners around the world.

**527 Vernacular Traditions** 2  
Advanced seminar to explore the vernacular design traditions in North America and elsewhere.

**528 Socio-Cultural Issues** 2  
Advanced seminar focused on the social issues and movements that have influenced environmental design.

**561 Architecture Programming** 2  
See Landscape Architecture for description.

**571 Advanced Architectural Design III** 6  
Studio course involving complex design problems requiring increased self-direction. Prereq: Arch 472; Coreq: Arch 561.

**572 Advanced Architectural Design IV** 8  
Studio course devoted to the execution of a capstone thesis project from schematic design through design development, presentation, and review. Prereq: Arch 571.

**582 Professional Practice** 2  
Study of contemporary practice covering professional development, firm organization, and project management within the context of the ethical, legal, and regulatory environment. Prereq: Arch 472.

**589 Professional Seminar** 2  
Various topics related to theoretical or methodological aspects of architecture. Prereq: Arch 472, fifth-year standing in the department.

## ART (Art)

Bromley, Kapplinger, Penuel, Swan, Swenson

### COURSES

**Art Appreciation and History**  
**110 Introduction to the Visual Arts (CCN)** 3  
Study and analysis of artistic methods and meaning in the visual arts. (ND:Hum)

**122 Two-Dimensional Design (CCN)** 3  
Basic study of two-dimensional design for the studio artist.

**124 Three-Dimensional Design (CCN)** 3  
Basic study of three-dimensional design for the studio artist.

**130 Drawing I (CCN)** 3  
Study and application of different drawing media, methods, and techniques. Drawing from the human figure required.

**210, 211 Art History I, II (CCN)** 3 each  
Survey of western art from Paleolithic to the Renaissance and from the Renaissance to the present.

**220 Painting I (CCN)** 3  
Introduction to basic painting through a variety of materials. Includes historical examples, painting the human figure, using acrylics, oils, pastel, and mixed-media.

- 230 Drawing II (CCN)** 3  
Advanced study and application of different drawing media, methods, techniques and drawing the human figure. Prereq: Art 130.
- 250 Ceramics I (CCN)** 3  
Introduction to basic ceramic techniques. Includes wheel-throwing and hand-building techniques, surface decoration, glazing, and firing.
- 265 Sculpture I (CCN)** 3  
Introduction to basic sculpture materials and techniques. Includes exploration of sculptural form in maquettes and large scale work; additive and subtractive approaches in wood, stone, and mixed media; casting practice in plaster and hydrostone.
- 270 Printmaking I (CCN)** 3  
Introduction to basic printmaking techniques and materials. Includes monoprint, collagraph, intaglio, relief, and serigraphy in both traditional and non-toxic methods.
- 275 Digital Media** 3  
Introduction to basic visual arts techniques and applications using computers, tablets, and other digital media.
- 280 Photography I (CCN)** 3  
Introduction to basic photography. Includes visual issues of black and white and color photography. Experience with black and white processing and printing.
- 361 Drawing III** 3  
Advanced study, studio practice, and critique. Use of mixed-media approaches. Emphasis on individual concept and content. Life drawing emphasis. May be repeated. Prereq: Art 230.
- 362 Painting II** 3  
Intermediate study, studio practice, and critique. Use of oils, acrylics, water color, and mixed media. Painting the human figure and development of individual concept and content. Prereq: Art 220.
- 363 Printmaking II** 3  
Intermediate study, studio practice, and critique. Extension of process and media. Development of individual concept and content. Prereq: Art 270.
- 364 Photography II** 3  
Intermediate study, studio practice, and critique. Use of traditional and alternative black and white and color processes. Emphasis on image gathering strategies. Development of individual concept and content. Prereq: Art 280.
- 365 Ceramics II** 3  
Intermediate study, studio practice, and critique. Development of individual concept and content. Further exploration of forming skills and surface decoration. Introduction to basic mold techniques, clay and glaze theory, and kiln technology. Prereq: Art 250.
- 366 Sculpture II** 3  
Intermediate study, practice, and critique. Further exploration of materials and processes. Development of individual concept and content. Prereq: Art 265.
- 451 History of American Art** 3  
Study of American art from Pre-Columbian through contemporary (including Native American), emphasizing its highly individual nature and its effect on world art. Prereq: Art 210, 211.
- 452 Contemporary Art** 3  
Study of the development of contemporary art examining its cultural and intellectual basis; includes analysis of current art imagery and readings in art theory and criticism.
- 462 Painting III** 3  
Advanced study, studio practice, and critique. Exploration of mixed-media. Emphasis on individual concept and content. May be repeated. Prereq: Art 362.
- 463 Printmaking III** 3  
Advanced study, studio practice, the human figure, and critique. Exploration of mixed-media. Emphasis on individual concept and content. May be repeated. Prereq: Art 362.
- 464 Photography III** 3  
Advanced study, studio practice, and critique. Professional practice, promotion, and presentation. Emphasis on individual concept and content. May be repeated. Prereq: Art 364.
- 465 Ceramics III** 3  
Advanced study and studio practice with individual and group critique. Focus on current issues in ceramics and innovative use of form, process, and materials. Emphasis on individual concept and content. May be repeated. Prereq: Art 365.
- 466 Sculpture III** 3  
Advanced study, practice, and critique. Use of mixed-media. Specialization in materials and processes. Emphasis on individual concept and content. May be repeated. Prereq: Art 366.
- 489 [499] Baccalaureate Project** 3-6  
Capstone research and creative experience within a specific area of interest with emphasis on refinement of aesthetic applications of techniques and media.
- ATHLETICS (Athl)**
- COURSES**
- 111 Activity I** 1  
Basic techniques and practice of fitness activities.
- 116 Weight Training** 1  
Basic techniques and practice of weight training.
- 118 Fall Semester First-Year Intercollegiate Sports** 1  
First-year participation on an intercollegiate sports team.
- 123 Spring Semester First-Year Intercollegiate Sports** 1  
First-year participation on an intercollegiate sports team.
- 213 Fall Semester Second-Year Intercollegiate Sports** 1  
Second-year participation on an intercollegiate sports team.
- 223 Spring Semester Second-Year Intercollegiate Sports** 1  
Second-year participation on an intercollegiate sports team.
- 313 Fall Semester Third-Year Intercollegiate Sports** 1  
Third-year participation on an intercollegiate sports team.
- 323 Spring Semester Third-Year Intercollegiate Sports** 1  
Third-year participation on an intercollegiate sports team.
- 330 Coaching Football** 2  
Rules, theory, principles, and fundamentals of coaching football. Prereq: Knowledge of the sport.
- 331 Coaching Basketball** 2  
Rules, theory, principles, and fundamentals of coaching basketball. Prereq: Knowledge of the sport.
- 332 Coaching Track and Field** 2  
Rules, theory, principles, and fundamentals of coaching track and field. Prereq: Knowledge of the sport.
- 333 Coaching Wrestling** 2  
Rules, theory, principles, and fundamentals of coaching wrestling. Prereq: Knowledge of the sport.
- 334 Coaching Baseball and Softball** 2  
Rules, theory, principles, and fundamentals of coaching baseball and softball. Prereq: Knowledge of the sport.
- 335 Coaching Volleyball** 2  
Rules, theory, principles, and fundamentals of coaching volleyball. Prereq: Knowledge of the sport.
- 413 Fall Semester Fourth-Year Intercollegiate Sports** 1  
Fourth-year participation on an intercollegiate sports team.
- 423 Spring Semester Fourth-Year Intercollegiate Sports** 1  
Fourth-year participation on an intercollegiate sports team.
- 433 Fall Semester Fifth-Year Intercollegiate Sports** 1  
Fifth-year participation on an intercollegiate sports team.
- 434 Spring Semester Fifth-Year Intercollegiate Sports** 1  
Fifth-year participation on an intercollegiate sports team.

**BIOCHEMISTRY (Bioc)**

Killilea, Chair; Fleeker, Meinhardt, Sparks, Srivastava

**COURSES****Chem 260 Elements****of Biochemistry (CCN)**

4

Protein structure, function conformation, and dynamics; enzymes, DNA-RNA: structure and flow of genetic information; biological membranes; metabolism. 4 lectures. Prereq: Chem 117 or 122, 140; Chem 240 recommended. Also listed under Chem.

**460 Foundations of Biochemistry and Molecular Biology I**

4

Rigorous treatment of biomolecules, generation and use of metabolic energy, biosynthesis, metabolic regulation; storage, transmission, and expression of genetic information. 3 lectures, 1 hour discussion, 1 three-hour laboratory. Prereq: Chem 240 or 342.

**461 Foundations of Biochemistry and Molecular Biology II**

4

Interrelations between metabolic pathways and controls, with emphasis on mammalian systems; biochemistry of specialized tissues, fluids, and hormones. Regulation of gene expression in eukaryotes; genetic defects in metabolism. 4 lectures. Prereq: Bioc 460.

**465/665 Principles of Physical Chemistry and Biophysics**

4

Conceptual approach to physical chemistry and biophysics; molecular structure, energy, equilibria, and kinetics. Application of fundamental concepts and related instrumental techniques to the life sciences. 4 lectures. Prereq: Math 147, Phys 212; Coreq: Bioc 460.

**473/673 Methods of Biochemical Research**

3

Advanced separation, characterization, and enzymological techniques for research in the biological sciences are emphasized. 1 lecture, 2 three-hour laboratories. Prereq: Bioc 461 or 701 or Coreq: Bioc 701.

**474/674 Methods of Recombinant DNA Technology**

3

Principles and techniques of recombinant DNA construction, gene cloning, and analysis of gene structure. 1 lecture, 2 three-hour laboratories. Prereq: Bioc 461 or 702 or Coreq: Bioc 702.

**475/675 Computer Applications in Biochemistry and Molecular Biology**

3

This course will cover basic and advanced biochemical calculations and the use of computer programs to make these calculations. Programs for the presentation of data and seminars will also be presented. Prereq: Bioc 460.

**483/683 Cellular Signal Transduction Processes and Metabolic Regulation**

3

Advanced topics in regulation of metabolic processes including signal transduction, reversible and irreversible covalent modification, hormonal effects, protein turnover, and related phenomena. 2 lectures. Prereq: Bioc 702. F (alternate years)

**485/685 Industrial Biotechnology**

3

Discussion of commercial biochemical processes, including industrial fermentation and fermentor design, immobilized cell and enzyme bioreactors, product recovery methods, relevant metabolic pathways, and other aspects of industrial biotechnology. 3 lectures. Prereq: Bioc 460 or 702, Micro 350. S

**487 Molecular Biology of Gene Expression**

3

This is an advanced undergraduate course designed to analyze current information regarding biochemistry and molecular biology of gene expression and regulation in prokaryotes, eukaryotes and archaea, with primary emphasis on eukaryotic systems.

**701, 702 Comprehensive Biochemistry I, II**

4 each

Comprehensive treatment of the chemistry and biochemistry of proteins, nucleic acids, carbohydrates, lipids, vitamins, hormones, and the specific metabolism of these substances. 4 lectures. Prereq for 701: Chem 342; Prereq for 702: Bioc 701.

**716 Protein and Enzyme Biochemistry**

3

Advanced topics in protein properties and structure, and the influence of these factors on enzyme kinetics and mechanism. 3 lectures. Prereq: Bioc 702. S (alternate years)

**717 Carbohydrate/Lipid Biochemistry**

3

Advanced topics in the structure, reactions, biosynthesis, and properties of carbohydrate and lipid materials of plant and animal origin. 3 lectures. Prereq: Bioc 702. S (alternate years)

**719 Molecular Biology of Gene Expression and Regulation**

3

Advanced topics in molecular biology and regulation in prokaryotes, eukaryotes, and archaea; early events in developmental gene expression. 3 lectures. Prereq: Bioc 702. F (alternate years)

**BIOLOGICAL SCIENCES (Biol)**

Bleier, Chair; Anderson, Barker, Butler, Clambey, Clark, Esslinger, Fawley, Gerst, Grier, Hutchison, Montplaisir, Nuechterlein, Olson, Reed, Sheridan, Stewart, Stockwell, White

**COURSES****Biology (Biol)****124 Environmental Science (CCN)**

3

Ecological principles related to human cultures, resource use, and environmental alterations. (ND:Sci)

**126 Human Biology (CCN)**

3

Consideration of selected problems in human biology. Cross-listed with Zoo. (ND:Sci)

**150, 150L General Biology I, Lab (CCN)**

3,1

Introduction to cellular and molecular biology, genetics, evolution, and ecology. (ND:LabSc)

**151, 151L General Biology II, Lab (CCN)**

3,1

An introduction to the biology of living organisms and their interactions with each

other and their environments. Examples primarily involve plants and animals, but include other groups of organisms as well. (ND:LabSc)

**202, 202L Introductory Microbiology, Lab (CCN)**

2,1

See Veterinary and Microbiological Sciences for description.

**220, 220L Human Anatomy and Physiology I, Lab (CCN)**

3,1

An in-depth introduction to structure and function of human organ systems—cells, tissues, the integumentary system, the skeletal system, joints, muscle and muscular system, nervous tissue and nervous system, and the special senses. ND:LabSc) F

**221, 221L Human Anatomy and Physiology II, Lab (CCN)**

3,1

A continuation of Biol 220, 220L; the endocrine, cardiovascular, lymphatic, immune, respiratory, digestive, urinary, and reproductive systems and development. (ND:LabSc) S

**315, 315L Genetics, Lab (CCN)**

3,1

See Plant Sciences for course description.

**321 Human Karyotyping**

1

See Plant Sciences for course description.

**323 Ecological Issues**

3

Applied view of ecological relationships, natural resources and services, and human impacts and risks. Case studies and analytical approaches included. Prereq: Biol 124 or 150.

**364 General Ecology**

3

Ecological principles associated with organism-environment interactions, populations, communities, and ecosystems. Quantitative approach with examples (animal, plant, microbial) included. Prereq: Biol 150. Cross-listed with Zoo.

**435 Hematology**

2

A survey of the biology and physiology of blood and blood forming organs. Identification of normal and abnormal blood cells in various hematological disorders will be included. Prereq: Biol 202L or Micr 350L.

**440/640 Biotechnology and Ethics**

2

Study of ethical issues associated with the development of emerging technologies and their application in solving biological problems. Prereq: Biol 150 or Junior standing.

**459/659 Evolution**

3

Discussion of the mechanisms of evolution, including population genetics, selection, speciation, adaptation, and molecular evolution. Capstone course for Botany and Biology majors. Prereq: Biol 315, 364, Bioc 260 or 460.

**722 Current Topics in Cell and Molecular Biology**

3

Advanced studies on selected current topics in cellular and molecular biology.

**776 Population Dynamics**

4

Principles and mechanics of animal population dynamics. Prereq: Biol 364 and an interest in working with numbers. F (even years)

- 784 Biological Research Principles** 3  
Discussion, analysis of published research papers, lectures on selected topics, and student project. Prereq: Stat 725 or 330 and 331. F (odd years)
- 785 Photobiology of Plants** 3  
Photosynthesis, pigments, light regulated metabolism, photoreceptors, photoperiodism, photomorphogenic responses. Emphasis on recent molecular studies of photoregulation. Prereq: Bot 380, Bioc 460.
- Botany (Bot)**
- 149 Plants and People** 3  
Study of the numerous ways plants affect human existence. Emphasis on major groups of useful plants and their impact on civilization.
- 314 Systematic Botany** 3  
Principles of plant systematics as illustrated by study of variation within and relationship between selected families and orders of vascular plants. Prereq: Bot 170.
- 315, 315L Genetics, Lab (CCN)** 3,1  
See Plant Sciences for description.
- 370 Structure and Diversity of Plants and Fungi** 4  
See Department for course description.
- 380 Plant Physiology** 4  
Broad coverage of plant growth and metabolism including water relations, mineral nutrition, photobiology, carbon fixation, metabolic processes, stress responses, developmental biology, and growth regulation. Prereq: Bot 170.
- 431/631 Intermediate Genetics** 3  
See Plant Sciences for description.
- 450/650 Range Plants** 3  
See Animal and Range Sciences for description.
- 452/652 Plant Structure** 3  
See Plant Pathology for description.
- 460/660 Plant Ecology** 3  
Ecological structure, processes, and patterns observed with plant communities and populations as influenced by environmental conditions. Illustrations provided with local fieldwork. Prereq: Bot 170. Cross-listed with ARSc.
- 471/671 Phycology** 3  
Identification, systematics, evolution, ecology, life histories, physiology, cytology, and culture of algae. Prereq: Bot 170.
- 472/672 Lichenology** 3  
Biology, ecology, and systematics of lichen fungi. Prereq: Bot 170.
- 480/680 Plant Tissue Culture** 2  
Introduction to the culture of plant cells, tissues, organs, and protoplasts and its applications. Prereq: Bot 170.
- 714 Advanced Systematic Botany** 2  
Discussion of cytotaxonomy, biochemical systematics, experimental biosystematics, and mathematical systematics. Emphasis on using related data in the study of systematic problems. Prereq: Bot 314.
- 716 Agrostology** 3  
See Animal and Range Sciences for description.
- 717 Aquatic Vascular Plants** 2  
See Animal and Range Sciences for description.
- 720 Advanced Cell Biology** 3  
In-depth survey of cell biology, including studies of membranes, secretion cytoskeleton, cellular movement organelles, and gene regulation. Prereq: Bioc 702.
- 750 Advanced Ecology** 3  
This course covers classical ecological literature and current literature focusing on ecological research philosophy and techniques. An overview/introduction of a variety of statistical methods for analyzing ecological data is covered. Prereq: Zool 364, Stat 330.
- 762 Environment and Adaptation** 3  
Environmental factors and responses evidenced with life-history patterns, genetic variation, population dynamics, species-interactions, and physiological processes. Prereq: Bot 460/660.
- 764 Ecological Processes** 3  
Ecosystem dynamics (short-term, successional, evolutionary), component interactions, ecological energetics, and biogeochemical transfers, with consideration of anthropogenic aspects. Historical and theoretical viewpoints included. Prereq: Bot 460/660.
- 780 Plant Metabolism and Plant Stress Physiology** 3  
Study of the characteristic metabolic pathways and enzyme systems of higher plants in relation to subcellular organization. Prereq: Bot 380, Bioc 460.
- 782 Regulation of Plant Growth** 4  
Role of hormones, water, and mineral elements in plant growth. Ion and water absorption and translocation. Hormone dynamics. Emphasis on recent molecular studies of hormonal regulation. Prereq: Bot 380, Bioc 460.
- BUSINESS ADMINISTRATION (Busn)**  
Bahrami, Chair; Brown, Elder, Froelich, Garrison, Jones, Jung, Macintosh, Martin, Ramaya, Rymph, Smith, Stevens, Traub, Walker
- COURSES**  
(All courses 300 level and above require a minimum of Junior standing.)
- 310 International Business** 3  
Study of international business: ways in which it differs from domestic operations; benefits of operating globally; and political, cultural, and economic problems faced by managers of firms engaged in international activities. Prereq: Junior standing.
- 318 Taxation in Management Decisions** 3  
See Accounting for description.
- 340 Principles of Finance** 3  
Various concepts and analytical tools in business finance. Includes financial mathematics, valuation, financial analysis and planning, funding sources, capital budgeting, cost of capital, leverage, dividend policy, and working capital management. Prereq: Acct 200, 201, Econ 201, 202, Stat 330.
- 347 Principles of Real Estate** 3  
See Agricultural Economics for description.
- 350 Foundations of Management** 3  
Study of the major functional areas of management including an international perspective of management. Prereq: Psyc 111.
- 351 Foundations of Organizational Behavior** 3  
A behavioral approach to management with emphasis on the understanding of individual behavior in groups in organizations. Topics include motivation, communication, perception, and cultural diversity. Prereq: Busn 350.
- 352 Operations Management** 3  
Study and application of concepts and managerial techniques for manufacturing and service operations. Includes production technology, facility location/layout, inventory management, MRP, just-in-time manufacturing, and total quality management. Prereq: Busn 350, Stat 330.
- 360 Foundations of Marketing** 3  
Survey of the four basic areas of marketing: product, price, place, and promotion. Exposure to consumer behavior and strategic marketing from an international perspective.
- 361 Marketing Management** 3  
Focus on analysis, planning, implementation, and control of worldwide marketing programs for the purpose of achieving an organization's objectives. Prereq: Busn 360.
- 362 Foundations of Retailing** 3  
Analysis of the global retail environment and exposure to issues such as the development of retailing image, location theory, inventory management, and integrated marketing communication. Prereq: Busn 360.
- 372 Global Retailing** 3  
See Apparel, Design, Facility and Hospitality Management for description.
- 374 Cooperatives** 3  
See Agricultural Economics for description.
- 413 Business Internship** 3  
Supervised professional experience with an appropriate public or private business. Students must meet standards established by the employer and the College of Business Administration.
- 415 Small Business Institute** 3  
Practical application of classroom learning in a supervised consulting project with a local business. Teams analyze actual business problems, and develop recommendations for the client. Prereq: Consent of instructor.

- 430/630 Legal and Social Environment of Business** 3  
Study of legal and regulatory environment in which business firms operate, as well as the social environment. Includes business ethics and social responsibility issues.
- 431, 432 Business Law I, II** 3 each  
Study of the principles of law encountered in business including the law of contracts, torts, property and bailments, sales, commercial paper, creditor's rights, and business organizations. Prereq for 432: Busn 431.
- 435/635 International Business Law** 3  
Study of public and private international law as it relates to international business: international contracts and sales; international business organizations; and international trade, tariffs, and agreements. Prereq: Busn 430.
- 441/641 Investment Analysis and Management** 3  
Evaluation of various securities for investment (stocks, bonds), investment analysis (fundamental and technical), concepts of efficient markets, and market risk. Portfolio management and international investment aspects are briefly covered. Prereq: Busn 340 or 540.
- 442/642 Speculative Markets** 3  
Evaluation of options, futures, and other derivative securities used for hedging, speculation, and arbitrage. Related market structure, trading strategies, and risks are examined. Prereq: Busn 441/641 or 444/644.
- 443/643 Management of Financial Institutions** 3  
Development, role, and functions of depository financial institutions. Emphasis on domestic and international regulation, structure, management, and operations of commercial banks. Prereq: Busn 340 or 540.
- 444/644 Money and Capital Markets** 3  
Examination of saving-investment decisions, flow of funds, interest rate theories, risk structure, and function of financial markets. Security pricing and portfolio strategies in money, bond, tax exempt, and foreign exchange markets. Prereq: Busn 340 or 540.
- 445/645 International Finance** 3  
Concerns international financial markets, exchange rates, currency futures, and options. Includes financial aspects of international corporations such as management of corporate assets and liabilities, capital structure, cost of capital, capital budgeting, and international risks. Prereq: Busn 340.
- 450/650 Human Resource Management** 3  
Survey of human resource management, including job analysis, recruitment, selection, performance appraisal, compensation, training, and labor relations. The impact of environmental influences such as legislation, court decisions, and unions on human resource activities are addressed. Prereq: Busn 350.
- 451 Managerial Economics** 4  
Use of decision science techniques such as statistical and numerical analysis and optimization to study profit, demand and supply, cost and production, market structure, pricing practices, and the impact of government regulations on management decisions. Prereq: Busn 350, Econ 201, 202, Math 146.
- 452 Compensation Management** 3  
Study of the human resource management function of compensation. Topics include the analysis and evaluation of jobs, wage determination, pay-for-performance, and employee benefits. The impact of compensation on recruitment, employee satisfaction, and performance is examined. Prereq: Busn 450.
- 453 Cultural Pluralism and the Management of Organizations** 3  
Use of case analysis and experiential learning to consider implications of cultural pluralism at three management levels: personal values, beliefs, and actions; group dynamics; institutional policies, practices, and norms. Prereq: Busn 350.
- 454/654 International Management** 3  
Focused on management challenges associated with business activity across national boundaries. Development of management skills for global contexts. Prereq: Busn 350.
- 455/655 Labor Relations and Alternative Dispute Resolution** 3  
Examines the impact of the law on labor-management from a historical and current perspective. Focuses on the preparation and issues involved in the negotiation process, and the various forms of mediation and arbitration. Prereq: Busn 350.
- 460/660 Consumer Behavior** 3  
Examination of dimensions of consumer buying theories. Aimed at understanding the buying behavior of customers. Prereq: Busn 360.
- 461/661 Advertising and Integrated Marketing Communication** 3  
Examination of the use of advertising as part of the worldwide marketing function; prepares the student to analyze and plan integrated marketing communication campaigns. Prereq: Busn 360.
- 462/662 Sales and Sales Force Management** 3  
Examination of different aspects of effective personal selling with focus on decision areas pertaining to sales force management. Prereq: Busn 360.
- 463/663 Marketing Research** 3  
Study of research methods with focus on research design, data collection, and analysis techniques. Prereq: Busn 360.
- 464/664 International Marketing** 3  
Focused on identifying and satisfying global customer needs better than the competition, both domestic and international, and coordinating marketing activities within the context of the global environment. Prereq: Busn 360.
- 465/665 Internet Marketing** 3  
Examines the progress and potential of the Internet for the marketing of goods and services. Scans the e-commerce environment. Includes marketing strategy and research ideas. Prereq: Busn 360.
- 481 Supply Chain Management** 3  
Identification of the key elements in a firm's management of their supply chain. Theory and practical applications for analyzing and developing strategies to assist firms in obtaining and maintaining a competitive advantage.
- 483/683 Organizational Communication** 3  
See Communication for description.
- 486 Senior Thesis** 3  
Directed development of a paper showing the application, synthesis, and integration of business concepts. Prereq: Instructor approval.
- 489 Strategic Management** 4  
Integration and application of management, marketing, and finance principles in written and oral case analysis of organizations. Consideration of global, ethical, and current social issues. Capstone for accounting, business administration, and management information systems majors. Prereq: Busn 340, 350, 360, 430. Senior standing.
- 520 Financial and Managerial Accounting** 3  
Intensive single semester treatment of accounting emphasizing concepts. Includes a study of accounting information for analytical, product costing, and decision-making purposes.
- 540 Corporate Finance** 3  
Survey of financial management covering financial mathematics, financial planning and analysis, sources of capital, capital budgeting, and working capital management. Emphasis on firm value maximization concepts. Prereq: Busn 520, Stat 331.
- 551 Production/Operations Management** 3  
Overview of the operations management field. Includes operations strategy, production technology, operation planning, facility location/layout, inventory management, MRP, just-in-time manufacturing, productivity management, and total quality management. Prereq: Busn 350, Stat 331.
- 571 Management Information Systems** 3  
Fundamental concepts in management information systems. Discussion of information needs of managers at a conceptual level followed by hands-on experience in solving business problems. Prereq: CSci 116.
- 740 Advanced Financial Management** 3  
In-depth coverage of concepts and decision-making tools in financial analysis, cost of capital, capital structure, capital budgeting, and dividend policy. Emphasis on risk analysis, international perspectives, and current topics in corporate finance. Prereq: Busn 340 or 540.

**750 Advanced Organizational Behavior 3**

Study of theory and current management research dealing with individual and small-group behavior in organizations. Topics include motivation, reward, job satisfaction, stress, communication, and conflict resolution. Prereq: Busn 350.

**751 Advanced Operations Management 3**

Advanced study of concepts and technologies used by service and manufacturing firms with emphasis on process analysis and improvements. Includes demonstration and application of techniques such as simulation, linear/integer programming, and project scheduling. Prereq: Stat 330.

**752 Industrial Relations and Negotiation 3**

Study of the impact of the law on labor-management relations, negotiation theory, strategy, and tactics including application to dispute resolution. Prereq: Busn 350.

**760 Strategic Marketing Management 3**

Focus on the major decision areas that marketing executives face in their efforts to match the objectives and resources of the organization with the needs and opportunities in the marketplace. Prereq: Busn 360.

**780 Business Conditions Analysis 3**

Preparation of students to analyze domestic and global economic factors that impact the U.S. and world economy. Prereq: Busn 540, 720, 760.

**789 Business Policy and Strategy 3**

Process and tools of strategy formulation and implementation in a variety of organizational environments. Prereq: Busn 720, 740, 750, 751, 760.

**CEREAL AND FOOD SCIENCES (CFS)**

Khan, Interim Chair; Bhattacharya, Chang, Hall, Manthey, J. Schwarz, P. Schwarz, Wiesenborn; Adjunct Faculty: Doehler, Grant, Hareland

**COURSES****210 Introduction to Food Science and Technology 2**

Overview of food components, food quality, nutrition, processing, packaging, safety, sanitation laws, sensory evaluation, distribution, and utilization. Cross-listed with F&N.

**430/630 Food Unit Operations 2**

Thermodynamics, materials and energy balance, fluid flow, heat transfer, heat exchange, all related to food processing. Prereq: Math 147, Phys 211, 211L. Coreq: CFS 631.

**431/631 Food Unit Operations Laboratory 1**

Experiments relevant to 430/630, with emphasis on application of mass and energy balances and heat transfer to food processing operations. Coreq: CFS 630.

**450/650 Cereal Technology 3**

Discussion of cereal grains, their properties, evaluation, and utilization.

**452/652 Food Laws and Regulations 3**

See SAFE 452/652 for course description.

**453/653 Food and Dairy Microbiology 3**

See Microbiology for description.

**460/660 Food Chemistry 3**

Study of food components including water, carbohydrates, lipids, proteins, vitamins, minerals, and enzymes. Prereq: CFS 210, Chem 341, 341L, Bioc 460.

**461/661 Food Chemistry Laboratory 1**

Laboratory isolation, observation of characteristics, and quantitation of food components. Coreq: CFS 460/660.

**464/664 Food Analysis 3**

Principles, applications, and practice of methods for quantitative determination of food components. Two lectures and one three-hour lab. Prereq: Bioc 460 and CFS 460/660.

**470/670 Food Processing 3**

Capstone course integrating principles of food chemistry, food microbiology, food engineering, nutrition, statistics, and sensory evaluation through the discussion of food processing operations. Prereq: CFS 450, 460, or departmental approval.

**471/671 Food Processing Laboratory 1**

Field trips, experiments on freezing, freeze drying, spray drying, canning, beverage production, water activity measurements, shelf life, and quality control. Coreq: CFS 470/670.

**725 Food Policy 3**

See SAFE 725 for course description.

**752 Advanced Food Microbiology 3**

See SAFE 752 for course description.

**758 Fundamentals of Flour Testing and Baking 3**

Flour testing, industrial, and experimental bread baking. Production methods, ingredients, and baking reactions. Lectures and laboratories. Prereq: CFS 450/650.

**759 Milling 3**

Experimental and industrial feed and flour milling. Production, equipment, and factors involved in the milling process. Lectures and laboratories. Prereq: CFS 450/650.

**760 Pasta Processing 3**

Durum wheat quality, pasta production, and pasta quality evaluation. Lectures and laboratories. Prereq: CFS 450/650.

**761 Malting and Brewing 3**

Barley and malt quality; malting and brewing. Lectures and laboratories. Prereq: CFS 450/650.

**764 Cereal Carbohydrates 2**

Carbohydrates (monosaccharides, oligosaccharides, and polysaccharides) of cereals with emphasis on barley, wheat, and flour and their importance in industrial products. Prereq: Bioc 701.

**765 Advanced Cereal and Food Chemistry I 4**

Lipids with emphasis on cereals; chemical and physical properties in foods. Prereq: Bioc 701.

**766 Advanced Cereal and Food Chemistry II 4**

Physicochemical, structural, and functional properties of cereal and food proteins and the biochemical characteristics of enzymes in food systems. Prereq: Bioc 701.

**CHEMISTRY (Chem)**

Hershberger, Chair; Campiglia, Cook, Eaton, Garvey, Hamilton, Jacobson, Mallik, McCarthy, Page, Rasmussen, Rodgers, Sibi, Sun, Tallman

**COURSES****117, 117L Chemical Concepts and Applications, Lab (CCN) 3,1**

Introduction to general and organic chemistry, with applications drawn from the health, environmental, and materials sciences. Prereq: Math 103 or equivalent. (ND:LabSc)

**121, 121L General Chemistry I, Lab (CCN) 3,1**

Matter, measurement, atoms, ions, molecules, reactions, chemical calculations, thermochemistry, bonding, molecular geometry, periodicity, and gases. Prereq or coreq: Math 103. (ND:LabSc)

**122, 122L General Chemistry II, Lab (CCN) 3,1**

Intermolecular forces, liquids, solids, kinetics, equilibria, acids and bases, solution chemistry, precipitation, thermodynamics, and electrochemistry. Prereq: Chem 121, 121L. (ND:LabSc)

**140 Organic Chemical Concepts and Applications (CCN) 1**

Introduction to organic chemistry for pre-nursing and other students who need to meet the prerequisite for Chem 260.

**150, 160 Principles of Chemistry I, Lab 3,1**

Chemistry for students with good high school preparation in mathematics and science. Electronic structure, stoichiometry, molecular geometry, ionic and covalent bonding, energetics of chemical reactions, gases, transition metal chemistry.

**151, 161 Principles of Chemistry II, Lab 3,1**

Liquids and solids, equilibrium, kinetics, thermodynamics, acids and bases, oxidation-reduction chemistry, electrochemistry. Prereq: Chem 150, 160.

**240 Survey of Organic Chemistry (CCN)3**

Structure and bonding, nomenclature; hydrocarbons: alkanes, alkenes, alkynes, aromatics; substituted hydrocarbons: alkyl halides, stereochemistry, alcohols, phenols, ethers, amines; carbonyls: aldehydes, ketones; carboxylic acids, esters, amides. Prereq: Chem 121.

- 260 Elements of Biochemistry (CCN)** 4  
See Biochemistry for description.
- 341, 341L Organic Chemistry I, Lab (CCN)** 3,1  
First semester of a two-semester course in organic chemistry for students in sciences and pre-professional curricula. Prereq: Chem 122, 122L.
- 342, 342L Organic Chemistry II, Lab (CCN)** 3,1  
Structure and reactivity, named reactions, carbon-carbon bond forming reactions, aromatic and heterocyclic chemistry, biomolecules and polymers, and multistep synthesis. Prereq: Chem 240 or 341, 341L.
- 353 Majors' Organic Chemistry Laboratory I** 1  
Organic functional group synthesis. Modern analytical tools for functional group analysis and structure determination. Coreq: Chem 341.
- 354 Majors' Organic Chemistry Laboratory II** 2  
More advanced aspects of organic laboratory operations, synthesis, analysis, and structure determination using spectroscopic techniques. Coreq: Chem 342.
- 364, 365 Physical Chemistry I, II** 4 each  
Mathematical and physical basis of chemical phenomena. Quantum chemistry and chemical kinetics. Thermodynamics and statistical mechanics. Prereq for 364: Chem 151, Math 266, Phys 252; Prereq for 365: Chem 364.
- 380 Chemistry Junior Seminar** 1  
Includes discussion of chemistry topics, technical writing instruction and assignments; participation in senior seminar discussions.
- 425/625 Inorganic Chemistry I** 3  
Electronic structure, ionic and covalent structure and bonding, point groups and symmetry, coordination chemistry, acid-base and redox chemistry. Prereq: Chem 364.
- 426/626 Crystallography/Crystal Chemistry** 2  
Geometric and space group crystallography. Structure and bonding in common minerals and industrially important solids. Structure-property relationships. Half semester. Cross-listed with Geol.
- 427/627 X-Ray Diffraction** 2  
Analytical X-ray powder diffraction for qualitative and quantitative analysis of crystalline solids. Crystal structure analysis using powder methods. Introduction to X-ray fluorescence spectrometry. Half semester. Cross-listed with Geol.
- 428/628 Geochemistry** 3  
See Geology for description.
- 429 Inorganic Chemistry Laboratory** 2  
Methods of synthesis and characterization of inorganic and organometallic compounds. Capstone laboratory experience for ACS certified chemistry majors. Coreq: Chem 425.
- 431, 431L Analytical Chemistry I, Lab** 3,2  
Chemical equilibrium and its analytical applications; introduction to chromatography and potentiometry. Prereq: Chem 122, 122L or 151, 161.
- 432/632, 432L/632L Analytical Chemistry II, Lab** 3,1  
Theory and application of modern instrumental techniques, including spectroscopy and electrochemistry. Prereq: Chem 431, 431L.
- 471 Physical Chemistry Laboratory** 2  
Measurement of thermodynamic and spectroscopic properties of chemical substances, analysis of data. Prereq: Chem 364.
- 486/686 Corrosion and Its Control by Coatings** 2  
See Polymers and Coatings for description.
- 724 Chemical Applications of Group Theory** 1  
See Department for course description.
- 725 Inorganic Chemistry II** 3  
Molecular orbital and valence bond theories, inorganic reactions and mechanisms. Prereq: Chem 425.
- 726 Inorganic Photochemistry** 2  
Principles underlying the photochemical reactivity of coordination and organometallic compounds; photochemical and photophysical experimental techniques. Half semester. Prereq: Chem 725.
- 727 Organometallic Chemistry** 2  
Synthesis, reactivity, and bonding in organometallic compounds. Half semester. Prereq: Chem 725.
- 728 Physical Methods in Inorganic Chemistry** 2  
Physical methodology especially appropriate to the characterization of inorganic and organometallic compounds. Includes electronic, vibrational absorption, electronic spin resonance, Mössbauer spectroscopy and nuclear magnetic resonance methods. Prereq: Chem 725.
- 729 X-Ray Structure Determination** 2  
Use of single crystal X-ray diffraction data to determine molecular and crystal structures. Half semester. Prereq: Chem 626 or 627.
- 730 Separations** 2  
Theory of equilibrium chemistry in aqueous and nonaqueous systems; principles of chromatographic and other separation techniques. Prereq: Chem 432/632.
- 732 Electrochemistry** 4  
Theory and application of modern electrochemical methods, including potentiometry, voltammetry, electrochemical impedance spectroscopy, kinetics and mechanisms of electrode processes, corrosion, simulation techniques, and instrumentation. Prereq: Chem 432/632.
- 734 Instrumentation Electronics** 5  
Design and operation of digital and analog circuits used in chemical instrumentation, computer interfacing. Includes laboratory. Prereq: Chem 432/632.
- 736 Mass Spectrometry** 2  
Theory and application of mass spectrometry in analysis, tandem mass spectrometry, ionization techniques. Half semester. Prereq: Chem 432/632.
- 737 Gas Phase Ion Chemistry** 2  
Principles and applications of gas phase ion techniques to the study of the chemical and physical properties of reactive intermediates. Half semester. Prereq: Chem 736.
- 741 Physical Organic Chemistry I** 4  
Principles governing the reactivity of organic compounds and methods for determining reaction mechanisms.
- 742 Physical Organic Chemistry II** 2  
Aromaticity, electrophilic substitution, Woodward-Hoffman rules. Half semester. Prereq: Chem 741.
- 743 Reactive Intermediates** 2  
Radicals, carbenes, nitrenes, arynes, carbenium ions, survey of other reactive intermediates. Half semester. Prereq: Chem 741.
- 744 Organic Spectroscopy** 2  
Structure elucidation by spectrometric methods, including infrared, mass spectrometry, UV, and nuclear magnetic resonance. Interpretation of 2-D NMR spectra. Half semester.
- 745 Organic Synthesis** 2  
Functional group synthesis, synthetic design, stereochemical control. Half semester. Prereq: Chem 741.
- 746 Advanced NMR Spectrometry** 2  
Theory of pulsed FT-NMR, instrumentation, pulse sequences (with emphasis on multipulse experiments), two-dimensional NMR and applications. Half semester. Prereq: Chem 744.
- 754 Organic Spectroscopy Laboratory I** 1  
Laboratory to accompany Chemistry 744, with emphasis on NMR techniques. Half semester. Coreq: Chem 744.
- 759 Intermediate Physical Chemistry** 3  
Fundamental principles of physical chemistry including quantum chemistry, spectroscopy, molecular thermodynamics, and kinetics.
- 760 Statistical Thermodynamics** 4  
Macroscopic and microscopic models for the study of equilibrium properties of pure phases and solutions. Prereq: Chem 365.
- 761 Optical Spectroscopy** 2  
Theory and practice of modern spectroscopic methods. Emphasis on visible and ultraviolet wavelength ranges. Half semester. Prereq: Chem 632.
- 763 Kinetics** 2  
Experimental methods to determine reaction rates, empirical rate laws, transition state theory. Half semester. Prereq: Chem 365.

**764 Dynamics** 2  
Chemical physics of energy transfer and reactive collisions. Half semester. Prereq: Chem 763.

**766 Quantum Chemistry I** 4  
Wave functions and their properties, quantum mechanical behavior of atoms and molecules. Prereq: Chem 365.

**767 Quantum Chemistry II** 2  
Ab initio and semi-empirical methods for the calculation of energetic and structural properties of molecules; computational methods. Half semester. Prereq: Chem 766.

## CHILD DEVELOPMENT AND FAMILY SCIENCE (CDFS)

Deal, Chair; Bailey, Brotherson, Carlson, Duggan, Fitzgerald, Habedank, Hektner, Kaler, Light, McCann, Randall, Sanders

### COURSES

**135 Family Science** 3  
Introduction to family science concepts including family life cycle, different styles of family life, and the influence of society on the family.

**186 Consumer and Society** 3  
Consumer rights, responsibilities, and consequences of consumer decision making. Overview of advertising, fraud, and other issues.

**230 Life Span Development** 3  
Study of human growth and development throughout the life span.

**242 Marriage and the Family** 3  
Study of factors related to mate selection, marital dynamics, and family relationships.

**247 Creative Family Management** 3  
Management decision making, goal setting, and resource allocation within families. Factors affecting decision conflict.

**320 Prenatal, Infant and Toddler Development** 3  
A functional approach to the study of growth and development of the infant during the first two years of life. Prereq: CDFS 230 recommended.

**330 Child Development** 3  
Study of children, birth through middle childhood. Emphasis on social, cognitive, physical, and emotional development. Prereq: CDFS 230 recommended.

**341 Parent-Child Relations** 3  
Contemporary parenting principles and strategies. Emphasis on application in the home and professional settings. Prereq: CDFS 230.

**353 Children, Families, and Public Policy** 3  
Interaction of the national economy and the family economy with regard to the public programs affecting well-being of families. Emphasis on philosophies of service delivery and policy alternatives. Prereq: CDFS 135.

**357 Personal and Family Finance** 3  
Factors influencing decisions on acquiring and using financial resources and budgeting to achieve goals. Overview of credit, taxation, savings, insurance, and investments. Prereq: CDFS 186 recommended.

**371 Guidance and Curriculum in Preschool Programs** 4  
Examination of philosophies, curriculum models, and guidance techniques in the field of childhood care and education, including sensitivity to cultural diversity. Prereq: CDFS 230, 330.

**372 Programs for Children and Families** 3  
Study of service agencies and delivery ethics, legislation, and laws associated with child and family services. Prereq: CDFS 135, 230.

**381 Creative Activities for Children** 3  
Study of developmentally appropriate activities for infants, toddlers, and preschoolers. Prereq: CDFS 230, 330; Coreq: CDFS 382.

**382 Implementing Creative Activities for Children** 2  
Supervised implementation and evaluation of developmentally appropriate activities for infants, toddler, and preschoolers. Prereq: CDFS 230, 330; Coreq: CDFS 381.

**424/624 Observation and Assessment of Children** 3  
Overview of observation/assessment of children for research and practice application.

**425/625 Children and Stress** 3  
Survey of theory and research relating to children's reactions to stress and coping, infancy through adolescence. Examination of strategies for working with children, including topics on children's reactions to divorce, sibling death, and hospitalized children. Prereq: CDFS 230, 6 credits of social science.

**448/648 Issues in Sexuality** 3  
Study of personal, interpersonal, and societal meanings of human sexuality. Decision making relevant to sexual behavior. Prereq: Psyc 210 recommended.

**450/650 Adolescent Development** 3  
Study of physical, social, cognitive, and emotional development of adolescents. Includes examination of contemporary issues related to this age group. Prereq: CDFS 230, 6 credits of social science.

**460/660 Adult Development and Aging** 3  
Study of development during adulthood and later life. Emphasis on perceptual-motor and cognitive functioning, personality, adjustment, social, familial, and cultural aspects of adulthood. Prereq: CDFS 230, 6 credits of social science.

**462/662 Family Crisis** 3  
Effects of crisis-producing situations on adjustment within the family. Intervention strategies. Prereq: CDFS 135, 6 credits of social science.

**468/668 Women in Economic Systems** 3  
Study of economic behavior and circumstances of women in various economic systems worldwide. Policies of economic institutions and their impact on women. Prereq: 6 credits of social science.

**471 Program Administration and Professional Relations** 3  
Overview of policies, strategies, and skills involved in administration of early childhood programs. Includes parent-professional relations. Prereq: CDFS 230, 330, 371, 381; CDFS 341 recommended.

**475/675 Children and Families Across Cultures** 3  
Study of developmental and family issues as viewed from a cross-cultural diversity perspective. Prereq: 6 credits of social science.

**477/677 Financial Counseling** 3  
Advanced analysis of family financial issues. Evaluation of alternative financial programs. Prereq: CDFS 357.

**478/678 Financial and Consumer Issues of Aging** 3  
Integration of economic and consumer problems of the elderly including income trends in retirement and health care. Prereq: 6 credits of social science.

**480/680 Learning and Cognition in Children** 3  
Study of developmental research and theoretical approaches to learning and cognitive development in children from birth through adolescence. Prereq: CDFS 230, 330.

**481/681 Women and Aging** 3  
Study of theory, research, and application of issues related to women and the aging experience.

**482/682 Family Dynamics of Aging** 3  
Examination of issues related to family life in the later years from the perspectives of the elderly and the family. Prereq: 6 credits of social science.

**483/683 Family Wellness** 3  
Principles and theories of family wellness/enrichment. Includes study of preventive and enrichment programs for couples and families. Prereq: CDFS 135, 6 credits of social science.

**485 Capstone Experience in CDFS** 3  
Integration and application of concepts. Emphasis on theory and research in CDFS, processing and presenting information, and community service. For CDFS majors who will graduate within one year. Prereq: CDFS major, Senior standing.

**486/686 Children in Social Contexts** 3  
Critical examination of research and theory on social relationships established in childhood and adolescence. Special attention given to the development of peer relationships and school contacts and contexts specific to certain children. Prereq: CDFS 330.

- 487 Practicum in Child Development Programs** 1-8  
Supervised on- or off-campus experience in early childhood settings. Application of theoretical and practical knowledge as a professional. Prereq: Grades of C or better in CDFS 330, 341, 371, 381; First aid and infant/toddler CPR certification.
- 488/688 Exceptional Child and Family** 3  
Study of children and their families who vary from the norm in development and functioning. Prereq: CDFS 230, 6 credits of social science.
- 703 Research Methods in Child Development and Family Science** 3  
Introduction to research methods in child development and marital and family relationships. Includes instrument selection/construction, data collection, interpretation of results, and proposal writing. Emphasis on the unique methodological features associated with the field.
- 722 Applied Research in Gerontology** 3  
Study of research in applied social gerontology. The course will explore quantitative and qualitative approaches to studying older persons and related systems.
- 760 Aging Policy** 3  
Formation, implementation and impact of policies that affect the well-being of the elderly in the United States.
- 761 Applications in Gerontology** 3  
Study of the applications of gerontology research and theory. The course will provide an overview of programs, methods and evaluations of services for older adults.
- 762 Retirement Planning, Employee Benefits and the Family** 3  
Critical examination of micro and macro considerations in retirement planning for individuals and families.
- 763 Personal Income Taxation** 3  
Study of principles and concepts of personal income tax planning as they relate to families.
- 764 Family Economics** 3  
Overview of basic concepts and theories in family economics with emphasis on the economics situation of families in the United States.
- 765 Insurance Planning for Families** 3  
An in-depth study of risk management concepts, tools, and strategies for individuals and families.
- 766 Estate Planning for Families** 3  
Study of principles and concepts of estate planning as they relate to families.
- 767 Professional Practices in Family Financial Planning** 3  
Study of strategies and methods for managing private family financial planning practices including ethics, compensation, client-centered marketing and practice management.
- 768 Housing/Real Estate** 3  
Overview of the role of housing and real estate in the family financial planning process including taxation, law, mortgages, ethics and financial calculations.
- 769 Financial Planning Case Studies** 3  
Examines professional issues in family financial planning including ethics, regulation on certification, communication, and professional responsibility. Emphasis on personal finance case studies and investment policy.
- 770 Fundamentals of Financial Planning** 3  
Survey of personal/family financial planning including process, time value of money, cash management, credit, taxation, insurance, housing, investments, retirement, and estate planning.
- 771 Investing for the Family's Future** 3  
Study of the concepts of time and risk value of money in evaluating investment markets.
- 773 Foundations of Marital and Family Therapy I** 3  
Introduction to theoretical foundations of marital and family therapy and the historical and contemporary development of the field.
- 774 Foundations of Marital and Family Therapy II** 3  
Study of critical epistemological issues in the field of marriage and family as they relate to contemporary models in the practice of therapy.
- 775 Clinical Applications in Marital and Family Therapy I** 3  
In-depth study of current approaches to family therapy. Emphasis on contextual, structural, and strategic approaches.
- 776 Clinical Applications in Marital and Family Therapy II** 3  
In-depth study of current approaches to family therapy. Emphasis on constructivist approaches. Application in the clinical practice of marital and family therapy.
- 777 Diagnosis and Assessment in Marital and Family Therapy** 3  
Training in methods of diagnosis and assessment in mental health issues using DSM-IV criteria as applied to the discipline of marital and family therapy.
- 780 Ethics and Professional Issues in Marital and Family Therapy** 3  
Study of legal responsibilities, ethical issues, and professional matters as they pertain to the practice of marital and family therapy.
- 781 Family Systems** 3  
Advanced study of contemporary family systems with emphasis on research, ethics, media, and current family issues. Prereq: Graduate standing.
- 782 Advanced Human Development: Birth Through Childhood** 3  
In-depth examination of research and theory in lifespan development. Topics include physical, cognitive, social, sexual, and emotional development across the lifespan. Discussion of implications for development and implementation of services for children and families. Prereq: CDFS 784 or departmental approval.
- 783 Dynamics of Parent-Child Relations** 3  
Study of selected theories and research in parent-child relations. Emphasis on interaction between adults and children from infancy to youth. Prereq: CDFS 784 or 785 or departmental approval.
- 784 Advanced Human Development: Adolescence Through Adulthood** 3  
Examination and comparison of both historical and cutting-edge theories of child development. Exploration of links between theory and researching and working with children.
- 785 Family Theory** 3  
Identification and analysis of theoretical approaches to research on the family. Study of frameworks currently used.
- CIVIL ENGINEERING (CE)**  
Padmanabhan, Chair; Andersen, D. Katti, K. Katti, Kellogg, Khan, Lin, Varma, Yazdani
- COURSES**
- 111 Introduction to Civil Engineering** 1  
Introduction to engineering, duty and role of the professional engineer, phases of engineering activity, computer applications with word processing, and spreadsheets. 1 one-hour lecture, 1 one-hour laboratory. F, S
- 113 Elements of Surveying** 2  
Surveying for non-CE students. Importance of measurements and errors and use of surveying instruments for obtaining field data and valid measurements. 1 one-hour lecture, 1 three-hour laboratory. Prereq: Math 105. F, S
- 204 Surveying** 4  
Measurements and errors; topographical and construction surveys; vertical and horizontal control methods; field exercises and computation techniques for surveying data; computation of earthwork volumes. 2 one-hour lectures, 2 three-hour laboratories. Prereq: Math 105. F, S
- 303 Civil Engineering Materials** 3  
Physical and chemical properties of different types of bituminous materials and Portland cement concrete; industry standards and tests for evaluating raw materials and mix designs. 2 one-hour lectures, 1 three-hour laboratory. Prereq: CE 316 or CM&E 320. F, S
- 309 Fluid Mechanics** 3  
Statics, kinematics, and dynamics of fluid flow; momentum and energy concepts; flow through pipes; uniform flow in open channels; pumps and measurement of flow. 3 one-hour lectures. Prereq: ME 222. F, S
- 310 Fluid Mechanics Laboratory** 1  
Visualization and verification of the concepts of fluid flow, pumps, turbines, and flow meters. 1 two-hour laboratory. Prereq: CE 309. F, S

- 316 Soil Mechanics** 3  
Principles of soil mechanics including three-phase composition, classification, effective stress, consolidation, shear strength, compaction, and site investigation. 2 lectures, 1 two-hour laboratory. Prereq: ME 223. F, S
- 320 Elements of Structures I** 3  
Analysis of statically determinate structures, including beams and frames. Study of the design of steel elements and structural systems. 2 lectures, 1 three-hour session. Prereq: ME 223 or 228. F, S
- 332 Introduction to Structural Engineering** 3  
Structural systems, building materials, structural loading, review of free-body diagrams, shear and bending moment diagrams, moving loads, pattern loading, building codes, and deflection in beams, frames, and trusses. 2 one-hour meetings, 1 three-hour calculation period. Prereq: ME 223. F, S
- 343 Structural Analysis** 3  
Analysis of structures by classical and matrix methods; elastic deflections of trusses, beams, and frames; indeterminate analysis by compatibility and equilibrium methods; generalized matrix formulations. 3 one-hour lectures. Prereq: CE 332. F, S
- 370 Introduction to Environmental Engineering** 3  
Introduction to various municipal and industrial pollutants being introduced into water, air, and land systems and their effects on the environment. Application of chemical, physical, and biological principles to the management of these pollutants. 3 one-hour lectures. F, S
- 371 Environmental Engineering Laboratory** 1  
Water, wastewater, and solid waste analyses regarding their theory, objectives, and practices. Exposure to practical applications of the scientific and design theories presented in CE 370. 1 three-hour laboratory. F, S
- 404 Reinforced Concrete** 3  
Principles of design and analysis of reinforced concrete members, flexural and shear design of rectangular and tee beams, serviceability criteria, short and slender columns. 2 one-hour lectures, 1 two-hour session. Prereq: CE 343. F, S
- 405/605 Advanced Reinforced Concrete** 2  
Development and anchorage of reinforcement, details of reinforcement in flexural members, continuous beams and one-way slabs, slender columns, two-way slabs. 1 one-hour lecture, 1 two-hour session. Prereq: CE 404. F, S
- 408 Water Resources and Supply** 3  
Hydrologic concepts, development of water supply sources, principles involved in the collection and transportation of water/wastewater/storm runoff, and distribution of water for municipal use. Prereq: Chem 122, CE 309. F, S
- 410/610 Water and Wastewater Engineering** 3  
Principles involved in treatment, disposal, reuse, and recycling of municipal water supplies and wastewaters. Laboratory introduces tests to evaluate treatment requirements and effectiveness. 3 one-hour lectures, 1 three-hour laboratory. Prereq: Chem 122, CE 309. F
- 411/611 Design of Prestressed Concrete** 2  
Theory and design of prestressed concrete structures, pre- and post-tensioning, loss of prestress, proportioning of flexural members, deflections. 2 one-hour lectures. Prereq: CE 404. S
- 417/617 Slope Stability and Retaining Walls** 2  
Performance and design of retaining walls, sheet pile walls, braced walls, and reinforced earth. Also evaluation and mitigation of unstable earth slopes. 2 one-hour lectures. Prereq: CE 316. S
- 418/618 Transportation Engineering** 4  
Location, analysis, modeling, and design of multi-modal facilities including highways, railways, airports, terminals, harbors, ports, canals, waterways, pipelines, and conveyor systems. 3 one-hour lectures, 1 two-hour session. Prereq: CE 204.
- 419/619 Pavement Design** 3  
Design of flexible and rigid pavements including subgrade, base courses, surface courses; evaluation criteria including soil, climate, traffic, material, drainage; initial and maintenance cost considerations; construction practices. 2 one-hour lectures, 1 two-hour session. Prereq: CE 316. S
- 421/621 Open Channel Flow** 3  
Geometric and hydraulic properties of open channels, momentum and energy principles, design of channels for uniform flow, gradually varied and rapidly varied flow. 2 one-hour lectures. Prereq: CE 309. S
- 430/630 Timber and Form Design** 3  
Analysis and design of wood structures and concrete form work. 2 one-hour lectures, 1 three-hour session. Prereq: ME 223. S
- 441/641 Finite Element Analysis** 2  
Weak and strong solutions to governing differential equations in bars, boundary conditions, Galerkin approximation, nodal basis functions, shape functions. Two-dimensional problems with triangular and quadrilateral elements. 2 two-hour lectures. F, S
- 442/642 Matrix Analysis of Structures** 2  
Review of matrix algebra, flexibility and stiffness methods, direct stiffness method, introduction to finite element analysis. 2 lectures. Prereq: CE 343. F, S
- 444 Structural Steel Design** 3  
Design of metal structures including mechanical behavior of metals; behavior and proportioning of tension and compression members; beams, beam columns, and connections; selection of metal structural systems. 2 one-hour lectures, 1 two-hour session. Prereq: CE 343.
- 445/645 Advanced Steel Design** 2  
Analysis and design of metal structures including connections, selection of structural systems. 1 one-hour lecture, 1 two-hour session. Prereq: CE 444. S
- 446/646 Basic Dynamics of Structures** 3  
Analysis of single degree of freedom structural systems to harmonic and general dynamic loading, free vibration of multiple degree of freedom systems, modal superposition, earthquake engineering. 3 one-hour lectures. Prereq: CE 343. F
- 451/651 Advanced Surveying** 2  
Property description and legal land surveys. Astronomical observations to establish position and direction. State plane coordinates. 2 one-hour lectures. Prereq: CE 204.
- 454/654 Geometric Highway Design** 3  
Location and design of highways and streets; design controls, elements of design; cross-section and alignment; design of intersections, interchanges, safety appurtenances, and noise barriers. 2 one-hour lectures, 1 two-hour session. Prereq: CE 418. F
- 455/655 Airport Planning and Design** 2  
System planning and demand forecasting; siting and configuration of airports; aircraft characteristics; air traffic controls; standards for geometric design, pavement design, earthwork, drainage, lighting, and marking. 2 one-hour lectures. Prereq: CE 418. F
- 456/656 Railroad Planning and Design** 2  
Rail planning and location analysis, track/rail structure, track layout and control system, locomotives and train resistance, track safety standards and geometrics, terminal design. 2 one-hour lectures. Prereq: CE 418. F
- 457/657 Pavement Management Systems** 2  
Pavement design, maintenance, and rehabilitation strategies; planning, budgeting, and programming for pavement management at network and project levels; development, design, and maintenance of pavement management systems. 2 one-hour lectures. Prereq: CE 418, 419. F, S
- 461/661 Foundation Engineering** 2  
Performance and selection of the following foundations: shallow, mat, combined pile, and drilled piers. 2 one-hour lectures. Prereq: CE 316. F
- 462/662 Designing with Geosynthetics** 2  
Theories, principles, and engineering design using geosynthetic materials for a variety of civil engineering applications. Applications to geotechnical, environmental, transportation, and water resources fields are emphasized. Includes construction issues. Prereq: CE 316. S
- 472/672 Solid Waste Management** 3  
Basic study of solid waste materials, current collection methods, available disposal techniques, recycling and resource conservation, and economics of solid waste collection and disposal. 3 one-hour lectures. Prereq: CE 370, 408. F, S
- 473/673 Air Pollution** 3  
Fundamentals of air pollution and its control technology. Types and sources of air pollutants, meteorology, effects on plants, animals, people,

and property. Design of control equipment. 3 one-hour lectures, 1 three-hour laboratory. Prereq: CE 370. S

**477/677 Applied Hydrology** 3  
Scope of hydrology, probabilistic concepts in water resources, regional frequency analysis, application of risk concepts to hydrologic design, hydrologic data generation for ungaged watersheds, hydrologic modeling. 2 one-hour lectures. Prereq: CE 408. F

**478/678 Water Quality Management** 3  
Physical, chemical, biological, hydrological characteristics, and hydrodynamic elements of receiving waters. Characterizations, measurement, and modeling methods of river/streams, lakes/reservoirs, and groundwater systems. 2 one-hour lectures. Prereq: CE 408, 410. F

**479/679 Advanced Water and Wastewater Treatment** 3  
Selected problems in the investigation and design of sewerage systems, water distribution systems, wastewater treatment plants, and water purification plants. 2 one-hour lectures. Prereq: CE 408, 410. S

**482 AutoCAD** 1  
Introduction to the fundamentals of the AutoCAD computer package, with applications for civil engineering and architecture. Prereq: PC skills. F, S

**483 Contracts and Specifications** 3  
Formation, interpretation, and termination of engineering contracts. Engineering specifications and drawings. Other legal matters of concern to engineers. 2 one-hour lectures. Prereq: Senior standing. F, S

**489 Senior Design** 2  
An open-ended capstone design project encompassing a number of the disciplines within civil engineering. 2 one-hour lectures. Prereq: Senior standing. F, S

**671 Water and Wastewater Laboratory** 2  
Emphasis on recent developments in and standard methods of water and wastewater analysis. Studies of efficiency, operation, and evaluation of water and wastewater treatment. 1 one-hour lecture, 1 three-hour laboratory. Prereq: CE 408, 410. F, S

**701 Theory of Elasticity** 2  
A theoretical study of linear elasticity, Saint Venant's problems, plain stress, plain strain, strain energy, and torsion. 2 one-hour lectures.

**702 Plates and Shells** 2  
Theoretical and applied study of the classical theories of plates and shells as they pertain to engineering problems including small displacement of rectangular and circular plates and thin shells. 2 one-hour lectures.

**706 Plastic Design in Structural Steel** 2  
Inelastic bending of beams and frames, application of upper and lower bound theorems, calculation of deflection, effect of axial and shearing forces on flexural strength, connections, structural safety, and rules of plastic design. 2 one-hour lectures.

**707 Numerical Methods in Structural Engineering** 3  
Methods of successive approximations in stress, vibrations, and stability analysis of structural members and frames; numerical methods for the calculation of beam deflections, buckling of nonuniform columns, diaphragms, and webs. 3 one-hour lectures.

**709 Dynamics of Structures and Foundations** 2  
Advanced topics in structural dynamics, frequency domain response, generalized coordinates, nonlinear structural response, dynamic analysis of framed structures, structures with distributed properties, seismic design considerations. 2 one-hour lectures. Prereq: CE 446.

**712 Ductile Structures** 2  
Ductile behavior of reinforced concrete structures, failure criteria, ductility of confined concrete, moment/rotation behavior of reinforced concrete members, collapse mechanism, and limit analysis. 2 one-hour lectures.

**713 Structural Mechanics** 2  
Elements of classical mechanics: stress, strain, stress-strain relations, two dimensional problems in elasticity, torsion, axisymmetrically loaded elements. Introduction to plates and shells. 2 one-hour lectures.

**714 Theory of Elastic Stability** 2  
Bending of beams under simultaneous action of axial and lateral loads, buckling of compressed bars in both the elastic and plastic ranges, design formulas, lateral buckling of beams. 2 one-hour lectures.

**720 Continuum Mechanics** 3  
Tensor analysis in affined and metric spaces, kinematics of motion, general principles of continuum mechanics, thermodynamics of deformation, and postulates on constitutive laws. 3 one-hour lectures. Cross-listed with ME. F

**722 Theory of Models** 2  
Physical, analog, mathematical, and computer models; application of dimensional analysis to physical hydraulic model studies, scaling ratios, distorted models. 2 one-hour lectures. Prereq: CE 309.

**762 Advanced Foundation Engineering** 2  
Advanced topics in performance and design of foundations. Current topics include a two-dimensional finite element analysis of the foundation and its supporting soil. 2 one-hour lectures. Prereq: CE 461/661.

**770 Hazardous Waste Site Remediation** 3  
Hazardous waste site remediation, hazardous treatment technologies. 3 one-hour lectures. Prereq: CE 370, 408. F

**771 Economics of Transportation Systems** 3  
See Agricultural Economics for description.

**772 Rural Logistics and Distribution Management** 3  
See Agricultural Economics for description. S

**774 Statewide Transportation Planning** 3  
Introduction to transportation institutions, regulation and safety, transportation finance, modal planning (for highways, railroads, airports, and waterways), multimodal planning, and transportation impact assessment.

**775 Industrial Waste Management** 3  
Regulations and standards on industrial pollution control, industrial waste characteristics, industrial waste management strategies, and waste treatment methods. Prereq: CE 610.

**776 Groundwater and Seepage** 3  
Groundwater as a resource, relation to hydrologic cycle, well hydraulics, seepage, ground water quality and contamination, ground water flow models. 2 one-hour lectures. Prereq: CE 408. S

**778 Transportation Administration** 3  
Public organization behavior and administration, fund accounting, public budgeting, financial management, and strategic management of transportation agencies. Includes transportation case studies.

**780 Transportation Planning** 3  
Development and trends in travel demand forecasting; trip generation, trip distribution, mode choice, traffic assignment; transportation plans for modal, multi-modal, and paratransit alternatives; policy formulation and analysis. 3 one-hour lectures. Prereq: CE 418.

**781 Traffic Engineering** 3  
Traffic characteristics, studies, and control devices; operations analysis and design; aspects of signing, signalization, markings, and lighting; accident analysis; traffic laws and ordinances; work zone safety practices. 2 one-hour lectures, 1 two-hour laboratory. Prereq: CE 418. S

**782 Public Infrastructure Management and Construction** 3  
Management and construction of public infrastructure including streets, highways, and sidewalks; public transportation; street lighting and traffic control systems; potable water; wastewater and drainage; parks, recreation facilities, solid waste handling and disposal, and others. Prereq: CE 619 and 656.

## CLASSICAL LANGUAGES (Clas)

Andreini, Nichipor

### COURSES

**101, 102 First-Year Latin I, II (CCN)** 4 each  
Introduction to forms, syntax, and vocabulary of classical Latin.

- 151, 152 First-Year Greek I, II (CCN)** 4 each  
Introduction to forms, syntax, and vocabulary of Attic Greek along with selected readings.
- 180 Scientific Terminology: Greek and Latin (CCN)** 2  
Brief survey of prefixes, suffixes, and roots from Greek and Latin, which form the technical vocabulary for science and medicine.
- 201, 202 Second-Year Latin I, II (CCN)** 3 each  
Designed to form a transition from introductory material to the Latin authors. Prereq for 201: Clas 102; Prereq for 202: Clas 201.
- 251 Second-Year Greek I (CCN)** 3  
Introduction to Koine Greek as found in the New Testament. Prereq: Clas 152.
- 252 Second-Year Greek II** 3  
Readings from selected classical Attic Greek authors. Prereq: Clas 251.
- 289, 290 Biblical Hebrew I, II (CCN)** 3 each  
Fundamentals of Hebrew script, grammar, and syntax. Includes selected readings from Biblical prose.
- 350 Glory of Greece** 3  
History of the ancient Greeks, their literature, politics, customs, art, and architecture.
- 360 Grandeur of Rome** 3  
History of ancient Rome, its literature, politics, customs, art, and architecture.
- 361 Cicero** 3  
Study of the life and times of Cicero through selections from his letters, speeches, and philosophical essays. Prereq: Clas 202.
- 362 Virgil** 3  
Study of the poetry of Virgil with a concentration on the Aeneid. Prereq: Clas 202.
- 363 Advanced Latin Prose** 3  
Readings from Roman historians and other writers of Latin prose. Prereq: Clas 202.
- 364 Advanced Latin Poetry** 3  
Readings from Catullus, Horace, Ovid, and other Latin poets. Prereq: Clas 202.
- 370 Classical Mythology** 3  
Study of the gods and heroes of the Greeks and Romans as found in classical and modern literature, sculpture, and painting.
- 451 Advanced Greek Prose** 3  
Readings from Classical Greek philosophers, historians, and orators in the original. Prereq: Clas 252.
- 452 Greek Tragedy** 3  
Appreciation of Greek drama through reading selections from Aeschylus, Sophocles, and Euripides in the original. Prereq: Clas 252.
- CLINICAL LABORATORY SCIENCE (CLS)**  
P. Olson
- COURSE**
- 111 Introduction to Clinical Laboratory Science (CCN)** 1  
Introduction to clinical laboratory science. Lectures, discussions, and field trips focus on professional traits and communication, ethical behavior of the health care provider, major curriculum requirements, and scope of practice.
- COMMUNICATION (Comm)**  
P. Nelson, Chair; Burnett, Collins, D. Hindman, E. Hindman, Littlefield, Mattern, Meister, Nielson, Okigbo, Pearson, Penuel, D. Sellnow, T. Sellnow, Venette
- COURSES**
- 109 Communicating with Confidence** 1  
Designed for students who are reluctant to enroll in speech due to high speech anxiety. Focused on discussing causes of speech anxiety and practicing anxiety-reducing techniques. *Does not satisfy any requirements for graduation.*
- 110 Fundamentals of Public Speaking (CCN)** 3  
Theory and practice of public speaking with emphasis on content, organization, language, delivery, and critical evaluation of messages. (ND:Comm)
- 112 Understanding Media and Social Change (CCN)** 3  
Exploration of the purpose, function, and impact of media on society. Mass communication majors must earn a grade of "B" or better.
- 114 Human Communication** 3  
Overview of communication theory with emphasis on information transmission and social influence functions of communication behavior in personal and mediated contexts. Speech communication majors must earn a grade of "B" or better.
- 150 Forensic Practice (CCN)** 1  
Applied speaking experiences in competitive and non-competitive settings. Speaking experiences in public address, oral interpretation, and reader's theatre settings. Competitive debate also offered. May be repeated.
- 200 Introduction to Media Writing** 3  
Introduction to writing in the styles and forms required in journalism, advertising, broadcasting, and public relations. Mass communication majors must earn a grade of "B" or better. Prereq: Comm 112 and Engl 120.
- 212 Fundamental Concepts of Communication Between Individuals** 3  
Includes aspects of self-expression and relationship communication. Focuses on theory and practice of communication in interpersonal relationships. Speech communication majors must earn a grade of "B" or better.
- 214 Persuasive Speaking (CCN)** 3  
Persuasive speaking with focus on evaluating information directed at the consumer. Strategies of altering attitudes, beliefs, values, and behavior. Prereq: Comm 110.
- 216 Intercultural Communication (CCN)** 3  
Exploration of the definition, models, and verbal processes of communication between different cultural groups. (ND:SS)
- 242 Advanced News Photography** 3  
Further exploration of photography in all phases of news. Introduction to the techniques of photojournalism, including composition, lighting, and computerized editing of news photos. Prereq: Comm 200 or instructor permission.
- 260 Principles of Internet Web-Based Design** 3  
This course aims to orient students to Web concepts, design, presentation, and evaluation. Prereq: CSci 114 or 116.
- 261 Introduction to Web Development** 3  
Introduces the tools used by Web Development professionals, including HTML, Web editors, imaging software, Javascript, and Acrobat pdf format. Prereq: CSci 114 or 116.
- 271 Listening and Nonverbal Communication (CCN)** 3  
Theory and practice of effective listening; nonverbal aspects of human communication.
- 308 Business and Professional Speaking** 3  
Oral and written communication skills for those involved in professional and business settings. Includes resume, cover letter and memo writing; interpersonal and group applications; and interviewing and professional presentations emphasis. Prereq: Comm 110.
- 310 Advanced Media Writing** 3  
Construction of professional quality messages for print, public relations, and broadcast. Prereq: Comm 200 with grade of B or better.
- 312 Oral Performance Studies** 3  
Study and practice of the principles involved in oral performance. Includes the development of vocal qualities and articulation, as well as the analysis of literary texts representing a variety of genres and formats of interpretation. Prereq: Comm 110.
- 313 Editorial Processes** 3  
Principles of print media copy editing, headline composition, publication design, photo editing, and computer editing. Prereq: Comm 200.
- 314 Argumentation and Debate (CCN)** 3  
Theory and process of argumentation with practical experience in preparation and delivery of formal debate. Prereq: Comm 110.
- 315 Small Group Communication** 3  
Focus on group processes, methods of problem solving, parliamentary procedures, and relational components of group interaction.

- 320 Communication Analysis** 3  
Overview and application of basic methods used in communication analysis. Mass communication and speech communication majors must earn a grade of "B" or better.
- 340, 341 Social Research Methods, Lab** 3,1  
See Sociology for description.
- 345 Principles of Broadcast Production** 3  
Creation, critique, and analysis of audio production and single camera video productions with special emphasis on radio and television news. Prereq: Comm 112, 310.
- 362 Principles of Design for Print** 3  
Applications of various design principles and pagination techniques to cognitive problem-solving involved in developing material for publication. Prereq: Comm 313.
- 370 Principles of Public Relations** 3  
Public relations as a professional field; theory, principles, and practices used in solving public relations problems. Prereq: Comm 200.
- 401/601 Survey of Rhetorical Theory** 3  
Historical/descriptive examination of rhetorical theory from the classical through contemporary periods. Exploration of the foundations and evolution of modern rhetorical theory. Capstone option.
- 402/602 Contemporary Rhetoric** 3  
Examination of the use of public address in the contemporary culture to identify styles of usage and ethical practices employed by communicators. Prereq: Junior standing.
- 411/611 Communication Theory** 3  
Major theoretical approaches to the study of human communication from social scientific and humanistic traditions. Capstone option.
- 412/612 Gender and Communication** 3  
Exploration of philosophical and theoretical issues surrounding gender construction, communication, and culture. Focus on ways in which communication in families, schools, media, and other institutions create and sustain gender roles.
- 425/625 Specialty Writing** 3  
Methods and practice of writing features and opinion for print publications. Prereq: Comm 200, 310.
- 431 Communication Ethics** 3  
Study of ethical theories and their role in conceptions of mass media responsibility. Capstone course.
- 433/633 Legal Communication** 3  
Designed for students interested in applied communication theory or pre-law. Focuses on verbal and nonverbal factors in the legal interview, negotiation and conflict resolution, jury selection, opening statements, witness examination, closing arguments, and jury deliberation.
- 434/634 Communication Law** 3  
Exploration of speech and press protections of the First Amendment. Topics include libel, privacy, electronic media regulation, and speech regulation.
- 435/635 Popular Culture and Mass Media** 3  
Analysis of popular culture messages (programming, content, and advertising) presented by the media as an expression of social values. Media include television, cinema, music, and radio.
- 436/636 Issues in Mass Communication** 3  
Studies in mass communication topics in interaction with social, cultural, political, and economic realities. Media impact on national life and thought. Prereq: Junior standing. May be repeated.
- 437/637 Mass Communication Theory** 3  
Survey of social scientific, interpretive, and cultural critical theories used in mass media research and criticism. Prereq: Junior standing.
- 442/642 Information Technologies and Mass Media** 3  
Study of mass media programming and management with an emphasis on the impact of new information technologies. Prereq: Junior standing.
- 443/643 Mass Media and Public Opinion** 3  
Overview of theories and methodologies used in the study of the role of mass media in attitude formation, attitude change, and public opinion. Prereq: Junior standing.
- 445 Advanced Broadcast Production** 3  
Development of skills in the creation, critique, and analysis of television productions in the studio and in the field. Prereq: Comm 345.
- 450/650 Issues in Communication** 3  
Theory and philosophy of research issues in the field of communication. Prereq: Junior standing. May be repeated.
- 460 Introduction to Web Scripting** 3  
Introduces students to Common Gateway Interface (CGI) programming, that is, on understanding, developing, and applying CGI scripting. Prereq: CSci 114 or 116; Comm 260 and 261.
- 461 UNIX Systems Administration** 3  
Provides an introduction to concepts and design of UNIX systems, and the implementation and maintenance of them. Prereq: CSci 114 or 116; Comm 260 and 261.
- 462 Web Database Programming** 3  
Introduces students to Web database concepts, design, normalization processes, and implementation. Prereq: CSci 114 or 116; Comm 260 and 261.
- 472/672 Public Relations Campaigns** 3  
Social science research as applied to public relations, case study analysis, construction, and implementation of public relations campaigns. Prereq: Comm 370 or departmental approval.
- 473 Case Study in Public Relations** 3  
Advanced study of applied public relations theory through intense case study analysis and research focused on organizations. Case studies from the Public Relations Society of America are used. Prereq: Comm 472.
- 480/680 Health Communication** 3  
Designed to help individuals communicate in the health professions. Exploration of professional behavior as communication, staff-client communication, and team communication in the health-care setting.
- 483/683 Organizational Communication I** 3  
Exploration of the theory of management communication practices in organizations. Emphasis on the formal structure and interpersonal aspects of supervisor-subordinate relations. Prereq: Junior standing. Cross-listed with Busn.
- 485 Crisis Communication** 3  
Crisis communication practices in organizations of all types with emphasis on planning, emergency communication, image restoration, and organizational learning.
- 700 Research Methods in Communication** 3  
Introduction to research planning and design, methods of research, and presentation of research results.
- 705 Advanced Communication Theory** 3  
See Department for course description
- 706 Advanced Interpersonal Communication** 3  
Interpersonal communication theory and research methods are developed from the perspectives of uncertainty reduction, conflict management, relationship reciprocity, constructivism, compliance gaining, discourse dominance, and relational dynamics.
- 708 Advanced Qualitative Methods in Communication Research** 3  
Description to come.
- 710 Advanced Quantitative Methods in Communication Research** 3  
See Department for course description.
- 715 Theories of Small Group Communication** 3  
Survey of theoretical constructs of communication in the small group setting. Examination of current methods of research.
- 721 Intercultural Communication** 3  
Advanced theories of verbal and nonverbal behavior, attitudes, and communication styles that affect interaction between cultural groups.
- 725 Communication and Change** 3  
See Department for course description.

**750 Advanced Issues in Communications** 3  
Advanced theory and philosophy of research issues in the field of communication. May be repeated. Course is restricted to Ph.D. students or Master's students with instructor permission.

**751 Directing Forensics** 2  
Theory and philosophy of coaching individual speaking events and debate. Designed for those who will coach at the high school or junior college level.

**752 Theory of Argument** 3  
Philosophy and theory of argumentation. Exploration of analytical methods employed in argumentation.

**755 Rhetoric of Environmental Science** 3  
Exploration into the communication of science within contemporary society. Particular emphasis on how scientists can communicate more clearly to non-expert audiences.

**767 Rhetorical Criticism** 3  
Survey of critical methods of inquiry that may be applied to oral discourse and frameworks for critically evaluating communication processes and products.

**782 Theories of Persuasion** 3  
Survey of the theories related to persuasion, attitudes, and values of societal groups, and the assessment of attitudes and values held by the public.

**784 Organizational Communication II** 3  
Study of the structure and function of communication interaction in formal organizations and survey of methods of analysis including the communication audit. Also includes models of introducing innovations.

**785 Advanced Crisis Communication** 3  
Long term and short term issues for managing communication related to organizational crises are discussed in the stages of pre-crisis, crisis and post-crisis.

## COMPUTER SCIENCE (CSci)

Nygaard, Chair; Erickson, Juell, Kamel, Magel, Martin, Perrizo, Salah, Shi, Slator, Ubhaya, Van Horn

### COURSES

**101 Introduction to Computing** 2  
Introduction to word processing and spreadsheets on personal computers.

**114 (147) Microcomputer Packages** 3  
General introduction to computer concepts, operating systems, the internet, word processing, spreadsheets, database management and presentation software.

**116 (146) Business Use of Computers** 4  
Exploration of how microcomputers are used in business. Use of word processing, spreadsheet, database, graphing, and telecommunication applications.

**122 Beginning BASIC/Visual BASIC (CCN)** 3  
Introduction to programming in the BASIC/Visual BASIC language. (ND:CompSc)

**125 Beginning COBOL (CCN)** 3  
Introduction to programming in the COBOL language. (ND:CompSc)

**126 Beginning FORTRAN (CCN)** 3  
Introduction to programming in the FORTRAN language. Prereq: Math 103. (ND:CompSc)

**155 Immigration (CCN)** 2  
Introduction to programming in the current language of CSci 160. For transfer students with CSci 160 or equivalent, in a language different from that used here. Prereq: CSci 160 or equivalent.

**159 Computer Science Problem Solving2**  
Problem solving techniques for both closed-ended and open-ended problems. Includes flow charting, data flow, and entity relationship diagrams.

**160 Computer Science I (CCN)** 4  
Introduction to computer science including problem solving, algorithm development, and structured programming in a high-level language. Emphasis on design, coding, testing, and documentation of programs using accepted standards of style.

**161 Computer Science II (CCN)** 4  
Advanced concepts in computer science including data structures, algorithm analysis, standard problems such as searching and sorting and memory management issues. Prereq: CSci 160.

**162 Intense FORTRAN** 2  
Intensive introduction to FORTRAN and its use in engineering applications. Students receive an introduction to numerical analysis, particularly error analysis. Prereq: Math 103. (ND:CompSc)

**172 Intermediate BASIC/Visual BASIC** 3  
Elements of visual Basic for those with previous programming background. Topics include fundamental constructs, Active X controls, file processing, database management, and SQL. Prereq: one semester/experience in any programming language.

**212 Self-Paced C++** 1  
Introduction to the C++ programming language. Students complete exercises and programming assignments at their own pace. Prereq: Programming skill in another language.

**214 Self-Paced C** 1  
Introduction to the C programming language. Students complete exercises and programming assignments at their own pace. Prereq: CSci 160.

**222 Discrete Mathematics** 3  
Sets, functions, relations, logic, methods of proof, mathematical induction, combinatorics, recurrence relations, generating functions. Prereq: CSci 160.

**227, 228 Computing Fundamentals I, II** 3 each  
Two-semester sequence focused on problem solving and writing computer programs in a modern high-level programming language in a state-of-the-art programming environment. Second semester includes an introduction to the object-oriented programming paradigm. Prereq for 227: Math 103 or equivalent; Prereq for 228: CSci 227.

**235 Theoretical Computer Science I** 3  
Models of computation, regular expressions, finite automata, Kleene's Theorem, lexical analysis, context-free grammars, pushdown automata, introduction to parsing. Prereq: CSci 161, 222.

**236 Theoretical Computer Science II** 3  
Parsing techniques, context-free languages, Turing machines, recursive and recursively enumerable languages, unrestricted grammars, unsolvable decision problems, computability, introduction to computational complexity. Prereq: CSci 235.

**275 [270] Digital Systems I** 3  
See Electrical and Computer Engineering for description.

**315 System Analysis and Design** 3  
Introduction to the front end of the software development life cycle. Includes various modern concepts, techniques, and tools for analyzing and designing well-structured software systems. Prereq: CSci 160.

**316 System Testing and Maintenance** 3  
Introduction to the back end of the software development life cycle. Includes various modern concepts, techniques, and tools for testing and maintaining software systems. Prereq: CSci 315.

**345 Topics on Personal Computers** 3  
Exploration of some aspects of personal computers not covered in other courses, varies each time it is offered. May be repeated. Prereq: CSci 161.

**366 Files for Database Systems** 3  
File organization techniques, design, and implementation of database systems. Prereq: CSci 374.

**372 Comparative Languages** 3  
Explanation of the concept and impact of a block-structured language. Several languages will be compared with respect to application, suitability, syntax, and semantics. Prereq: CSci 161 or 228.

**373 Assembly Programming** 3  
Machine language, assembly language, and related hardware concepts, assembly language programming, macros and subroutines, system facilities and macros. Prereq: CSci 160. Cross-listed with ECE.

**374 Computer Organization and Architecture** 3  
Organization and structure of the major sections of a computer: CPU, memory, and I/O system organization and implementation issues. Prereq: CSci 373. Cross-listed with ECE.

- 418/618 Simulation Models** 3  
Fundamental techniques involved in using a computer to simulate business, social, and industrial systems. Includes principles of random variate generation, statistical sampling, and design of experiments. Prereq: Stat 367.
- 426/626 Introduction to Artificial Intelligence** 3  
Introduction to artificial intelligence for undergraduates. Includes basic AI concepts and techniques. Prereq: CSci 372.
- 453/653 Linear Programming and Network Flows** 3  
Linear programming models and applications, primal and dual formulations, computational procedures; introduction to networks, maximum flow, and shortest path problems. Prereq: Math 265.
- 454/654 Operations Research** 3  
Deterministic and probabilistic models of operations research: networks and project management, dynamic programming, non-linear programming, inventory, queuing, reliability, stochastic processes, and simulation. Prereq: CSci 453/653, Stat 367.
- 458/658 Microcomputer Graphics** 3  
Information on the techniques by which computers generate images of 2D and 3D objects. Principles to guide the use of computer graphics to enhance human-computer interaction. Prereq: CSci 372 and Math 146 or 165.
- 459/659 Local Area Networks** 3  
LANs interconnect modern computer work groups. LAN architecture, applications, implementations, protocols, management, security, external connections, and future directions are examined. Prereq: CSci 214, 474.
- 460/660 Dynamic Programming** 3  
Basic principles and algorithms of dynamic programming as applied to sequential decision problems in CS and OR. Prereq: Math 166.
- 467/667 Algorithm Analysis** 3  
Design, correctness, and analysis of algorithms and data structures. Prereq: Math 166, CSci 161, 222.
- 468/668 Database Systems Design** 3  
Overview of the maintenance and manipulation of databases. Includes a large project in C++. Prereq: CSci 366.
- 474 Operating Systems Concepts** 3  
How operating systems manage the resources of a computer. Topics include processes, concurrency, scheduling, deadlocks, memory allocation, virtual and secondary storage. Prereq: CSci 374.
- 475 Operating Systems Design** 3  
Advanced operating systems topics such as protection, errors, and distributed systems. Case studies of representative operating systems. Students work in small teams to implement their own basic OSs. Prereq: CSci 474.
- 477/677 Object-Oriented Systems** 3  
Introduction to the concepts and advantages of object-oriented computer systems. Introduces exercises with at least one such language. Prereq: CSci 372.
- 488/688 Human-Computer Interaction** 3  
Survey of the methodologies and alternatives used in developing and evaluating human-computer interfaces. Prereq: CSci 372. Cross-listed with Psyc.
- 489/689 Social Implications of Computers** 3  
Presentation and discussion of several ethical and social issues that have arisen from the introduction of the computer including copy-protected software and liability for computer software errors. Prereq: CSci 372, 467.
- 702 Performance Evaluation** 3  
Examination of basic techniques used to evaluate multi-programming systems. Both queuing models and other analytical approaches are constructed with simulation and direct measurements of actual systems. Prereq: CSci 475.
- 708 Foundations of Programming** 3  
Introduction to formalisms, in which computer programs are considered as mathematical objects, including weakest precondition and predicate calculus. Prereq: CSci 236.
- 713 Software Engineering** 3  
This course is designed as a breadth course on the software engineering process. Basic concepts are reviewed and reassured to create a basis for higher concepts and techniques. Prereq: Graduate standing.
- 714 Software Engineering II** 3  
This course is designed to introduce the student to concepts and techniques of how to plan for a software project. This includes time and effort estimation, planning and teaming the project and manage the development activities. Prereq: CSci 713.
- 715 Software Requirements Definition and Analysis** 3  
This course is designed to make the student able to identify and capture requirements for a software system and be able to document and assess the requirements. Prereq: CSci 713.
- 716 Software Design** 3  
This course covers both architectural design and module design. Students receive practice using a set of patterns to produce software designs with several different types of architecture. Substantial presentation and practice with the UML modeling language is provided. Prereq: CSci 713.
- 717 Software Construction** 3  
This course covers the fundamentals of software construction including programming and evaluation of the source code. Students receive a good grounding in and extensive practice with the comprehensive libraries associated with a modern programming language. Prereq: CSci 713.
- 718 Software Testing and Debugging** 3  
This course covers the goals, practices, evaluation and limitations of software testing and software debugging. Students receive practice in developing and using test plans and various testing and debugging techniques. Prereq: CSci 713.
- 722 Compiler Construction** 3  
Design and structure of complex grammars, lexical analysis, parsers, semantic data structures, and code generating and optimization. Construction of a simple compiler. Prereq: CSci 372 or graduate standing.
- 724 Survey of Artificial Intelligence** 3  
Survey of major areas of AI including theorem proving, heuristic search, problem solving, computer analysis of scenes, robotics, natural language understanding, and knowledge-based systems. Prereq: CSci 372 or graduate standing.
- 728 Computer Graphics** 3  
Principles and algorithms used in computer graphics packages. Emphasis on raster graphics, clipping, hidden-surface elimination, ray-tracing, radiosity. Prereq: Graduate standing.
- 730 Office Information Systems** 3  
Exploration of the evolution of the office since the introduction of the computer. Examination of the introduction of computers, word processors, database management systems, networks, and AI into the office. Prereq: CSci 160 or graduate standing.
- 734 Expert Systems** 3  
Examination of types of expert systems, their powers and limitations. Students write their own expert system. Prereq: CSci 724.
- 735 Neural Networks** 3  
Introduction to the parallel processing paradigms that have been developed recently including neuronetworks and genetic algorithms. Students will work on projects using these tools. Prereq: CSci 724. Cross-listed with Psyc.
- 737 System Simulation** 3  
Systems, models, discrete event simulation models, queuing systems, fundamental statistics of simulation. Prereq: CSci 653, Math 166.
- 741 Algorithm Analysis** 3  
Algorithm design and analysis, asymptotic analysis, worst and average case, recurrences, generating functions, divide-and-conquer, the greedy method, search and traversal, backtracking, branch-and-bound. Prereq: CSci 161, Math 166.
- 742 Algorithms and Complexity** 3  
Linear and nonlinear recurrences, algebraic problems, fast Fourier transforms, lower bound theory, computational geometry, the classes P and NP-completeness, Cook's theorem, NP-hard problems. Prereq: CSci 741.
- 745 Formal Methods for Software Development** 3  
The course is a high level course with the aim of formal representation to be able to formally assess characteristics of software. The formal representations are based on the theoretical foundations of computer sciences such as set theory, logic or graph theory. Prereq: CSci 713.

- 746 Development of Distributed Systems** 3  
This course is an advanced course in software engineering aiming at strategies and solutions of distributed systems. It assumes the knowledge of software engineering and particularly design and implementation of software systems, then builds on these concepts to how distributed systems are designed and implemented. Prereq: CSci 713.
- 747 Software Complexity Metrics** 3  
This course covers complexity metrics for the entire software lifecycle. Students gain experience in using requirements metrics, design metrics, program metrics, test metrics, and planning metrics. The effectiveness and limitations of metrics in all these areas are emphasized. Prereq: CSci 713 and 718.
- 751 Nonlinear Optimization I** 3  
Convex sets, convex functions and extensions, one-dimensional optimization, theory and algorithms for constrained and unconstrained nonlinear programs, optimization without derivatives. Prereq: CSci 653.
- 752 Nonlinear Optimization II** 3  
Convergence, rates, primal and dual methods of constraining optimizations of large scale programs, linear complementarity, quadratic programs, computational complexity, minimax problems. Prereq: CSci 751.
- 760 Dynamic Programming** 3  
Dynamic programming as an algorithm design method, formulating and solving problems using dynamic programming, deterministic and stochastic problems in OR and CS. Prereq: Math 166.
- 761 Integer Programming** 3  
Integer linear programs and modeling, theory and algorithms, duality and relaxation, cutting plane and branch-and-bound methods, combinatorial problems, total unimodularity, matching and matroids. Prereq: CSci 653.
- 762 Network Flows** 3  
Theory and algorithms for network flow optimization including network representation data structures, basic change methods, maximum flow, shortest path, minimum cost problems, and generalized networks. Prereq: CSci 653.
- 765 Introduction to Database Systems** 3  
Basic database concepts, models, management facilities, data structures, storage structures, data definition languages, data manipulation languages, normalization, operator implementation algorithms, transactions, correctness, reliability, distribution, performance analysis. Prereq: CSci 366 or graduate standing.
- 766 Database System Internals** 3  
Transaction management, processing; correctness; recoverability; serializability (conflict and view); concurrency control (2PL, BTO, SGT, multiversion); recovery; distributed systems (correctness, recovery, replication); query processing and optimization. Prereq: CSci 765.
- 773 Foundations of the Digital Enterprise** 3  
See CSci Department for course description.
- 774 Topics of the Digital Enterprise** 3  
Topics in database, networks, cryptography, security, and software engineering as they apply to the digital enterprise. Prereq: CSci 315. CSci 783 recommended.
- 778 Computer Networks** 3  
Examination of computer networks using the ISO-OSI model as a framework. Practical and theoretical issues are explored in modems, codes, error, impairments, modulation, protocols, and interfaces. Prereq: CSci 474 or graduate standing.
- 783 Topics in Software Systems** 3  
Includes an area of computer science not otherwise treated in computer science courses. Varies each time offered. May be repeated. Prereq: Graduate standing or departmental approval.
- 785 Topics in Computer Architecture** 3  
Includes an area of computer architecture not considered in other courses. Varies each time offered. May be repeated. Prereq: Graduate standing or departmental approval.
- 787 Topics in Operations Research** 3  
Includes an area of operational research not considered in other courses. Varies each time offered. May be repeated. Prereq: Graduate standing or departmental approval.
- 789 Topics in Theoretical Computer Science** 3  
Includes an area of theoretical computer science not considered in other courses. Varies each time offered. May be repeated. Prereq: Graduate standing or departmental approval.
- CONSTRUCTION MANAGEMENT AND ENGINEERING (CM&E)**  
Padmanabhan, Chair; G. Smith, Director; Mayo, McIntyre, Nguyen, Salem
- COURSES**
- 111 Introduction to Construction Management and Engineering** 1  
Review of the history of engineering and construction, duty, and role of the professional engineer, construction engineer, and construction manager. 1 lecture. F
- 205 Building Construction** 3  
Introduction to planning, design, and construction of residential structures, including cost estimating and project scheduling. Computer applications. 3 lectures. S
- 301 Construction Technology and Equipment** 4  
Study of construction techniques, analysis of equipment costs, production, and methods of proper equipment selection. Analysis of earth moving equipment, dewatering systems, and aggregate production. Prereq: ME 223, CE 309 or CM&E 325, CE 316 or CM&E 320, IME 440. S
- 310 Construction Quality Control Management** 2  
Discussion of inspection procedures and requirements; design and management of quality control/assurance programs for design and construction phases of a project. Includes statistical quality control methods and total quality management in construction. 2 lectures. Prereq: Junior standing; Coreq: Stat 330 or IME 460. S
- 315 Specifications and Contracts** 3  
Discussion of procedures used to prepare and administer construction specifications and contracts. Construction Specification Institute format and AIA Documents and General Conditions are discussed. Also discusses the liabilities and incentives for various kinds of construction contracts. 3 lectures. Prereq: Junior standing. F
- 320 Soils and Foundations** 4  
Topics include physical properties of soils, stress, settlement, consolidation, slope stability, earth pressures, bearing capacity, drainage, pore pressure, and foundations. 3 lectures, 1 three-hour laboratory. Prereq: ME 223, CM&E 325.F
- 325 Fluid Mechanics for Technologists** 3  
Basic principles of fluid mechanics are introduced with an emphasis on topics pertinent to construction management students. Topics include fluid properties, fluid statics, fluid kinematics, energy and impulse-momentum considerations in fluid flow, pumping systems, steady uniform flow in open channels, fluid measurements, and forces on immersed bodies. Prereq: ME 221. S
- 370 Introduction to Cost Estimating** 2  
Includes plan reading, definitions of drawing symbols, and material takeoff for estimating quantities for a commercial construction project using the Construction Specifications Institute Technical Divisions 1 through 16. 2 lectures. Prereq: Junior standing. F
- 385 Construction Safety** 2  
Planning and administration of construction safety programs. Includes the history and development of federal and state construction safety standards and the methods for abatement and control of job site hazards to develop a safe construction project. 2 lectures. S
- 403/603 Scheduling and Project Control** 4  
Includes theories, principles, and techniques of construction planning and scheduling; emphasizes the management of time, costs, and other resources through the preparation and analysis of network schedules. Computer applications. 4 lectures. Prereq: CM&E 411. F
- 409 Highway Construction** 2  
Attention is given to the design and construction of flexible and rigid pavements including subgrade, base courses, surface courses; evaluation criteria including soil, climate, traffic, material, drainage, initial and maintenance cost considerations; construction practices. 2 lectures. Prereq: CE 316. S

**411/611 Construction Cost Estimating** 2  
This course covers quantity takeoffs, labor, materials, equipment, overhead cost, profit, and bidding strategies. Computer software is used. 2 lectures. Prereq: CM&E 370. S

**412/612 Construction Management** 3  
Covers the concepts of development and organization of projects, project contract administration, project delivery systems; management methods; management information systems, constructability review, value engineering; and construction productivity. 3 lectures. Prereq: CM&E 403. F

**413 Construction Capstone** 2  
Capstone project dealing with a construction project. 2 lectures. Prereq: Senior standing in construction management. F, S

**420 Labor Productivity in Construction** 3  
Study of the many complex issues relating to labor productivity, labor contracts and regulations, and the effective use of labor resources. 3 lectures. Prereq: CM&E 315, 411, senior standing. S

**421 Electrical and Mechanical Construction** 3  
Basic understanding of electrical and mechanical systems, design and construction procedures used, flexibility in each system, space requirements, and at what point in the job the work on a particular system is done. 3 lectures. Prereq: Phys 123, senior standing. S

**425/625 Decision Making and Risk Analysis** 3  
Decision making and decision theory. Decision support systems, applied risk identification, and analysis in construction activities. Computer applications. 3 lectures. Prereq: CM&E 403. S

**430/630 Land Development** 3  
Practical applications of the planning, design, and construction phases of the land development process. Computer applications. 3 lectures. Prereq: CE 204 and Senior standing. F

**450 Steel Design for Technologists** 3  
Selection of metal structural systems with simplified design and structural characteristics of members and connections. Methods of assembly. 3 lectures. Prereq: ME 223. F

**453 Concrete Design and Construction** 3  
Fundamentals of design for concrete mix. Formwork and concrete structures. 3 lectures. Prereq: ME 223. S

**455 Formwork Design** 2  
Design and construction of formwork structures for concrete structures. Computer applications. 2 lectures. Prereq: ME 223.

**489 Construction Design** 3  
Capstone project focusing on design and construction activities. Prereq: Senior standing in construction engineering. F, S

**782 Public Infrastructure Management and Construction** 3  
See Department for course description.

## COUNSELOR EDUCATION (CnEd)

Hannon, Hundley, Nielsen, Pennymon, Wigtil

### COURSES

**750 Secondary School Counseling** 2  
Overview of principles and functions of a secondary school counseling program and examination of secondary school counseling materials.

**751 Elementary School Counseling** 2  
Exploration of models of elementary counseling and examination of counseling materials in implementing a counseling program.

**752 Guidance Administration and Consulting** 2  
Role of administrators, counseling personnel, and teachers in the management of and consulting in K-12 counseling programs.

**753 Middle School Counseling** 2  
Exploration of models for middle school counseling and examination of counseling materials for middle school counseling programs.

**754 Assessment Techniques** 3  
Techniques and procedures of studying the individual and diagnostic process in identifying client issues. Prereq: Educ 760, 761, admission to program.

**755 Career Counseling and Testing** 3  
Study of theories of career development and the use of career information and testing in career counseling.

**756 Dynamics of Addiction** 3  
Study of the theories and scope of addiction from both the personal and social viewpoints with consideration given to the impact on the family. Prereq: Educ 760, 761, admission to program.

**757 Professional Orientation and Ethics** 3  
Introduction to dealing with professional and ethical responsibilities and multicultural issues in the counseling field. Prereq: Educ 760, 761, admission to program.

**758 Social and Cultural Foundations in Counseling** 3  
Issues and trends in counseling with multicultural and diverse populations within our society. Prereq: Educ 760, 761, admission to program.

**759 Sexual Functioning and Abuse Issues in Counseling** 3  
Study of sexual dysfunction, incest and abuse, and strategies of intervention and counseling with victims and perpetrators. Prereq: Educ 760, 761, admission to program.

**760 Counseling Techniques** 3  
Basic principles and techniques in the counseling process. Emphasis given to counseling techniques from several counseling orientations. Prereq: Admission to program.

**761 Counseling Theory** 3  
Study of various theories and philosophies of counseling and therapy. Prereq: Admission to program.

**762 Group Counseling** 3  
Study of group counseling principles appropriate to various counseling settings including schools, treatment centers, and agencies. Includes a group experience. Prereq: Educ 760, 761, admission to program.

**764 Advanced Assessment in Counseling** 3  
Assessment and diagnostic procedures: how to use appropriate tools for accurate diagnosis and assessment; how to interpret assessment and diagnostic instruments; and how to make effective use of assessment results in counseling with clients.

**765 Advanced Group Counseling** 3  
Study of group facilitation skills, group process and dynamics, and group facilitator and member roles. Includes a supervised group facilitation experience. Prereq: Educ 762.

**766 Dynamics of Self** 3  
Application of personality theory and the life stages to human behavior and the counseling process.

**768 Counseling Children and Adolescents** 3  
Counseling with children and adolescents including specific counseling strategies; mental, physical, and emotional development issues related to counseling. Prereq: Educ 760, 761, admission to program.

**773 Family Counseling** 3  
Principles and techniques of family counseling, study of family dynamics, family systems, and theories of family counseling. Prereq: Educ 760, 761, admission to program.

**774 Marital Counseling** 3  
Survey of marital counseling theories and techniques; analyses of dysfunctional communications. Prereq: Educ 760, 761, admission to program.

## CRIMINAL JUSTICE (CJ)

McDonald

### COURSE

**CJ 201 [Soc 160] Introduction to Criminal Justice (CCN)** 3  
Examination of the criminal justice system and process. Includes crime, law-making, criminality, prosecution, police, courts, and corrections.

## CROP AND WEED SCIENCES

(See Plant Sciences.)

## ECONOMICS (Econ)

Lambert, Chair; Gustafson, Hearne, Herren, Koo, B. Leitch, Mack, O'Relley

### COURSES

**105 Elements of Economics** 3  
Study of demand and supply, competitive and noncompetitive markets, concepts of national income, unemployment, inflation, money, and fiscal and monetary policies. This course cannot be substituted for Econ 201 and 202.

**201 Princ of Microeconomics (CCN)** 3  
See Agricultural Economics for description. (ND:SS)

**202 Princ of Macroeconomics (CCN)** 3  
See Agricultural Economics for description. (ND:SS)

**324 Money and Banking** 3  
Institutional and theoretical framework of the financial structure including the banking system, Federal Reserve, money markets, and international monetary systems. Prereq: Econ 201, 202.

**341 Intermediate Microeconomics** 3  
Analysis of markets in terms of efficiency, resource use, and economic welfare. Prereq: Econ 201, 202.

**343 Intermediate Macroeconomics** 3  
Analysis of national output, business cycles, inflation, unemployment rates, interest rates, exchange rates, impact of monetary and fiscal policies, and economic growth. Prereq: Econ 201, 202.

**456/656 History of Economic Thought** 3  
Development of economic thought from the mercantilists to Keynesian economics. Prereq: Econ 341 or Busn 451 and Econ 324 or 343.

**461/661 Economic Development** 3  
Analysis of the main causes of economic development. Prereq: Econ 341 or Busn 451.

**465/665 Labor Economics** 3  
Theoretical analysis and survey of empirical studies relating to labor markets, human capital formation, and nature and causes of unemployment. Prereq: Econ 341 or Busn 451.

**470/670 Public Finance** 3  
Taxation, intergovernmental fiscal relations, and public expenditures; implications of various taxation policies. Prereq: Econ 341 or Busn 451.

**472/672 International Trade** 3  
Theories of international trade, payments, and foreign exchange markets. Prereq: Econ 341 or Busn 451.

**476/676 Monetary Theory and Policy** 3  
Analysis of relationships among money, credit, employment, price stability, and national monetary policy. Prereq: Econ 324 or 343.

**480/680 Industrial Organization** 3  
Structural analysis of American industry in terms of the markets for business enterprise. Analysis of antitrust policy and its application to large corporations. Prereq: Econ 341 or Busn 451.

**481/681 Natural Resource Economics** 3  
Application of economic tools to evaluate natural resource policies. Concepts such as property rights, non-market goods, resource allocation over time, externalities, open access, and public goods are discussed in an intermediate micro-economics and calculus-based format. Prereq: Econ 341. Cross-listed with NRM.

**482 Environmental Economics** 3  
Application of economic tools to evaluate environmental policies. Topics include cost-benefit analysis, regulatory versus market pollution control approaches, environmental damage assessment, and green accounting. Prereq: Econ 341.

## EDUCATION (Educ)

Wigtill, Chair; Daniels, Haney, Miller-Boschert, Overton, Schmidt, Stammen, Wageman, Wilhelm

### COURSES

**120 Peer Counseling** 1  
Designed to bring peer counseling theory and practice together in helping freshmen overcome the hurdles of the first year. May be repeated.

**121 Improvement of Reading** 1  
A developmental reading program designed to help the student improve in reading efficiency.

**122 Interpersonal Relationships** 1  
Study of the development of interpersonal relationships with a focus on listening and sharing in an experiential manner.

**123 Study Skills** 1  
Assistance in the development of study skills necessary for academic achievement through learning and practice.

**124 Career Planning** 1  
Study of the world of work with attention to self-assessment, vocational choice, and career planning.

**125 Assertiveness Training** 1  
Behavioral approach to assertiveness combining a cognitive approach with role play and discussion.

**300 Orientation to Elementary Teaching** 2  
Overview of elementary education with special emphasis on the role of music and physical education. Required for K-12 certification in music and physical education.

**321 Introduction to Teaching** 3  
Nature and aims of education at middle and high school levels; social, philosophical, historical, curricular, and political foundations in a changing multicultural society; analyze teaching as a career choice, initiate teacher education program exit portfolio. Coreq: Educ 381 recommended.

**322 Educational Psychology** 3  
Review of human development with special emphasis on development of the young adolescent. Learning theories and learning styles with applications to individual student differences, exceptionalities, and cultural diversity; strong emphasis on educational research.

**381 Early Experience** 1  
Field-based experience in a middle or high school setting. Overview of professional educators; opportunity to observe and interact with students, teachers, and administrators. At least five hours required in special education classroom with ESL teacher. Coreq: Educ 321 recommended. Cross-listed with H&CE (CCN).

**389 [489] Native Americans and Multicultural Instructional Practices** 3  
History of North Dakota tribes and reservations. Traditional and modern Native American cultures and values. Issues in Native American education. Goals of multicultural education. Instructional strategies and resources for teaching students of diverse ethnic backgrounds.

**451 Instructional Planning, Methods, and Assessment** 3  
Process of planning for teaching and implementing plans; micro-teaching activities reflecting various models for middle and high school classrooms; personalizing instruction; meeting multicultural needs. Includes computer applications; use of audiovisual equipment and other resources. Prereq: Educ 321, 322, admission to School of Education (SOE).

**471/671 Middle School Philosophy and Curriculum** 2  
Educational foundations for middle schools, essential to meeting young adolescent needs and improving their learning. Identifies and expands central ideas in philosophy, historical background, curriculum, facilitating learning, organizational structures and practices, assessment, and planning. Prereq: Educ 451 or graduate standing.

**472/672 Middle Level Teaching Methods** 3  
Instruction and guidance in the design, implementation, and assessment of teaching strategies adapted to young adolescents. Prereq: Educ 451 or graduate standing.

**475 Reading in the Content Area** 2  
Introduction to the relevance and need for incorporating reading and developing reading skills in middle and high school classrooms.

**480 Stress Management** 2  
The dynamics of stress, sources and symptoms of stress, and stress management techniques will be presented and practiced.

**481, 482, 483 Classroom Practice/ Methods of Teaching I, II, III** 2-3 each  
Specialized methods and classroom practices appropriate to the specific subject area. Prereq: Educ 321, 322, 381, admission to School of Education.

**485 Student Teaching Seminar** 1  
Orientation to student teaching. Analysis of professional issues and concerns associated with education. Prereq: Admission to School of Education, completion of professional education courses; Coreq: Educ 486, 487.

- 486 Classroom Management for Diverse Learners** 2  
Examine and apply various classroom management and evaluation techniques to middle and high school levels. Offered during the student teaching semester as a five-week block prior to student teaching. Prereq: Completion of professional education courses, admission to School of Education.
- 487 Student Teaching** 6-12  
Supervised teaching in an approved and accredited school. Includes an on-campus seminar. Prereq: Completion of professional education courses, admission to School of Education. Cross-listed with H&CE.
- 702 Statistics in Educational Research** 2  
Basic theory; techniques for using descriptive and inferential statistics; application in educational research designs.
- 703 Research, Measurement, and Program Evaluation** 3  
Methodology and design of research studies; organization, reporting analysis, and interpretation of research.
- 710 Philosophy of Education** 2  
Major philosophical concepts and principles of education from Plato to the present.
- 712 Social, Cultural, and Political Dimensions of Schools** 4  
Social processes and interaction among diverse populations in educational settings. Relationship of schools to society.
- 714 History of American Education** 2  
Historical and intellectual development of education in the United States from the colonial period to the present.
- 716 Comparative Education** 2  
Analysis of educational systems of selected nations, including emerging and economically developed countries.
- 717 Adult Learning** 2  
Includes recent research concerning adult learning in the context of planning and operating effective adult education programs.
- 718 Community Education** 2  
Study of the theory base on which community education is founded. Consideration is given to implementing the concept in the community with available resources.
- 720 Supervision of Student Teachers** 2  
See Human and Community Education for description.
- 722 Instructional Systems, Media, Materials** 2  
Preparation of instructional systems in support of a variety of teaching techniques and alternative media approaches. Prereq: Educ 451.
- 724 Advanced Educational Psychology** 2  
Principles of effective human learning. Discussion of learning theories, the teacher as a director of learning experiences, and factors in students representing a variety of cultures and abilities in the educational setting.
- 726 Diagnosis of Learning Disabilities** 2  
Identification of different types of learning disabilities with an overview of diagnostic techniques and remediation procedures.
- 730 Leadership, Planning, and Organizational Behavior** 3  
Introduction to models of educational leadership including organizational structure, theory, and leadership styles. Consideration of concepts, problems, and issues in administration.
- 731 Educational Law and Organizational Structure of Schools** 3  
Examination of the legislative and judicial actions affecting the public schools. Consideration is given to contemporary legal issues for teachers, administrators, and boards.
- 732 Curriculum, Instruction, and Learning Theory** 4  
Investigation of curricular decision-making and program evaluation strategies as they affect the educational program. Problem-solving skills are presented through theory and simulation. Prereq: Educ 730.
- 733 Technology and Information Systems** 2  
Provides an understanding of selected computer applications for educational administrators at the building and district office levels.
- 734 Personal Communications and Ethics** 3  
Prepares aspiring school leaders to plan for their personal and professional development and to understand and use the principles of communication, ethics, and values.
- 735 Personnel, Supervision, and Staff Development** 4  
Specific techniques and systems to supervise instruction. Review of interpersonal communication and group process skills as applied to administrative supervision. Prereq: Educ 730.
- 736 Policy and Educational Finance** 2  
Provides school leaders with an understanding of managing and allocating resources in a political climate in which policy decisions are based on historical resource allocations.
- 737 The Helping Relationship and the Elderly** 3  
The theoretical foundations and the techniques of the helping relationship between the helper and people of advanced age will be studied and applied.
- 738 Administration of Elementary Schools** 2  
Common elements of leadership as they apply to the principalship. Consideration of practical applications in an elementary school setting. Prereq: Educ 730.
- 739 Administration of Secondary Schools** 2  
Common elements of leadership as they apply to the principalship. Consideration of practical applications in a secondary school setting. Prereq: Educ 730.
- 742 Elementary School Curriculum** 2  
History, development, evaluation, and revision of the curriculum. Review of recent research in elementary school curriculum.
- 743 Secondary School Curriculum** 2  
Study of contemporary curriculum patterns with emphasis on curricular construction and evaluation.
- 744 Administration of the Middle School** 2  
Organization and administration of educational programs for early adolescents with special consideration given to block scheduling, interdisciplinary teams, advisor-advisee problems. Prereq: Educ 730.
- 747 Analysis of Elementary Reading Instruction** 2  
Reading process, psychological and linguistic foundations, program assessments, and diagnostic approaches, skills, and individualization.
- 748 Collective Bargaining and Negotiation in Education** 2  
Study of the principles and processes of collective bargaining in public educational institutions. Development of negotiation skills through participation in simulations.
- 770 Empowerment and Advocacy in Human Development and Education** 3  
See Department for course description.
- 775 Content Area Reading** 2  
Examination of content, instructional methodologies, and evaluation techniques for reading in content classes.
- 777 Tort Liability** 2  
Examination of the legal liability of teachers, administrators, and public school boards for injurious intentional or unintentional acts. Prereq: Educ 731.
- 778 School Fund Management** 3  
Proper recording and reporting of financial accounts for elementary and secondary schools. Use of procedures and concepts for governmental fund accounting and financial management. Prereq: M.S. or equivalent in educational administration.
- 780 Instructional Models** 2  
Investigation of current practices and trends in instructional models. Emphasis is on the relationship of current research to contemporary practice.
- 781 Science Teaching and Curriculum** 3  
Overview of recent research on science teaching, learning, and curriculum. Special attention given to contemporary theories on science teaching models that enhance student understanding.

**782 Supervisory and Administrative Theories** 4

Study of management models and techniques, needs assessment, goal setting, planning and evaluation systems, and decision-making problems as they relate to the school improvement process. Prereq: Educ 732.

**783 Computer Data Management and Decision Making** 2

Interpretation of effective computer applications for computer use as a decision-making and planning tool for school finance and managerial functions relating to the field of school business administration and school district superintendency. Prereq: Educ 730 and 10 credits in educational administration.

**784 School Personnel Administration** 2

Study of personnel administration in public school systems. Includes an examination of the purposes, policies, plans, procedures, and personnel administration. Prereq: Educ 782.

**785 Organization and Administration of Vocational/Technical Education** 2

Overview of the vocational education services of local educational agencies and their relation to post-secondary education. Emphasis on planning, organizing, administering, and managing resources.

**786 School Facility Planning** 2

Overview of the principles in planning, construction, and maintenance of school buildings. Visits to educational facilities and the assessment of school buildings. Prereq: M.S. or equivalent.

**788 School Finance and Business Management** 4

Overview of school fund revenues and expenditures pertaining to local, state, and federal funding. Includes in-depth study of the practices of school business administration pertaining to all fund activities in instruction and ancillary operations.

**789 School Community Relations** 2

Purposes, organization, agencies, and criteria of good school-community relationships; knowledge and techniques for effective public relations. Prereq: Educ 739, M.S. or equivalent in educational administration.

## ELECTRICAL AND COMPUTER ENGINEERING (ECE)

Ewert, Chair; Farden, Glower, Green, Jorgenson, Katti, Mitra, Nelson, Patterson, B. Rao, Rogers, Stuehm, Tareski, Yuvarajan

**COURSES****111 Introduction to Electrical Engineering** 3

Introduction to electrical engineering; engineering problem solving, design, and professional issues. 3 lectures. Prereq: Math 105. F, S

**173 Introduction to Computing** 3

Programming in a high level language with applications to engineering computation, analysis, and design. 3 lectures, 1 recitation. F, S

**EE 206 [211] Circuit Analysis I (CCN)** 4

Linear electric circuits. Component models, circuit laws, transient analysis, design, computer tools. 3 lectures, 1 two-hour recitation. Prereq: Math 265 with grade of C or better and Phys 252. F, S

**275 [270] Digital Systems I** 3

Introduction to number systems, combinational circuits, and sequential circuits. 3 lectures. Cross-listed with CSci. F, S

**301 Electrical Engineering I** 3

Introduction to electrical engineering for non-majors. Fundamental laws of circuit analysis. Steady-state and transient analysis of DC and AC circuits. 3 lectures. Prereq: Math 265, Phys 252. F, S

**303 Electrical Engineering II** 3

Electronic circuits and their applications. Electromechanical energy conversion. Transformers, DC and AC machines. 3 lectures. Prereq: ECE 301. F, S

**306 Electrical Engineering Lab I** 1

Electronic instruments and measurements. Applications to electrical and electronic circuits, power devices, and systems. 1 two-hour laboratory. Coreq: ECE 303. F, S

**311 Circuit Analysis II** 3

Analysis of single-phase and three-phase circuits, Laplace transforms in circuit analysis, Phasor analysis. Two-port networks. 3 lectures. Prereq: EE 206 with grade of C or better, Math 266. F, S

**312 Digital/Analog Circuits Lab** 1

Experiments in digital and analog circuits. 1 two-hour laboratory. Prereq: ECE 275; Coreq: ECE 311. F, S

**314 Electromagnetics/Signals Lab** 1

Experiments in signals/systems and electromagnetics. 1 two-hour laboratory. Prereq: ECE 312, 351; Coreq: ECE 343. F, S

**321 Electronics I** 3

Characteristics and modeling of diodes, bipolar junction transistors, and MOSFETS. Biasing of transistors. Analysis of transistor amplifiers. Fabrication of integrated circuits. 3 lectures. Coreq: ECE 311. F, S

**322 Electronics I Laboratory** 1

Laboratory experiments on electronic devices and basic electronic circuits. 1 two-hour laboratory. Coreq: ECE 321. F, S

**323 Electronics II** 3

Frequency response of amplifiers. Feedback amplifiers. Power amplifiers. Introduction to digital electronics. 3 lectures. Prereq: ECE 321. F, S

**324 Electronics II Laboratory** 1

Experiments on electronic circuits and signals and systems. 1 two-hour laboratory. Prereq: ECE 322; Coreq: ECE 323, 343. F, S

**331 Energy Conversion** 3

Magnetic circuits, transformers, DC and AC rotating machines. 3 lectures. Prereq: ECE 311. F, S

**343 Signals and Systems** 3

Discrete-time and continuous-time signals and systems. Linearity, frequency response. Difference and differential equations. Transform techniques. 3 lectures. Prereq: ECE 311. F, S

**351 Applied Electromagnetics** 3

Electromagnetic waves in linear media, effects of boundaries, transmission lines, electrostatics, and magnetostatics. 3 lectures. Coreq: ECE 311. F, S

**373 Assembly Programming** 3

See Computer Science for description. Prereq: ECE 173 and 275. F, S

**374 Computer Organization** 3

See Computer Science for description. Prereq: ECE 173 and 275 or CSci 373.

**375 [370] Digital System Design and Implementation** 3

Experience with digital system design and prototyping, including use of digital laboratory equipment. 2 lectures, 1 two-hour laboratory. Prereq: ECE 173, 275. S

**376 Embedded Systems** 3

Use of microcontrollers for data acquisition and device control. Includes assembly language and high level programming, serial and parallel I/O, timers and interface design. 3 lectures. Prereq: ECE 173, 275, EE 206. F, S

**401 Design I** 3

Capstone experience in formulation and design of a system or device. Prereq: Senior standing. F, S

**402 Machines/Control Systems Lab** 1

Experiments in machines and control systems. One two-hour lab. Coreq: ECE 443, 461. F, S

**403 Design II** 3

Capstone experience in design of devices and systems. Constraints: performance, economics, environment, manufacturing, testing, maintenance, and protection of the public. Design trade-offs. Teamwork, concurrent engineering, product implementation. Prereq: ECE 401. F, S

**404 Communications/DSP Lab** 1

Experiments in communication systems and digital signal processing. Coreq: ECE 443. F, S

**411/611 Optics for Scientists and Engineers** 3

See Physics for course description

**421/621 Communication Circuits** 3

Resonant circuits and tuned amplifiers, oscillators, modulators and demodulators, phase-locked loops, and power amplifiers. Analysis, design, and applications in communication systems. 3 lectures. Prereq: ECE 323.

- 423/623 Digital Electronics** 3  
Analysis and design of digital integrated circuits. Characteristics and applications of logic gates and regenerative logic circuits. 3 lectures. Prereq: ECE 323. S
- 425/625 Introduction to Semi-Conductor Devices** 3  
Properties and applications of semi-conductors and solid state electronic devices. Semi-conductors, junctions, and transistors. 3 lectures. Prereq: ECE 321, 351.
- 431/631 Power Systems** 3  
Electrical characteristics of high voltage lines. Symmetrical components, per unit system, and transformers. Matrix methods, load flow, and fault analysis. 3 lectures. Prereq: ECE 311. F
- 433/633 Power Systems Design** 3  
Unbalanced power systems, economic dispatch, transients in power systems, power system stability, power system protection. 3 lectures. Prereq: ECE 311. S
- 437/637 Power Electronics** 3  
Characteristics and modeling of power electronic devices. Rectifiers, choppers, and inverters and their applications in power supplies and motor drives. 3 lectures. Prereq: ECE 321.
- 441 Random Processes** 3  
Principles of probability. Application of probability and statistics to engineering problems. 3 lectures. Prereq: Math 266. F, S
- 443/643 Communications I** 3  
Communications theory and design with an emphasis on spectral techniques. Modulation and noise effects. 3 lectures. Prereq: ECE 343; Coreq: ECE 441. F, S
- 445/645 Communications II** 3  
Continuation of ECE 443. Digital communications systems. Optimum receivers. Information theory and coding. 3 lectures. Prereq: ECE 443. S
- 453/653 Signal Integrity** 3  
Topics in system level signal integrity are presented. The construction and design of passive printed circuit cards are discussed, with computer aided design software used for analysis and class presentations. Circuit card fabrication issues and case examples of applications are discussed. Prereq: ECE 311, 351. S
- 455/655 Designing for Electromagnetic Compatibility** 3  
Principles and methods concerning electronic system designs that are not sources of or susceptible to electromagnetic interference. 3 lectures. Laboratory. Prereq: ECE 343, 351. F/2
- 457/657 Optical Signal Transmission** 3  
Optical signal transmission including geometric optics and modal analysis for homogeneous and inhomogeneous light guides. Systems studies including coupling, inter-symbol interference, sources, photodetectors, and modulation. 3 lectures. Prereq: ECE 351.
- 461 Control Systems** 3  
Analysis and design of control systems. Controller design to meet time and frequency specifications. 3 lectures. Prereq: ECE 343. F, S
- 463/663 Digital Control** 3  
Analysis and design of sampled-data control systems including z-transforms, sampling theory, design to specifications, controllability, observability, stability, and optimization. 3 lectures. Prereq: ECE 461.
- 470 Digital Systems II** 3  
Design and analysis of reliable digital systems through robust information coding, fault-avoidance, and fault-tolerance. 3 lectures. Prereq: ECE 275.
- 471 Computer Systems Design and Implementation** 3  
Design and implementation of reliable, interrupt-driven systems. Use of development tools. System components issues including co-processors, buses, run-time. Prereq: ECE 376, 401, CSci 474. S
- 483/683 Instrumentation for Engineers** 3  
Study of instrumentation including design, fabrication, and application. F
- 485/685 Biomedical Engineering** 3  
Unified study of engineering techniques and basic principles in physiological systems. Focus on membrane biophysics, biological modeling, compartmental analysis, and systems control theory. Prereq: Senior standing. F
- 487/687 Cardiovascular Engineering** 3  
This course includes the application of engineering techniques to cardiovascular physiology and medicine. Basic cardiac and vascular physiology will be presented, modeling techniques will be examined. Instrumentation, measurement theory, and assist devices will be discussed.
- 701 Advanced Engineering Problem Solving** 3  
Application of advanced mathematical and computational methods to engineering problems. 3 lectures.
- 702 Advanced Research Topics** 3  
Prepare the student in 1) finding a major adviser; define the research questions or objectives; 3) begin a literature search; and 4) learn how to prepare a manuscript and/or grant application with their major adviser.
- 703 Advanced Teaching and Classroom Topics** 1  
To help prepare the Ph.D. student for the challenge of teaching in a classroom.
- 721 Integrated Circuits** 3  
Introduction to CMOS circuits. Circuit characterization and performance estimation. CMOS circuit and logic design, CMOS testing. CMOS subsystem design. 3 lectures. Prereq: ECE 423/623.
- 723 Advanced Electronics** 3  
Characteristics and detailed modeling of operational amplifiers. Applications to waveform generation, analog multiplication, modulation, and data conversion. IC and special amplifiers. 3 lectures. Prereq: ECE 421/621. Alternate years.
- 731 Power System Protection** 3  
Power system protective relaying. Generator, transformer, line, bus, motor protection. 3 lectures. Coreq: ECE 433/633. S
- 733 Power Distribution** 3  
Power distribution systems. Lines and transformers, characteristics of loads, voltage drops and corrective measures, lightning protection. Fault analysis, fuses, reclosers, sectionalizers. Power system harmonics and power quality. 3 lectures. Coreq: ECE 431/631. F
- 741 Signal Processing I** 3  
Analysis and design of discrete- and continuous-time signals and systems. Advanced treatment of transform techniques and Fourier analysis. Classical filter design techniques. Fast Fourier transform algorithms and applications. 3 lectures. Prereq: ECE 443/643.
- 743 Signal Processing II** 3  
Discrete-time Wiener and Kalman filtering. Least squares signal processing and filter design. Spectral analysis. Adaptive signal processing. 3 lectures. Prereq: ECE 741. S
- 745 Statistical Communications** 3  
Advanced topics in communications theory including detection theory, estimation theory, and information theory. 3 lectures. Prereq: ECE 443/643. S
- 751 Electromagnetic Theory and Applications** 3  
Theory of radiation, antenna characteristics, complex waves, potential functions and spectral domain methods for waveguides and cavities, and dispersive media. 3 lectures. S/2
- 755 Advanced Topics in Electromagnetics** 3  
Topics of current interest in electromagnetics, microwaves, and optics. 3 lectures. Prereq: ECE 751 or departmental approval. S/2
- 761, 763 Advanced Control Theory I, II** 3 each  
State variable formulation of the control problem; system identification. Introduction to adaptive, distributed, multivariable, nonlinear, optimal, and stochastic control. Prereq for 761: ECE 461; Prereq for 763: ECE 761.
- 774 Computer Architecture** 3  
Processor operations, computer arithmetic, control mechanism, instruction sets, classification schemes, pipelining, parallel processing, hierarchical memory and memory management, I/O methods and interrupts, and interconnection buses. 3 lectures. Prereq: ECE 374.

**778 Computer Networks** 3  
Examination of computer networks using the ISO-OSI model as a framework. Exploration of practical and theoretical issues in modems, codes, error, impairments, modulation, protocols, and interfaces. 3 lectures. Alternate years. Prereq: CSci 474.

## EMERGENCY MANAGEMENT (EMgt)

### COURSES

**130 Principles of Emergency Management** 2  
Examines fundamental principles of emergency management and how public and private agencies work together to enhance disaster-related resources and capabilities.

**135 Emergency Planning** 1  
Develops capacity for effective participation in the all-hazard emergency operations planning process to save lives and protect property threatened by disasters or emergencies.

**167 State Hazard Mitigation Planning** 2  
Provides knowledge and skills needed to implement multi-hazard mitigation in communities long-range planning goals.

**185 Disaster Response and Recovery Operations** 2  
Introduces concepts and operations of a disaster environment, especially major disaster incidents, and examines state and local roles and responsibilities of response and recovery efforts.

**411/611 Community Disaster Preparation** 3  
Nature and rationale for public awareness of potential hazards that communities face, preparedness for these hazards, and potential strategies to mitigate adverse consequences.

**413/613 Building Disaster Resilient Communities** 3  
Role of emergency management programs in community resilience and sustainability; incorporation of preparedness, mitigation, response, and recovery in community comprehensive and strategic planning.

**415/615 Rural Society and Emergency Management** 3  
Application of emergency management principles and procedures of disaster preparedness, mitigation, and response, and recovery in the rural context.

**421/621 Hazard Mitigation Theory and Practice** 3  
Examination of disaster mitigation theory and the rationale and context of mitigation procedures, programs, and planning.

**431/631 Disaster Response Operations and Leadership** 3  
Principles and procedures related to emergency operations plans, warning, evacuation, search and rescue, mass casualty care, sheltering,

donations management, disaster declaration, and incident debriefing.

**451/651 Floods, Blizzards, and Tornadoes** 3  
Role of emergency management in floods, blizzards, and tornadoes; response of local, state, and federal governments and agencies to these conditions.

**453/653 Emergency Management Law and Ethics** 3  
Legal principles and ethical issues that impact emergency management services.

**461/661 Private Sector Crisis Management** 3  
Emergency management, risk assessment, component vulnerability, disaster recovery, and organizational continuity in the private sector.

**463/663 Voluntary Agency Disaster Services** 3  
Examination of the roles played by local, state, national, and international voluntary agencies in emergency preparedness, mitigation, response, and recovery.

**483/683 holistic Disaster Recovery** 3  
Examination of post-disaster policies and programs that protect the natural environment, improve disaster resistance, support diverse populations, improve economic conditions, and preserve community resources.

**489 Capstone in Emergency Management** 1  
Integrate course work taken in Emergency Management major; apply emergency management principles to real world events; and explore career and graduate options in the field of emergency management. Prereq: Senior standing.

**491/691 Disaster Analysis** 3  
Examination of natural and human-made disasters from a multidisciplinary perspective.

**712 Hazards Risk Assessment Theory and Practice** 3  
Examination of natural and human-made disasters from a risk assessment perspective, and preparedness and control procedures for each of these types of disasters.

**714 Hazardous Materials Regulation** 3  
Hazardous materials contingency planning and environmental regulations at the community, state, and federal levels.

**732 Disaster Response Theory and Practice** 3  
Examination of theory and practice in the relationship between incident command systems and emergency operating centers.

**782 Damage Recovery Theory and Practice** 3  
Theory, principles, and procedures used in disaster damage assessment and in emergency supply and service dissemination.

## ENGINEERING (Engr)

Helweg, Dean

### COURSES

**111 Introduction to Engineering** 1  
Designed to provide general engineering students with an opportunity to review, study, discuss, and evaluate various engineering professions as career choices. F, S

**310 Entrepreneurship for Engineers and Scientists** 3  
How to turn a great idea into a business by starting a company and/or profiting from a new invention. Developing a product, conducting patent searches, securing intellectual property rights, writing a business plan, obtaining financing, etc. are covered. F

**311 Impact of Technology on Society I** 3  
Study of the development of technology and its impact on the evolution of cities and societies; emphases on the forces that the technology has brought about on shaping and reshaping of the human environment. 3 recitations. F, S

**312 Impact of Technology on Society II** 3  
Study of the impact of technology on the natural environment; discussion of values, ethics, citizenship, social responsibilities, and relationship of humans and the natural and human-made environment. 3 recitations. F, S

**315 Impact of Energy on Society** 3  
Study of the development of energy and its impact on the evolution of modern society, history, and the environment. Discussion of world energy situation and current events. F, S

**320 Technical Communication** 3  
Application of written and oral aspects of technical communication geared especially toward the engineering profession. Students create documents and presentations for a variety of audiences and purposes. 3 recitations. Prereq: Engl 110. F, S

**402 Engineering Ethics and Social Responsibility** 1  
Philosophical basis for ethical decisions, guidance for ethical decision making in engineering practice, ethics of social responsibility, professionalism, case studies, and codes of conduct for engineers. F, S

**489 Collaborative Engineering Capstone** 3  
Integration of engineering and architecture topics and job functions projects. Students will plan, design, develop, verify, produce/construct/service facilities and systems created to fulfill industrial, agricultural, urban, and business needs. Prereq: Senior standing and approval of major department. F, S

**715 Engineering Systems** 3  
Interdisciplinary systems analysis approach to engineering problems. Mathematical and physical stochastic process and control systems.

- 721 Mechanics of Fluid States** 3  
Basic laws of fluid motion in differential and integral forms, Navier-Stokes equations, potential flow, boundary layer theory, dimensional analysis, and similitude. Computational fluid mechanics.
- 741 Systems—Linear and Nonlinear Concepts** 3  
Nonlinear and linear programming methods for engineering design optimization. Formulation and optimization of design problems from all areas of engineering.
- 742 Optimal Control Theory** 3  
Formulation of general control problems; controllability and observability in discrete and continuous systems; performance functionals; applications.
- 744 Modern Material Science** 3  
Internal structure of materials, diffusion, phase transformation, and structure control. Mechanical, electrical, magnetic, and optical properties of materials; engineering applications.
- 760 Thermodynamics** 3  
General foundations of thermodynamics valid for small and large systems and equilibrium and nonequilibrium states. Emphasis on the concepts of availability and its engineering applications.
- 762 Heat and Mass Transfer** 3  
Theory and application of transport of heat and mass. Heat diffusion equation in several coordinate systems. Fourier series and transforms and Laplace transform techniques. Mass transfer examples. Introduction to simulations.
- 770 Quantitative Modeling** 3  
Applications modeling and optimization methods. Domains: transportation, logistics, manufacturing, service systems scheduling, and supply-chain management. Decision models: linear programming and sensitivity analysis, transportation and assignment, network models and algorithms, and integer, dynamic and non-linear programming. Prereq: Math 265.
- 771 Probabilistic and Deterministic Methods** 3  
Applications modeling. Domains include transportation, logistics, manufacturing, service systems scheduling, and supply-chain management. Quantitative models and tools include Markov chains, stochastic processes, queuing, deterministic and stochastic decision analysis, time series, forecasting, and regression modeling. Prereq: Math 265 and IME 460/660.
- 780 Electromagnetic Theory** 3  
Physical concepts and mathematical solutions of Maxwell equations; boundary conditions, force, and energy equations; potential equations; Green's functions; wave equations, radiation, and propagation of electromagnetic waves. F/2
- 789 Advanced Research Methods in Engineering** 3  
Advanced study of the philosophy, reasoning, design, methods, and procedures employed in conducting and disseminating scientific research.
- Includes a survey of current and original research with interpretation and assessment.
- ENGLISH (Engl)**  
Brown, Chair; Bergman, Birmingham, Brooks, Cater (Emeritus), Cavins, Cosgrove, Fricker, Johnston, Krishnan, Martinson, Matchie, Nichols, O'Connor, Sandland, Scott, Shaw, Strandness, Trump, Ward
- COURSES**
- 086 Basic Writing** 3  
Basic work on word choice, sentence structure, paragraph development, and organization. *Does not satisfy any requirements for graduation.*
- 103 English for Non-Native Speakers: Grammar/Writing** R-5  
Grammar, usage, syntax, and extensive work with sentence and paragraph structure, stressing unity, coherence, and emphasis for ESL students. *Does not satisfy any requirements for graduation.*
- 104 English for Non-Native Speakers: Vocabulary/Reading** R-5  
Intensive instruction in vocabulary and reading skills required for successful completion of university work by speakers of English as a second language (ESL). *Does not satisfy any requirements for graduation.*
- 106 English for Non-Native Speakers: Oral Skills** R-5  
Intensive instruction in speaking and listening skills required for successful completion of university work by ESL students. *Does not satisfy any requirements for graduation.*
- 107 English for Non-Native Speakers: Advanced Skills** R-5  
Development of advanced level English skills in speaking, listening, reading, and writing for non-native speakers. Emphasis on skills needed for academic work. May be repeated. *Does not satisfy any graduation requirements.*
- 110 College Composition I (CCN)** 3  
Guided practice in college-level reading, writing, and critical thinking. Includes process writing and an introduction to library research. (ND:Engl)
- 111 Honors Composition I (CCN)** 3 each  
Accelerated reading, writing, and critical thinking activities designed to enhance qualified students' well-developed skills of language use. Requires enrollment in the Scholars Program. Equivalent to Engl 110.
- 112 ESL College Composition I (CCN)** 4  
Guided practice in college level reading, writing, and critical thinking, with special attention to the issues of usage encountered by non-native speakers of English. Includes process writing and an introduction to library research. Equivalent to Engl 110.
- 120 College Composition II (CCN)** 3  
Advanced practice in college-level writing from sources and in applying rhetorical strategies. Requires library research and use of summaries, paraphrases, and quotations from relevant sources in analysis and persuasion essays. Prereq: Engl 110. (ND:Engl)
- 121 Honors Composition II (CCN)** 3  
Accelerated practice in college-level writing for qualified students' with skills in research and argumentation. Essays using library research and summaries, paraphrases, and quotations from relevant sources. Requires enrollment in the Scholars Program. Equivalent to Engl 120. Prereq: Engl 111.
- 122 ESL College Composition II (CCN)** 4  
Guided advanced practice in college level writing from sources and in rhetorical strategies, with additional support related to higher level language acquisition and usage for non-native speakers of English. Equivalent to Engl 120. Prereq: Engl 112.
- 215 Writing for Work (CCN)** 3  
Introduction to business and technical writing and to strategies for completing business-related writing projects. Prereq: Engl 110, 120.
- 220 Introduction to Literature (CCN)** 3  
Reading and discussion of representative examples of poetry, drama, and fiction, with emphasis on the use of common literary terminology. Classic and contemporary works. Focus on enjoyment and appreciation of verbal art. Prereq: Engl 120. (ND:Hum)
- 222 Introduction to Poetry (CCN)** 3  
Examination of poetic forms including the uses of figurative language and the techniques of rhythm and meter, as well as imagery and structure. Includes traditional and contemporary lyrics.
- 225 Introduction to Film (CCN)** 3  
General introduction to film studies, including analysis of narrative and stylistic elements of films for their artistic merits and their reflection of an influence on society.
- 226 The Poetry of Rock (CCN)** 3  
Examination of rock lyrics as contemporary poems, using techniques of literary criticism to analyze their themes, their aesthetic principles, and their place in art and culture.
- 240 World Literature Masterpieces (CCN)** 3  
Study of representative cultural and literary materials from the ancient world to modern times.
- 251 British Literature I (CCN)** 3  
Survey of major works and writers in British literature from the Anglo-Saxon period through the 18th century.
- 252 British Literature II (CCN)** 3  
Survey of major works and writers in British literature from the romantic age to the present.
- 261 American Literature I (CCN)** 3  
Survey of major works and writers in American literature from the colonial period through the Civil War. Emphasis on the development of unique American values and literature.

- 262 American Literature II (CCN)** 3  
Survey of major works and writers in American literature from the Civil War to the present. Includes traditional as well as experimental, innovative, and counter-cultural works and authors.
- 271 Literary Analysis (CCN)** 3  
Introduction to traditional and contemporary approaches in the study of literature and the fundamental skills required for the analysis of literary texts.
- 275 Introduction to Writing Studies** 3  
A broad history of writing, as well as a focused introduction to "writing studies" as reflected in the study of literature, creative writing, composition, and professional/technical writing. Prereq: Engl 120.
- 320 Practical Writing** 3  
Intensive practice of the writing needed in professional settings: writing to inform, analyze, evaluate, and persuade. Prereq: Engl 120, Junior standing.
- 322, 323 Creative Writing I, II** 3 each  
Writing poetry, short stories, and nonfiction, with the goal of publishing a manuscript. Exploration of contemporary genres and writing techniques. Prereq: Engl 120.
- 330 British and American Women Writers** 3  
Investigation of the literary portrayal of women and its effects on society. Some consideration of problems specific to women writers.
- 331 Contemporary Women Writers** 3  
Study of the language, imagery, themes, and genres in 20th century literature by women of various cultural, ethnic, and national backgrounds.
- 333 Fantasy and Science Fiction** 3  
Study of social and psychological implications of fantasy literature and works of fiction concerned with the impact of science and technology on the human imagination.
- 335 Multicultural Writers** 3  
Major literary figures within and outside the United States. Includes Asian, Mexican, and Canadian, as well as Native-American, Black, Asian-American, and Chicano writers.
- 340 19th-Century American Novel** 3  
Selected novels reflecting problems and ideas, including minority viewpoints, of the Westward Movement during the 1800s. Emphasis is on change from romantic to realistic/naturalistic genres.
- 341 20th-Century American Novel** 3  
Selected novels reflecting social, psychological, and literary trends after World War I. Includes multicultural and women authors, as well as recent experiments in the genre.
- 342 19th-Century American Short Story** 3  
Development of the American short story is traced from its hidden beginnings in Ben Franklin through the 19th-century romantics, regionalists, realists, and naturalists.
- 343 20th-Century American Short Story** 3  
Development of the American short story is traced by focusing on psychological realists, social critics, regionalists, Freudians, and the story of manners.
- 344 American Drama** 3  
20th-century traditions and experiments on the American stage. Includes classic writers like O'Neill, Williams, Miller, and Albee, as well as recent authors and techniques.
- 345 Themes in American Culture** 3  
A multidisciplinary approach, including art, music, and literature, to various eras and themes in American cultural history.
- 358 Intermediate Composition** 3  
Frequent essays emphasizing clear reasoning, effective structure, and a polished style for writing in the humanities and social sciences. Prereq: Engl 120, Junior standing.
- 380 Shakespeare** 3  
Study of representative comedies, histories, and tragedies.
- 450/650 Contemporary Linguistics** 3  
Language characteristics (sound, structure, meaning, conversation), relation to culture, first and second language acquisition.
- 451/651 Advanced English Grammar** 3  
Examination of the systematic structure and rules underlying English constructions; examination of current theories of syntactic analysis in both theoretical and pedagogical applications and issues concerning use and grammar. Prereq: Engl 450.
- 452/652 History of the English Language** 3  
Development of the English language from its Germanic origins to the modern period.
- 453/653 Social and Regional Varieties of English** 3  
Regional and social variables affecting language uses; attitudinal considerations with emphasis on the educational and sociopolitical ramifications of standardization policies. Focus on American English with reference to British and other English dialects.
- 454/654 Language Bias** 3  
Examination of how social asymmetries of race, gender, and ethnicity are reflected and sustained in discourse practices. Use of current critical linguistics theories to examine how gender, racial, ethnic abilities/disabilities are manifested through language.
- 458/658 Advanced Writing Workshop** 3  
Practice writing, revising, and editing essays for different audiences and purposes. Frequent response from peers and instructor. Analysis of selected readings and students' own writing. Prereq: Engl 358, Junior standing.
- 462/662 Modern European Drama** 3  
Study of representative modern plays and authors, including English and Irish, as well as those of continental Europe.
- 464/664 Comparative Literature** 3  
Study of important works of world literature in a particular genre: epic, romance, drama, or novel.
- 467 English Studies Capstone Experience** 3  
Cumulative and integrative study for English majors of English language, literature, and composition, which emphasizes the history of and the most current practices in English studies. Prereq: Engl 271.
- 470/670 American Literary Renaissance** 3  
Intensive study of major romantic and post-romantic figures, such as Hawthorne, Melville, Emerson, Thoreau, Stowe, Jewett, Whitman, and Dickinson. Combination varies.
- 471/671 American Realistic Literature** 3  
Principles of American literary realism as exhibited in the major works of Howells, James, Twain, Crane, Chopin, Gilman, Norris, Wharton, Dreiser, and others. Combination varies.
- 472/672 20th-Century American Writers** 3  
Intensive study of major American writers from 1900 to 1950.
- 473/673 Contemporary American Literature** 3  
American experimental and innovative literature from 1950 to the present, including existential, Black, women's, and social criticism works.
- 474/674 Native American Literature** 3  
The development of literature by and about Native Americans is traced from 1850 to the present. Focus on Native American identity and contributions to the American culture.
- 475/675 Regional Literature** 3  
Study of the literature and ideas of different regions of 20th-century America—South, West, and Midwest. Emphasis is on regional authors and unique genres.
- 477/677 Modern Poetry** 3  
Major poets in English during the 20th century up to World War II. Alternates between British and American poets, including Yeats, Auden, Smith, Eliot, Pound, Bishop.
- 480/680 Medieval Literature** 3  
British poetry and prose from the beginning of the Middle Ages to 1500, excluding Chaucer.
- 481/681 Chaucer** 3  
Intensive study of *The Canterbury Tales* plus selected readings from Chaucer's other works.
- 482/682 Renaissance Literature** 3  
Study of British writers of the 16th and 17th centuries, focusing on such writers as More, Sidney, Spenser, Shakespeare, Jonson, Donne, Browne, and Milton.

- 484/684 Restoration and 18th-Century Drama** 3  
Comedy, tragedy, and farce from Dryden to Sheridan.
- 485/685 18th-Century Literature** 3  
Study of major writers: Dryden, Pope, Swift, and Johnson, with occasional excursions into the fictional territory of Richardson, Fielding, Sterne, and Smollett.
- 486/686 Romantic Literature** 3  
Study of major British writers from the French Revolution to the coronation of Queen Victoria.
- 487/687 Victorian Literature** 3  
Study of the nonfiction and poetry of 19th-century England. Focus on revolutionary ideas as they evolved and changed Victorian society.
- 488/688 20th-Century British Writers** 3  
Study of selected British writers from the Edwardian period to the present.
- 489/689 British Novel** 3  
Study of selected major British novels from the 18th century to the present.
- 755 Composition Theory** 3  
Study of contemporary theories of teaching writing with frequent summary/response papers on assigned readings and a research paper on composition theory.
- 756 Composition Research** 3  
Study of designs and basic statistics for writing research; analysis of current research; and a research project in composition. Prereq: Educ 481 and 482 or Engl 764 or departmental approval.
- 757 Composition Studies** 3  
Overview of major areas in composition studies (rhetoric and composition, theory and practice, research, and instructional trends).
- 758 Composition and Rhetoric** 3  
Introduction to sources and elements of classical rhetoric and their relevance to composition instruction today. Analysis of rhetorical elements, practice writing effective arguments, application to teaching writing.
- 759 Trends in Writing Instruction** 3  
Study of trends and movements in education that have influenced and continue to influence writing instruction in secondary schools and colleges in the United States.
- 760 Graduate Scholarship** 3  
Introduction to scholarship in English studies and to the nature and state of the discipline.
- 762 Critical Theory** 3  
Study of contemporary literary theory and criticism.
- 764 Classroom Strategies for TAs** 3  
Introduction to current issues in composition pedagogy, research, and theory, focusing on how they inform teaching practices. Instruction on developing philosophy of and strategies for teaching through short position papers, literacy autobiography, and a sequence of assignments for English 120.
- 770 Studies in American Literature** 3  
Intensive study of a special period, theme, technique, or group of writers central to the formation, development, or flowering of American literature.
- 780 Renaissance Literary Studies** 3  
Intensive study of a special theme, form, or group of writers central to the formation and development of British literature in the Renaissance period.
- 781 18th-Century Literary Studies** 3  
Intensive study of a special theme, form, or group of writers central to the formation and development of British literature in the 18th century.
- 782 19th-20th Century British Literature** 3  
Intensive study of a special theme, form, or group of writers central to the formation and development of recent British literature.
- ENTOMOLOGY (Ent)**  
Brewer, Chair; Boetel, Foster, Glogoza, Harris, Olson, Rider
- COURSES**
- 210 Insects, Humans, and the Environment** 3  
Insect biology and its relevance to humans and the environment. 2 lectures. S
- 350 General Entomology** 5  
Fundamental aspects of insect structure, classification, and biology with sections emphasizing horticultural entomology, agronomic crop protection, insect ecology, and aquatic entomology. 3 lectures, 1 three-hour laboratory. F
- 731 Principles of Integrated Pest Management** 3  
Principles embodied in the implementation of multifaceted tactics designed to successfully manage pest populations. Prereq: Ent 350. S (even years)
- 732 Plant Resistance to Insects** 2  
Plant/insect interactions and their applications to plant breeding to increase resistance to pests. Prereq: Ent 350. F (even years)
- 741 Scientific Writing for Entomologists** 2  
Development of writing styles and skills and presentation of technical data. S (odd years)
- 742 Quantitative Biology** 2  
Philosophy and techniques for collecting, handling, and interpreting research data in the biological sciences. Prereq: Stat 330. S (odd years)
- 750 Systematic Entomology** 5  
Introduction to systematic methods and principles; identification of common families of insects. Prereq: Ent 350. F (even years)
- 751 Immature Insects** 3  
Characteristics of the immature forms of the orders and principal families of insects. Prereq: Ent 750. F (odd years)
- 760 Insect Structure** 4  
Structure of insects and physiological functions. The development of adult form from embryonic and larval precursors during growth and metamorphosis; evolutionary development of insect structures. Prereq: Ent 350. F (odd years)
- 761 Insect Physiology** 4  
Function of major insect organ systems and metabolism, growth, and molting of insects. Prereq: Ent 201, Chem 260. S (odd years)
- 765 Biological Control of Insects and Weeds** 3  
The natural or applied regulation of pests by predaceous and parasitic insects and pathogens. Prereq: Ent 350. F (odd years)
- 770 Insect Ecology** 3  
Role of insects in ecological communities. Emphasis on the importance of insects in development of ecological concepts and as primary herbivores, which provide an interface between plant and animal ecology. S (even years)
- EQUINE STUDIES**  
(See Animal and Range Sciences.)
- FAMILY AND CONSUMER SCIENCES EDUCATION**  
(See Human and Community Education.)
- FOOD AND NUTRITION**  
(See Health, Nutrition and Exercise Sciences.)
- FOOD SAFETY (Safe)**  
Nolan, Director; Bhattacharya, Coleman, Garden-Robinson, Gustad, Haggart, Hall, Horne, Jensen, Lardy, Logue, Marchello, Nganje, Panigrahi, Robinson, Schwarz, Sellnow
- COURSES**
- 450/650 Food Safety for the Food Industry and Consumers** 3  
A brief overview about food safety hazards, followed by discussions of sanitation, handling, processing, and serving food leading to explanation of Quality Assurance Programs at the farm and HACCP in food processing and food service.
- 452 Food Laws and Regulations** 3  
Regulations, laws, and dynamics governing development of food policy. Cross-listed with CDFS and AgEc. Prereq: Safe 470.
- 460/660 Etiology of Foodborne Illness** 3  
Study of the etiology, prevention, pathogenesis, and disease manifestations of foodborne illnesses, including those caused by pathogens, allergens, toxins, and contaminants, detection of the etiologic agents, and their entrance into the food chain. Prereq: Biol 202 and 202L. Cross-listed with Microbiology.

**470/670 Economic Epidemiologic and Regulatory Issues in Food Safety** 3

The study of the economic impact of foodborne illness and its prevention and tracking, and the regulations governing food safety in the U.S. and their impact on global trade. Prereq: Stat 330.

**474 Epidemiology** 3

Study of the distribution and dynamics of disease in populations. Cross-listed with Micr 470. Prereq: Stat 330 and Safe 470.

**480 Food Safety Practicum** 2

An integrated, laboratory study of food safety. Field trips, specialty speakers, workshops, and case studies will be used to foster students' abilities to solve food safety problems from farm to fork. Coreq: Safe 450, 460, 470. Cross-listed with Microbiology.

**485 Crisis Communication** 3

See Communication for description.

**486 Capstone Experience in Food Safety** 2

Integration of principles of food safety with the development of skills in solving food safety problems. Prereq: Senior standing in Food Safety minor.

**720 Food Safety Costs and Benefits Analysis** 3

Theoretical and empirical impacts of food safety costs and benefits. Three lectures. Prereq: SAFE 470/670, AgEc 670. Cross-listed with AgEc.

**725 Food Policy** 3

Provides quantitative tools and models used to analyze general food safety policies. Three lectures. Prereq: SAFE 470/670. Cross-listed with CFS and AgEc.

**750 Advanced Topics in Epidemiology** 3

Distribution and dynamics of disease in populations, and factors contributing to the costs of foodborne illness and its prevention. Three lectures. Prereq: SAFE 474/674, Micr 460 recommended. Cross-listed with Micr.

**752 Advanced Food Microbiology** 3

State-of-the-art techniques in isolation, detection, and characterization of food-borne pathogens. Three lectures. Prereq: Micr 653 or 660L, Safe 474/674, Micr 460 recommended. Cross-listed with CFS and Micr.

**762 Advanced Pathogenic Bacteriology** 3

See Microbiology for course description.

**785 Advanced Crisis Communication** 3

See Communication for course description.

**786 Risk Communication** 3

Explores the relationship between communication strategies and risk perception, assessment and management. 3 lectures. Prereq: permission of instructor. Cross-listed with communication.

**FRENCH (Fren)**

Homan, Chair; Hageman, Saar

**COURSES**

**101, 102 First-Year French I, II (CCN)** 4 each

Basic structures and vocabulary of French. Practice in the fundamentals of listening, speaking, reading, and writing. No previous knowledge of French required. 101:(ND:Hum)

**201, 202 Second-Year French I, II (CCN)** 3 each

Emphasis on developing proficiency in the four language skills. Review of grammar, practice in composition, and cultural and literary readings. Prereq: Fren 102 or equivalent.

**311, 312 French Conversation and Composition I, II** 3 each

Advanced practice to develop greater proficiency in oral and written skills through the study of cultural and literary readings. Prereq: Fren 202 or equivalent.

**315 Introduction to French Civilization** 3

Introduction to the political, social, and cultural history of France. Includes important schools of art, music, and architecture. Taught in French. Prereq: Fren 312.

**350 Introduction to French Linguistics and Pronunciation** 3

Study of the basic nature and function of languages as applied to French. Application of principles of phonetics to the pronunciation of the French language, plus extended practice in diction and intonation. Prereq: Fren 312.

**380 Women in French Literature** 3

Study of works by French women writers of different literary periods; portrayal of women by French male and female authors. Taught in English; counts toward French major/minor; counts toward women's studies minor.

**381 Masterpieces of French Literature in Translation** 3

Designed for those with no background in French. Introduction to important writers of several periods. Taught in English. *Does not count toward a French major or minor.*

**410 French Literature to 1600** 3

From La Chanson de Roland, courtly romances, and early poetry and theatre to Rabelais, the Pleiade, and Montaigne. Taught in French. Prereq: Fren 312.

**411 17th and 18th Century French Literature** 3

Literature of le grand siecle, the Enlightenment, and the pre-Revolutionary years. Taught in French. Offered alternate years. Prereq: Fren 312.

**412 19th and 20th Century French Literature** 3

From 19th-century romanticism, naturalism, and symbolism to the literature of modern France. Taught in French. Offered alternate years. Prereq: Fren 312.

**489 [499] Senior Thesis** 1-6

Capstone experience option. Research and original investigation under the guidance of a faculty member. Student work to be written in French.

**GEOGRAPHY (Geog)**

Ashworth, Chair; Arthur, Hatzembuhler, Saini-Eidukat, Schwert

**COURSES**

**151 Human Geography (CCN)** 3

Non-ethnocentric understanding of geography of human lifestyles and activities; their place and role in human-environment interaction.

**161 World Regional Geography (CCN)** 3

Study of geographic processes shaping major world regions and inter-relationships in the global village; geographic bases and implications of current world events.

**262 Geography of North America (CCN)** 3

Spatial approach to the development of the United States and Canada, which stresses changing cultural landscapes and assessing impacts of planning for resource utilization.

**315 Upper Midwest Geography** 3

Geography of the Upper Midwest region including Minnesota, North Dakota, South Dakota, and parts of adjacent states and provinces. Offered periodically.

**412/612 Geomorphology** 3

See Geology for course description.

**455/655 Introduction to Geographic Information Systems** 3

Introduction to basic concepts of geographic information systems and their applications to various spatial problems. Lectures and laboratories.

**456/656 Advanced Geographic Information Systems** 3

Advanced methods in Geographic Information Systems development and technology. Continuation of Geog 455/655, focusing on vector data structures, spatial analysis, and spatial decision support systems. Comprehensive lab assignments included to give students hands-on experience solving problems with state-of-the-art software. Prereq: Geog 455/655.

**GEOLOGY (Geol)**

Ashworth, Chair; Arthur, Hatzembuhler, Saini-Eidukat, Schwert

**COURSES**  
**105, 105L Physical Geology, Lab (CCN)** 3,1

Study of the Earth as a physical body; its structure, composition, and the geologic processes acting on and within the Earth. (ND:LabSc)

- 106, 106L The Earth Through Time, Lab (CCN)** 3  
Introduction to the Earth through time; its origin, history, and evolution of animal and plant life. (ND:LabSc)
- 300 Environmental Geology** 3  
Human interaction with Earth's environment. Earthquakes, floods, volcanoes, landslides, water use, pollution, energy, mining, and land-use planning. Offered alternate years. Prereq: Geol 105, 105L.
- 301 Lake Superior Field Course** 2  
Stratigraphy, mineralogy, and economic geology of northern Minnesota and northwestern Ontario. Weekly lecture, plus six-day field excursion. Offered periodically. Fee required. Prereq: Geol 105, 105L, 106, 106L, departmental approval.
- 302 Black Hills Field Course** 2  
Stratigraphy, structure, and mineralogy of the Black Hills and Williston Basin. Weekly lectures, plus seven-day field excursion. Offered periodically. Fee required. Prereq: Geol 105, 105L, 106, 106L, departmental approval.
- 303 Paleontology Field Course** 1  
Paleozoic stratigraphy and paleontology of southeastern Minnesota and northern Iowa. Lecture by arrangement, plus 1 three and one-half day field excursion. Offered alternate years. Fee required. Prereq: Geol 106, 106L, departmental approval.
- 304 Eastern North Dakota Field Course 1**  
Field study of Mesozoic and Cenozoic sediments of eastern North Dakota. Two-day field excursion and a report. Fee required. Prereq: Geol 105 or 106, departmental approval.
- 350 Invertebrate Paleontology** 3  
Survey of invertebrate fossils emphasizing systematics, environments and as stratigraphic markers. Offered alternate years. Prereq: Geol 106, 106L.
- 410 Sedimentology/Stratigraphy** 4  
Origin and classification of sedimentary rocks and their stratigraphic relationships. 3 lectures, 1 laboratory. Offered alternate years. Prereq: Geol 105, 105L, 106, 106L.
- 412/612 Geomorphology** 3  
Land forms and the processes by which they are formed and modified. 3 lectures, 1 two-hour laboratory. Offered alternate years. Prereq: Geol 105, 105L. Cross-listed with Geog.
- 413/613 Glacial Geology** 3  
Origin and operation of glaciers; geological work of glaciers, history of glaciations with emphasis on those of the Pleistocene Epoch. Offered periodically. Prereq: Geol 105, 105L, Junior standing.
- 414/614 Hydrogeology** 3  
See Department for course description.
- 420/620 Mineralogy** 4  
Crystal forms, crystal chemistry, and formation of non-silicate and silicate minerals. Offered alternate years. Prereq: Chem 121 or 150.
- 421/621 Mineralogy Laboratory** 2  
Identification and classification of minerals using morphology, physical properties, XRF and XRD. Offered alternate years. Coreq: Geol 420/620.
- 422/622 Petrology** 4  
Principles of igneous and metamorphic petrology including geochemistry, phase relations, and rock forming processes. Offered alternate years. Prereq: Geol 420/620.
- 423/623 Petrography** 2  
Identification and classification of rocks in hand specimens and thin sections. Optical mineralogy. Field and laboratory projects required. Offered alternate years. Prereq: Geol 422/622.
- 426/626 Crystallography/Crystal Chemistry** 2  
See Chemistry for description.
- 427/627 X-Ray Diffraction** 2  
See Chemistry for description.
- 428/628 Geochemistry** 3  
Introduction to geochemistry: chemistry of the Earth, groundwater, isotopes, global geochemical cycles, geochemical modeling, and environmental geochemistry. Offered alternate years. Prereq: Chem 121 or 150. Cross-listed with Chem.
- 440/640 Quaternary Biology** 4  
Biotic responses to climatic changes; the role of adaptation, extinction, and dispersal in response to the climatic changes of the Quaternary. 2 lectures, field and laboratory studies. Offered periodically. Prereq: Geol 106 and 106L or departmental approval.
- 450/650 Field Geology** 3  
Interpretation of geology in the field; preparation of base maps and plotting geological data. Lectures and one week fieldwork. Offered alternate years. Fee required. Prereq: Geol 410, 421/621, 423/623, 457/657.
- 457/657 Structural Geology** 4  
Dynamics of rock deformation and analyses of Earth structure. Offered alternate years. Prereq: Geol 105, 105L, trigonometry, geometry.
- 460/660 Biogeochemistry** 3  
An overview of how life affects Earth's chemistry, examining interactions between the atmosphere, the land surface, and the oceans. Biotic mechanisms will be followed via the global cycles of biologically relevant elements stressing human impacts. Prereq: Geol 105/105L, 106/106L, Chem 121, 122, Biol 150, 151.
- 760 Advanced Biogeochemistry** 3  
Examines the nature of the interaction between Earth's biogeochemical cycles and climate and how this interaction has evolved over time and will change in the future. Prereq: Geol 460/660.
- GERMAN (Germ)**  
Zenner
- COURSES**
- 101, 102 First-Year German I, II (CCN)** 4 each  
Basic structures and vocabulary of German. Practice in the fundamentals of listening, speaking, reading, and writing. No previous knowledge of German required. 101:(ND:Hum)
- 201, 202 Second-Year German I, II (CCN)** 3 each  
Emphasis on developing proficiency in the four language skills. Review of grammar, practice in composition, and cultural and literary reading. Prereq: Germ 102 or equivalent.
- 311, 312 German Conversation and Composition I, II** 3 each  
Advanced practice to develop greater proficiency in oral and written skills through the study of cultural and literary readings. Prereq: Germ 202 or equivalent.
- 315 Introduction to German Civilization** 3  
Introduction to the political, social, and cultural history of German-speaking lands. Includes important schools of art, music, and architecture. Taught in German. Prereq: Germ 312.
- 350 Introduction to German Linguistics and Pronunciation** 3  
Study of the basic nature and function of languages as applied to German. Application of principles of phonetics to the pronunciation of the German language. Extended practice in diction and intonation. Prereq: Germ 312.
- 401 Advanced German Grammar and Writing** 3  
Writing with primary focus on form, syntax, and style. Taught in German. Prereq: Germ 312.
- 410, 411, 412 Survey of German Literature I, II, III** 3 each  
Literature from 800-1680, 1680-1880, 1880 to present, respectively. General view of periods, movements, and cultural background using representative authors. Taught in German. Prereq: Germ 312.
- 489 Senior Thesis** 1-6  
Capstone experience option. Research and original investigation under the guidance of a faculty member. Student work to be written in German.
- Modern Language (Lang)**  
Uniform numbered courses offered irregularly. Initiated by the department.

# HEALTH, NUTRITION AND EXERCISE SCIENCE (HNES)

Strand, Chair; Albrecht, Ary, Barney, Barnhart, Driscoll, Edwards, Garden-Robinson, Hadley, Hansen, Liguori, Maughan, McLeod, Pleban, Rhee, Terbizan, Winters

## COURSES

<b>HPER 100 Concepts of Fitness and Wellness (CCN)</b>	2	Facts about exercise and physical fitness.
<b>110 Introduction to Health, Physical Education, and Recreation</b>	1	Introduction to career opportunities and requirements within the profession. Investigation of the various majors in health, physical education, and recreation. Coreq: HNES 150, 170, 180 or HPER 200.
<b>111 Wellness</b>	3	Examination of personal lifestyle choices related to emotional, nutritional, and mental well-being. 3 lectures.
<b>112 Activity II</b>	1	Basic techniques and practice of individual and dual sports activities.
<b>113 Activity III</b>	1	Basic techniques and practice of team sports.
<b>114 Racquetball</b>	1	Basic techniques and practice of racquetball.
<b>115 Bowling</b>	1	Basic techniques and practice of bowling.
<b>117 Judo</b>	1	Basic techniques and practice of judo.
<b>118 Tae Kwon Do II</b>	1	See Department for course description.
<b>119 Beginning PADI Open Water Scuba</b>	2	Beginning level scuba skills. Continuing Education course.
<b>120 Swimming I</b>	1	Technique and practice in Levels I-IV of the American Red Cross Swimming Program.
<b>121 Swimming II</b>	1	American Red Cross Level V-VII advanced level swimming techniques and practice. Prereq: HPER 120 or swimming proficiency.
<b>122 Advanced PADI Open Water Scuba</b>	2	Advanced level scuba skills. Continuing Education course.
<b>125 Folk and Square Dance</b>	1	Basic techniques and practice of folk dances of selected countries.
<b>126 Social Dance</b>	1	Basic techniques and practice of social and ballroom dance forms such as foxtrot, waltz, jitterbug, polka, schottische, and Latin American dances.
<b>129 Aerobic Dance</b>	1	Basic techniques and practice in aerobic exercise and dance activities.
<b>141 Food Sanitation</b>	1	Principles of safe food handling practices in the home and commercial operations. 3 lectures. Prereq: Biol 202, F&N 262.
<b>150 Foundations of Physical Education</b>	2	Introduction to developing a conceptual framework for teaching physical education. Includes an overview of the preparation needed and what is expected of physical education teachers. Coreq: HNES 110.
<b>151 Professional Preparation in Recreational and Adventure Sports</b>	3	Instruction in the fundamentals of recreational and adventure sports such as ultimate frisbee, archery, fencing, orienteering, new games, and cooperative activities. Limited to HNES majors and minors.
<b>152 Professional Preparation in Team Sports</b>	3	Instruction in the fundamentals of team sports such as soccer, football, volleyball, basketball, softball, and team handball. Limited to HNES majors and minors.
<b>153 Professional Preparation in Dance</b>	3	Instruction in the fundamentals of various types of dance such as line dances, folk dances, square dances, and other contemporary dances. Limited to HNES majors and minors.
<b>154 Professional Preparation in Elementary School Activities</b>	3	Instruction of various fundamental movements for elementary aged students. Students will be exposed to such activities as dance, gymnastics, fundamental movement skills, and games.
<b>155 Professional Preparation in Individual and Dual Sports</b>	3	Instruction in the fundamentals of individual and dual sports such as badminton, golf, tennis, pickleball, and racquetball. Limited to HNES majors and minors.
<b>170 Introduction to Human Performance and Fitness</b>	2	Discussion of human performance and fitness as a career. Fundamentals include aerobic systems, strength, flexibility, and exercise prescription. Coreq: HNES 110.
<b>180 Athletic Trainers' Profession</b>	2	Overview of athletic training and preparation required. Investigation of various career opportunities within the profession. Coreq: HNES 110.
<b>181 Practical Applications of Taping, Protective Devices, and Equipment</b>	3	Practical exposure to evaluation, application and construction of; protective devices, taping techniques and equipment safety modifications for use in the athletic training setting. Prereq: Biol 220, 220L.
<b>HPER 200 Introduction to Parks and Recreation (CCN)</b>	2	Introduction to the professions in leisure studies and community recreation programming. Coreq: HNES 110.
<b>210 Introduction to Food Science and Technology</b>	2	See Cereal and Food Sciences for description.
<b>HPER 210 First Aid and CPR (CCN)</b>	2	Instruction and laboratory practice in first aid procedures, including CPR; healthy life styles; prevention. American Red Cross and American Heart Association standards.
<b>HPER 217 Personal and Community Health (CCN)</b>	3	Study of vital personal and community health issues. Particular attention to current health facts, habits, and attitudes as they relate to home, school, and community.
<b>220 Lifeguard Training</b>	2	American Red Cross techniques and methods of aquatic safety and life guarding. Meets American Red Cross standards. Prereq: HNES 121 or swimming proficiency.
<b>225 Camp Management and Outdoor Recreation Skills</b>	2	Theories of camp management and counseling. Camping skills and techniques. Prereq: HPER 200 or departmental approval.
<b>226 Introduction to Therapeutic Recreation</b>	3	Survey of serving special populations, therapeutic recreation models, processes, rationales, terminology, and professional issues.
<b>230 Sports Officiating</b>	1	Rules and techniques of officiating selected sports.
<b>Nutr 240 Principles of Nutrition</b>	3	(See Nutrition for description.)
<b>240 Emergency Response</b>	3	First aid and CPR certification through the American Red Cross; AED training, transporting the injured/ill athlete for further medical care.
<b>250 Nutrition Science</b>	3	Scientific principles of nutrition based on chemical structure and function of the nutrients. 3 lectures. Prereq: Chem 117 or 121.
<b>251 Nutrition, Growth, &amp; Development</b>	3	Examination of the course of growth, maintenance, and senescence and nutrient needs during those periods. Prereq: Nutr 240 or HNES 250.
<b>252 Assessment in Physical Education</b>	3	This course will bridge the gap between theory and practice by providing a practical approach to measurement and evaluation techniques used in K-12 school physical education. Pedagogical concerns will be addressed and help prepare future professionals for careers in physical education. Prereq: HNES 110, 150, 151, 152, 153, 154, 155.

- 253 Motor Learning and Performance** 3  
Study of the principals of motor learning and development and how those principles apply in physical education and sport skill development. Prereq: HNES 110, 150, 151, 152, and 155.
- 254 Movement Analysis Change** 3  
Survey of conceptual and functional properties of motor systems, human performance, and biomechanics. Integration of biomechanics and motor systems for analysis of movement, motor, and sport skill acquisition. Prereq: HNES 150, Biol 220, 220L, 221, 221L.
- 260 Athletic Training Medical Terminology** 1  
Medical terminology related to athletic training and other allied health professions.
- 261 Food Selection and Preparation Principles** 3  
Scientific principles underlying food selection, preparation, and preservation; integration of nutrition principles, food standards, cost comparisons, and new food developments. 3 lectures. Prereq: Chem 117 or 121.
- 261L Food Selection and Preparation Principles Laboratory** 2  
Illustrates and extends lecture topics and stresses practical application of scientific food preparation principles. 2 three-hour laboratories. Prereq or coreq: HNES 261.
- 270 Consumer Issues in Food and Nutrition** 3  
Current developments in food and nutrition recommendations and consumer related concerns. 3 lectures.
- 271 Techniques of Strength and Conditioning** 3  
The course presents strength training and conditioning theory and practice. Explored are principles of strength and conditioning, periodization models and their utilization, mastery and analyses of different exercises, and program design and implementation for general/athletic/special populations. Prereq: HNES 170.
- 272 Techniques of Cardiovascular Conditioning** 3  
Understanding the techniques of conditioning the cardiovascular system. Types of conditioning explored: walking, jogging, spinning, aerobic dance, step aerobics, bench programming, cardio-kickboxing, TaeBo, and other popular types of programming.
- 276 Professional Observation** 1  
Observation in a setting providing established health-fitness services. Prereq: HNES 170, 272.
- 280 Sport Safety Training** 3  
Basic first aid and CPR skills and information needed to care for sports related injuries.
- 281 Injury Recognition** 3  
Introduction to athletic injuries. Treatment of injuries and illnesses associated with athletic participation. Prereq: Biol 220, 220L, 221, 221L.
- 282 Athletic Training Terminology and Equipment** 2  
Medical terminology related to athletic training and proper methodology used in the fitting, maintenance, and operation of athletic training equipment. Prereq: HNES 181.
- 284 Clinical Experience I** 3  
Clinical proficiencies and clinical experience hours. Prereq: 30 hours observation in athletic training room setting.
- 285 Clinical Experience II** 3  
Clinical proficiencies and clinical experience hours. Prereq: HNES 284.
- 286 Injury Recognition Laboratory** 1  
Introduction to athletic injury assessment. Practical application of topics discussed in HNES 281 lecture. Coreq: HNES 281.
- 302 Water Safety Instruction** 2  
Methods of teaching swimming and water safety. Meets American Red Cross standards. Prereq: HNES 121 or swimming proficiency.
- 326 Recreation Programming** 3  
Principles of the process for designing leisure experiences. Art, crafts, music, dance, sport and games, special events, and environmental activities are examined. Risk management, intramural sports organization and program budgeting are stressed. Prereq: HPER 200 or departmental approval.
- 336 Methods of Coaching** 3  
Provides information necessary to coach at any level from elementary to college. Includes broad overview of the philosophy, methodology, and management of sport.
- 340 Public Health Nutrition** 3  
Need for and objectives of nutrition education; assessing needs of the community; experience teaching nutrition in the community. 2 lectures, 1 four-hour laboratory. Prereq: HNES 251. Pre or coreq: Stat 330.
- 345 Methods and Materials of Comprehensive School Health Education** 3  
Development of methods and strategies for comprehensive school health education. Emphasis on lesson planning and delivery as they pertain to the content areas within health education. Prereq: HPER 217.
- 350 Fitness Education Activities and Materials** 3  
Topics related to teaching concepts-based fitness in high school physical education. Prereq: HNES 150-155, 254.
- 351 Metabolic Basis of Nutrition** 4  
Biochemical and physiological principles of human nutrition. Nutrients in relation to metabolic regulation. 4 lectures. Prereq: HNES 250, Chem 240, and BioC 260 or 460.
- 352 Physical Education Activities and Materials** 3  
Study of elementary physical education activities and materials that physical education majors and minors will use in Educ 481 and 482. Prereq: HNES 150-155, 254, or departmental approval.
- 354 Introduction to Medical Nutrition Therapy** 3  
Introduction to the role and skills in nutritional care and application of skills necessary for beginning competency as a clinical dietitian. 3 lectures. Pre or coreq: HNES 251, 351.
- 354L Introduction to Medical Nutrition Therapy Laboratory** 1  
Supervised practice in dietetics in a health care setting. 1 four-hour laboratory. Prereq: HNES 354.
- 361 Food Production Management** 3  
Principles and methods of purchasing, production, and management for quantity foodservice operations. 3 lectures. Prereq: HNES 261, 261L.
- 361L Food and Production Management Laboratory** 2  
Principles and methods of purchasing, production, and management for quantity food service operations. 1 four-hour laboratory. Pre or Coreq: HNES 361.
- 365 Kinesiology and Biomechanics** 3  
Study of movement analysis with emphasis on anatomical, biomechanical, and physical principles. Prereq: Biol 220, 220L, 221, 221L.
- 366 Kinesiology and Biomechanics Laboratory** 1  
Bone and muscle identification, muscle attachments and actions. Coreq: HNES 365.
- 367 Principles of Conditioning** 3  
Scientific theory and application of principles and techniques of physical conditioning to optimize training programs. Introduction of a wide variety of sports activities and associated training protocols. Prereq: HNES 254.
- 381 Athletic Injury Assessment -- Upper Body** 3  
Guidance and practice in the evaluation of athletic injuries to the upper body. Prereq: HNES 281.
- 382 Athletic Injury Assessment -- Lower Body** 3  
Guidance and practice in the evaluation of athletic injuries to the lower body. Prereq: HNES 281.
- 383 Psychosocial Aspect of the Injured Athlete** 2  
Intervention and counseling concepts that prepare the athletic trainer to handle the emotional aspect of an injured athlete. Prereq: HNES 281.
- 384 Therapeutic Exercise** 3  
Planning and implementing a comprehensive rehabilitation program of athletes with injuries/ illnesses. Prereq: HNES 281.

- 385 Therapeutic Modalities** 3  
Practical use of various therapeutic modalities used in treating athletic injuries. Emphasis on physiological effects, indications, and contradictions of each form of treatment. Prereq: HNES 384.
- 386 Clinical Experience III** 3  
Clinical proficiencies and clinical experience hours. Prereq: HNES 285.
- 387 Clinical Experience IV** 3  
Clinical proficiencies and clinical experience hours. Prereq: HNES 386.
- 426 Parks and Recreation Administration** 3  
Topics include marketing, planning, organizing, directing, coordinating, reporting, and budgeting in parks and recreation programs. Ethics, policy making, and philosophy issues are also discussed. Prereq: HPER 200, Junior standing, or departmental approval.
- 427 Leisure and Society** 3  
Survey of leisure problems and opportunities in society. Emphasis on critical analysis of completed writing and research in parks and recreation. Historical foundations and development of a personal philosophy of parks and recreation are stressed. Prereq: HPER 200, Junior standing.
- 429 Recreation Internship** 12  
Capstone course for recreation management majors. Supervised professional internship in an approved parks and recreational setting. Prereq: HNES 491.
- 430 Psycho-Social Aspects of Physical Activity and Sport** 3  
In-depth appreciation of the individual difference factors that affect a person's psyche and behavior in sport and physical activity contexts. Emphasis on social-environmental factors that influence a participant's behavior in sport and physical activity. Prereq: Senior standing.
- 434 Organization Management of Sports Teams** 2  
Principles, policies, procedures, and organization of sports teams. Prereq: Senior standing.
- 440 Nutrition Counseling Skills** 3  
Nutrition education for groups and individuals in clinical and community settings. Includes counseling theory; educational needs assessment; and implementation, evaluation, and documentation of learning activities. Three lectures. Prereq: HNES 251, 354.
- 441 Health and Safety Services** 3  
American Heart Association and American Red Cross Instructor's Course in responding to emergencies. Prereq: HPER 210 or HNES 240.
- 445 Organization and Administration of Coordinated School Health Programs** 3  
Examination of coordinated school health programs (CSHP). Analysis of the components of and approaches to development of CSHP. Emphasis on skills required for entry-level health educators. Prereq: HNES 345.
- 450/650 Coaching Young Athletes** 2  
Designed to help potential or present coaches reassess or develop a solid coaching philosophy. American Sport Effectiveness Program procedures are used and include three parts: a clinic, self-study, and the Coaches Certification Test.
- 452/652 Nutrition, Health, and Aging** 3  
Physiological changes with aging and their relationship to food habits and nutritional need. Common nutritional health problems with emphasis on prevention and treatment. 2 lectures, 1 two-hour laboratory.
- 453/653 Food and Dairy Microbiology** 3  
See Veterinary and Microbiological Sciences (microbiology) for description.
- 455/655 Sports Nutrition** 3  
Provides both current research and the translation of research findings into practical advice, offering unique insights on how nutrition can be used to design and effectively implement the optimal diet for lifelong physical fitness.
- 458/658 Advanced Medical Nutrition Therapy** 4  
Principles in the nutrition care of patients with conditions requiring nutrition care. 4 lectures. Prereq: HNES 354.
- 458L Advanced Medical Nutrition Therapy Laboratory** 3  
Supervised practice for CP students in nutrition care to accompany HNES 458. One eight hour laboratory per week. Coreq: HNES 458/658.
- 460/660 Foodservice Systems** 3  
Role of foodservice in today's society. Application of administration concepts in foodservice operation including equipment, layout, marketing, and budget management. 3 lectures. Prereq: Busn 350, HNES 361, 361L.
- 460L Foodservice Systems Laboratory** 3  
Supervised practice for CP students in foodservice to accompany HNES 460. 1 six-hour laboratory. Coreq: HNES 460/660.
- 461 Program Administration and Curriculum Design** 3  
Study of principles and procedures for developing physical education curricula. Organization and administration of physical education and extracurricular activities. Prereq: HNES 350, 351, Senior standing.
- 464/664 Food Analysis** 3  
Principles, applications, and practice of methods for quantitative determination of food components. 2 lectures and 1 three-hour laboratory. Prereq: Bioc 460; CS 460 recommended.
- 465 Physiology of Exercise** 3  
Effects of exercise on the physiology of the human body. Includes aerobic systems, strength/muscle adaptations, body composition, training programs, and other areas related to training. Prereq: HNES 365, 366.
- 466 Physiology Exercise Laboratory** 1  
Laboratory exercises to test aerobic and anaerobic capacity, strength, body composition, dietary analysis. Coreq: HNES 465.
- 467 EKG Monitoring Physiology** 2  
EKG monitoring and interpretation. Prereq: HNES 465, 466.
- 470 Activity Benefits and Exercise Prescription** 3  
Evaluation of the benefits of physical activity to health and well-being. Discussion of the development of exercise prescription for individuals with special medical problems.
- 471 Fitness Programming and Management** 3  
Development and implementation of health promotion programs in a worksite setting. Prereq: HNES 470.
- 472 Exercise Testing and Application** 3  
Physiological testing procedures applicable to physical activity settings. Coreq: HNES 467.
- 475 Human Performance and Fitness Internship** 12  
Capstone course for human performance and fitness majors. Supervised field work in a professional setting with emphasis on administration, supervision, and program leadership. Prereq: HNES 491.
- 480 Dietetics Practicum (Capstone Experience)** 12  
Practical experience with the responsibility equal to that of an entry-level dietitian on the job. 40 hours laboratory per week in clinical facility. Prereq: HNES 458L, 460L.
- 486 Medical Aspects of Athletic Training** 3  
Physicians from around the area will present information on a variety of illnesses and conditions that may affect the athlete. In addition, the student will be introduced to pharmacology competencies. Prereq: HNES 281.
- 487 Administration of Athletic Training Programs** 3  
Planning, coordinating, and supervising all administrative components of an athletic training program.
- 488 Clinical Experience V** 3  
Clinical proficiencies and clinical experience hours. Prereq: HNES 387.
- 489 Spring Athletic Training Practicum III** 3  
Capstone experience providing students the opportunity to deliver athletic training care in an off-site setting under the direct supervision of a member of the certified athletic training staff. Prereq: HNES 488, 491.
- 701 Theories and Ethical Issues of Coaching** 2  
Study of the values and ethical considerations at various levels of competition. Topics include youth sports programs, booster clubs, coaching philosophy, legal aspects, and recruiting. S/2

- 702 Marketing and Fundraising in HPER and Athletics** 2  
Understanding the issues and area involved in marketing and raising funds in an HNES and athletic setting. F/2 (even years).
- 703 Organization and Administration of Sport and Physical Education** 2  
Comprehensive study, including current research in physical education, recreation, and sports organization and administrative techniques. S/2 (even years).
- 710 Recent Literature and Research** 3  
Directed readings and class discussions of recent literature, steps involved in problem solving, and critical analysis of research in the field. F
- 711 The Physical Education Curriculum** 2  
Instruction on the role and importance of physical education in today's society; steps involved in curriculum planning; trends and issues in curriculum; various approaches to curriculum design. F/2 (odd years).
- 712 Supervision of Physical Education, Recreation, and Sports** 2  
Study of the scope of supervision, techniques for improvement of various phases of the learning process of teaching or coaching, and means of evaluating the effectiveness of supervision in the field. F
- 713 Advanced Exercise Physiology** 3  
See HNES Department faculty for course description.
- 714 Legal Liability in HPER** 2  
Focused on risk management and legal liability in health, physical education, and recreation. Overview of civil and criminal law related to sport and recreation. S/2 (even years).
- 715 Teaching Concepts-Based Fitness** 2  
Theoretical and practical aspects of the role of fitness education in contemporary physical education in a public school setting. F/2 (even years).
- 716 Analysis of Teaching Physical Education** 2  
Theoretical and practical aspects of the role of the physical education teacher in educational settings in contemporary society. F/2 (odd years).
- 717 Recreation and Sport Complex Management** 2  
Current practices in management, planning and design of facilities in sport, physical education, and recreation.
- 718 Community Relations and Communication Strategies** 2  
Development of communication skills necessary for the professional success of prospective and current athletic coaches and administrators. F/2 (odd years).
- 719 Wellness and Leisure for Adults** 2-3  
Leisure services and their effect on the adult population. F/2 (odd years).
- 720 Fitness/Wellness Management** 2-3  
Management principles and operational guidelines in fitness/wellness programs/settings. F/2 (even years).
- 721 Health Promotion Programs** 2-3  
Development of health promotion programs in wellness settings. S/2 (even years).
- 722 Epidemiology of Physical Activity** 2-3  
Association between sedentary habits, risk for chronic disease, and physical activity recommendations. S/2 (odd years).
- 723 Advanced Techniques in Sports Medicine** 2  
See HNES Department for course description.
- 744 International Food and Nutrition Problems** 2  
Malnutrition, hunger, and famine outside of the United States from a multi-disciplinary perspective.
- 750 Advanced Human Nutrition** 4  
Physiological and biochemical aspects of human digestion and metabolism. 4 lectures. Prereq: HNES 351, Bioc 701.
- 751 Minerals and Vitamins in Food and Diet** 3  
Mineral and vitamin absorption, transport, utilization, and excretion in humans. 3 lectures. Prereq: HNES 750.
- 752 Proteins and Amino Acids in Food and Diet** 2  
Nature of amino acids and protein in foods; their role in human physiological systems and contribution to nutritional quality of diet. 2 lectures. Prereq: HNES 750.
- 753 Lipids and Carbohydrates in Food and Diet** 2  
Effects of changes in the types and amount of lipids and carbohydrates in the diet on human metabolism, particularly inborn errors and metabolic diseases. 2 lectures. Prereq: HNES 750.
- 754 Assessment in Nutrition and Exercise Science** 3  
Selected techniques for assessment and interpretations of nutritional status. 1 lecture, 1 four-hour laboratory. Prereq: Stat 330.
- 763 Food Product Development and Sensory Evaluation** 3  
Concepts and methods of food product development. Sensory analysis of food qualities. Statistical analysis, interpretation, and presentation of data. 1 lecture, 2 two-hour laboratory. Prereq: HNES 462, Stat 330.
- HISTORY (Hist)**  
Peterson, Chair; Anderson, Danbom, Harvey, Helgeland, Isern, Justitz, Norris
- COURSES**
- 101 Western Civilization I (CCN)** 3  
Introductory survey of western civilization from prehistory to 1648, emphasizing major political, social, cultural, and intellectual developments. (ND:Hist)
- 102 Western Civilization II (CCN)** 3  
Introductory survey of western civilization from 1648 to the present, emphasizing major political, social, cultural, and intellectual developments.
- 103 U.S. to 1877 (CCN)** 3  
Survey of United States history to 1877, emphasizing major political, economic, social, and cultural developments. (ND:Hist)
- 104 U.S. Since 1877 (CCN)** 3  
Survey of United States history since 1877, emphasizing major political, economic, social, and cultural developments.
- 135 Race in U.S. History** 3  
The historical development of racism and racial ideas and the interactions among Native Americans, European-Americans, African-Americans, Latino-Americans, and Asian-Americans from pre-contact to the present.
- 220 North Dakota History (CCN)** 3  
Survey of North Dakota history. Includes social, economic, cultural, and political history of North Dakota from prehistoric times to the present.
- 251 Introduction to Public History (CCN)** 3  
Introduction to history career paths outside of the classroom including museums, historical societies, historic preservation, and historic sites.
- 252 Introduction to Museum Work (CCN)** 3  
Introduction to the variety of careers available and procedures used in museums and historical societies: curatorial, administrative, conservation, research, and educational. Prereq: Hist 251.
- 257 The Cold War (CCN)** 3  
Causes and ideological background of the Cold War. Development of the superpowers. The ideological nature of these opposing societies and how and why the Cold War ended are examined.
- 259 Women in European History 1400-1800 (CCN)** 3  
Exploration of what it meant to be female in early modern Europe: women's options, how women saw themselves, how they were perceived, and origins of these perceptions.
- 260 Women in America (CCN)** 3  
Women in America from pre-colonial times to the present. Focuses on experiences of typical women of the past, including minorities.
- 261 American Indian History (CCN)** 3  
Survey of Native American history, emphasizing diversity of historical experience. Themes include cultural persistence, leadership and activism, and strategies adopted by Indian communities for coping with change.
- 265 Families in America (CCN)** 3  
Varieties of family experiences in America from European colonization to the present.

- 268 Rural America (CCN)** 3  
American rural institutions and culture, agricultural practices, economic developments, politics, and public policies from the colonial period to the present.
- 270 American Religious History** 3  
See Religious Studies for description.
- 271 Introduction to Latin American History** 3  
Study of important social, economic, and cultural developments in Latin American history. Emphasizes the socio-economic and cultural topical developments and the political and international factors influencing the region.
- 290 Historical Research and Writing** 3  
To familiarize students with writing a historical research paper through researching in libraries and archives, constructing thesis statements, outlining papers, building logical arguments, writing clear and concise English, using primary sources, footnoting, and copyediting.
- 320 History of Christianity** 3  
See Religious Studies for description.
- 333 U.S. Environmental History (CCN)** 3  
History of the interrelationships of humans and the natural world in America. Emphasis on the emergence of the conservation and environmental movements from 1830s to the present.
- 381 Australia and New Zealand** 3  
Comprehensive, but not exhaustive, historical comparison of Australia and New Zealand. Organized topically to facilitate comparisons.
- 382 Canada** 3  
See Department for course description.
- 401/601 Archival Theory and Practice** 3  
Archival theory and its practical application in supervised projects utilizing the resources of the Institute for Regional Studies and University Archives.
- 403/603 Archival Photography (CCN)** 3  
Application of archival theory and practice to photographs, film, and video. Includes preservation and care methods of curating photographs in museums and libraries. Prereq: Hist 251.
- 410/610 U.S. Intellectual History I** 3  
American intellectual trends in areas such as religion, education, racism, science, feminism; social and political thought; 1600-1860. Prereq: Hist 103, 104.
- 411/611 U.S. Intellectual History II** 3  
American intellectual trends in areas such as religion, education, racism, science, feminism; social and political thought; 1860-present. Prereq: Hist 103, 104.
- 413 U.S. Economic History II** 3  
Transportation, agriculture, labor, mergers and consolidation, government regulation, the Great Depression, modern wars, inflation, debt, deficit, and the global economy; 1870-present. Prereq: Hist 104.
- 422/622 U.S. History 1829-1917 I** 3  
Political, social, and economic history of the United States 1829-1877; emphasizing socioeconomic change, the sectional crisis, the Civil War, and Reconstruction.
- 423/623 U.S. History 1829-1917 II** 3  
Political, social, and economic history of the United States 1877-1917; emphasizing industrialization, urbanization, and progressive reform.
- 424/624 U.S. History 1917-Present I** 3  
Political, social, and economic history of the United States 1917-1960; emphasizing the New Deal, the world wars, and the Cold War era.
- 425/625 U.S. History 1917-Present II** 3  
Political, social, diplomatic, and economic history of the United States since 1960; emphasizing foreign policy, domestic developments, and socio-economic change.
- 431/631 The North American Plains** 3  
Historical treatment of the Great Plains of North America as an international region, comprising the Canadian prairies and the American plains.
- 434/634 History of Environmental Science** 3  
Designed to acquaint students with seminal thinkers and events that have influenced the history of environmental science, politics, and policy, primarily in the United States since the late 19th century.
- 436/636 American Frontier to 1850** 3  
Key aspects of the early American frontier from 1500s to mid-1800s, emphasizing Indian-White relations, colonial wars, social life in the backcountry, and exploration and settlement.
- 437/637 American West Since 1850** 3  
The time period centers on a century of enormous change in the trans-Mississippi west. Major topics include the Plains Indian wars, post-conquest Indian history, mining, cattle, homesteading frontier, the urban west, and environmental history.
- 439/639 History of American Agriculture** 3  
American agriculture from its Native American and European roots to the present.
- 440/640 European Intellectual History I** 3  
Important changes in ideas about science, religion, ethics, political thought, and the arts; Medieval world view, Renaissance, Reformation, Scientific Revolution, the Enlightenment, Romanticism. Prereq: Hist 101, 102.
- 450/650 Ancient History** 3  
Cultural, political, economic, and social history of the ancient Near East, Greece, and Rome.
- 451/651 Medieval History** 3  
Cultural, political, economic, and social history of the Middle Ages.
- 454/654 Renaissance and Reformation** 3  
Political, social, and economic history of continental Europe from 1400 to 1650; with a focus on Renaissance and Reformation.
- 455/655 The Eighteenth Century** 3  
Political, social, and economic history of continental Europe from 1650 to 1815; with a focus on Enlightenment and French Revolution.
- 456/656 Europe 1815-1914** 3  
Political, social, and economic history of Europe from the defeat of Napoleon to outbreak of World War I.
- 457/657 Europe Since 1914** 3  
Political, social, and economic history of Europe including World War I, the Russian Revolution, Nazism, World War II, and the postwar era.
- 460/660 History of England I** 3  
England from ancient times to the Hanoverian Succession (1714); emphasis on the Middle Ages and the Tudor-Stuart period.
- 461/661 History of England II** 3  
England from 1714 to the present; emphasis on the Georgian Era industrialization, liberalism, social reform, and the impact of World War I and World War II.
- 466/666 History of Russia I** 3  
Cultural, diplomatic, intellectual and political history of Russia; evolution of the Russian state, expansion of imperial Russia, Great Reforms, populism, and socialism.
- 467/667 History of Russia II** 3  
Cultural, diplomatic, intellectual, and political history of Russia and the Soviet Union; agriculture, industry, Marxism in Russia, revolution of 1905 and 1917, and the Soviet Union from Lenin to present.
- 470/670 Modern Latin America I** 3  
Examines the social, economic, political, and cultural developments in Latin American history. Begins with the wars of independence (circa 1800) and concludes with the emergence of modern states at the close of the 19th century.
- 471/671 Modern Latin America II** 3  
Study of important social, economic, political, and cultural developments in Latin America from the late 19th century through the modern epoch.
- 473/673 Mexico I** 3  
Study of the important social, economic, political, and cultural developments in Mexican history from the pre-Columbian epoch through the wars for independence, ending in 1821.
- 474/674 Mexico II** 3  
Study of the important social, economic, political, and cultural developments in Mexican history from independence in 1821 through the contemporary era.
- 476/676 Southwestern Borderlands to 1848** 3  
Study of the important social, economic, political, and cultural developments of the American southwest from the pre-Columbian epoch, through Spanish and Mexican ownership, to U.S. acquisition in 1848.

- 480/680 Recent East Asia I** 3  
Political and diplomatic history of China, Japan, Korea, and Vietnam; interactions between East Asian countries and Western powers, World War I and aftermath in East Asia.
- 481/681 Recent East Asia II** 3  
Political and diplomatic history of China, Japan, Korea, and Vietnam; World War II in the Pacific, Communism in China, Korea, and Vietnam, and the industrialization of Japan and Korea.
- 489 [499] Senior Seminar** 3  
Capstone experience focused on understanding major concepts and applying knowledge of basic methods and problems. Students evaluate secondary literature, conduct primary research, and master standard forms of historical writing.
- 701 Methods of Historical Research** 3  
Techniques and frameworks of historical research, introduction to types of evidence, and evaluation of sources. Taken during the student's first semester in the program.
- 705 Directed Research** 1  
Directed research on the student's thesis prospectus. Taken close to the end of the student's course work. Prereq: Hist 701, 730, and 760 or 780.
- 730 Readings in United States History** 3  
Historiographical survey of a selected topic in U.S. history. Topics vary by semester. May be repeated. Prereq or Coreq: Hist 701.
- 760 Readings in European History** 3  
Historiographical survey of a selected topic in European history. Topics vary by semester. May be repeated. Prereq or Coreq: Hist 701.
- 780 Readings in World History** 3  
Historiographical survey of a selected topic in world history. Topics vary by semester. May be repeated. Prereq or Coreq: Hist 701.
- HORTICULTURE**  
(See Plant Sciences)
- HUMAN AND COMMUNITY EDUCATION (H&CE)**  
Wilhelm, Miller-Boschert
- COURSES**
- 232 Philosophy and Policy** 3  
Principles, philosophies, development, and implementation of agricultural education, family and consumer sciences education, and extension programs. Analysis of evolving concepts with emphasis on history, legislation, and principles underlying organization and practice.
- 341 Leadership and Presentation Techniques (CCN)** 3  
Development of youth leadership professionals in educational settings; methods, principles, and practices in organizing, developing, conducting, and evaluating community-based student organizations and student leadership programs.
- 345 Extension Education** 2  
Includes purpose, philosophy, and organizational structure of Extension Service nationwide; roles of extension workers and professional ethics; program development, implementation, and evaluation.
- 381 Early Experience (CCN)** 1  
See Education for description.
- 444 Planning the Community Program in Agricultural Education** 3  
Determining resources and trends of local communities. Emphasis on agricultural education program policies; planning and managing the primary program components; strategies for the management and organization of youth and adult programming in agricultural education. Prereq: Admission to the School of Education.
- 445 Technology Transfer in Agriculture** 3  
Methods of formal and informal educational programs. Attitudes and values as influences on the introduction and acceptance of new and emerging technologies. Emphasizes global issues. Prereq: H&CE 341.
- 468 Family Life and Adult Education Programs** 3  
Philosophy, issues, curricula, and techniques for teaching and evaluating family life and sex education programs K-12 and adult/parenting programs. Includes common program and instructional planning elements. Prereq: Educ 451 or departmental approval.
- 469 Housing Education and Issues** 3  
Issues, curricula, and techniques for teaching and evaluating K-12 and adult housing programs.
- 474 Extension Internship** 4  
Supervised full-time family and consumer sciences extension internship in an approved location. Prereq: H&CE 345.
- 481 Methods of Teaching Agriculture** 3  
Methods of planning and teaching agricultural education in secondary and post-secondary settings. Learning theories, innovations and advanced principles in teaching methods and materials, and ethics. Prereq: Educ 321, 322, admission to the School of Education.
- 482 Methods of Teaching Family and Consumer Sciences** 3  
Methods of planning and teaching consumer/homemaking and occupational family and consumer sciences in middle and secondary schools in diverse cultural settings. Professional ethics will be addressed. Includes advisory committees and vocational student organizations. Prereq: Educ 321, 322, 381, admission to the School of Education.
- 483 Student Teaching Seminar** 1  
Orientation to student teaching in agricultural education and analysis of professional issues, concerns, and problems associated with AgEd, FFA/SAE, and the student teaching experience. Prereq: H&CE 482; Coreq: H&CE 487.
- 487 Student Teaching** 12  
See Education for description.
- 720 Supervision of Student Teachers** 2  
Planning and carrying out effective supervision techniques when supervising student teachers in respective subjects. Cross-listed with Educ.
- 724 Program Development in Vocational Education** 2  
Methods and curricula development in vocational family and consumer sciences education in accordance with state and federal guidelines. Includes long-range and strategic planning competencies.
- 740 Vocational Philosophy and Policy** 3  
Philosophy in developing, planning, and conducting vocational education programs at federal, state, and local levels. Importance of legislation on state and local policy making.
- 743 SAE/Adult Programs** 3  
Principles of leadership, design, analysis, record keeping, student organizations, and activities in adult/youth programs. Community-based programs in adult farm business management education. Prereq: Teaching experience.
- 746 International Extension** 3  
The ideological and theoretical basis of world agricultural assistance programs and their effects on different sectors and classes. Prereq: H&CE 345.
- 751 Rural Survey in Agricultural Education** 3  
Research-type survey of the agricultural education resources unique to the local area/community, research data implications, and current technology implementation. Prereq: Teaching experience, Educ 702.
- 756 Program Development and Evaluation** 3  
Methods and procedures of long-range planning, strategic planning techniques, integrating new/emerging biotechnology, guidance and counseling, and evaluating program effectiveness.
- 772 Curriculum Development in Family and Consumer Sciences** 2  
Examination of the major concepts, philosophies, and strategies that influence curriculum decisions in family and consumer sciences programs at all educational levels. Includes assessment of curriculum goals and materials.
- 775 Internship** 1-3  
Supervised experience in a formal or informal environment relevant to the application of educational principles. Setting may include middle, secondary, post-secondary, and adult programs. Prereq: Admission to Graduate School.
- 777 Evaluation in Family and Consumer Sciences** 2  
Examination of the role of course assessment, teacher effectiveness, facilities, equipment, and staffing patterns in program evaluation. Review of research on evaluation and exploration of alternative evaluation models.

**781 Professional Development in Agricultural Education** 1-3  
Continued professional development in technical and pedagogical subjects of current importance for professionals in agricultural education.

**787 Issues in Education** 1-3  
Exploration and assessment of a current issue associated with middle and secondary applied academic programs. Prereq: Current employment or experience as middle/secondary teacher.

## HUMAN DEVELOPMENT AND EDUCATION (HD&E)

Dean's Office

### COURSES

**120 Orientation to Human Development and Education** 1  
Introduction to opportunities and professional advancement in human development and education careers. Overview of majors, activities, and support systems. 1 lecture. Coreq: HD&E 189.

**189 Skills for Academic Success** 1  
See University Interdisciplinary Studies for description. Coreq: HD&E 120.

**220 Individual and Family Wellness** 2  
Integrative investigation of the wellness of individuals and families in today's complex society. The interdisciplinary nature of human wellness is examined critically and means of optimizing lifelong wellness are addressed. 2 lectures.

**320 Professional Issues** 1  
Analysis and integration of professional perspectives and trends; life career development skills (self-assessment, resume writing, interviewing, and correspondence.) 1 lecture. Prereq: Junior standing.

## HUMANITIES (Hum)

Cater (Emeritus), Laliberte, Penna, Weiler

### COURSES

**256 Questions of Philosophy** 3  
Introduction to philosophy, some of its major problems and personalities.

**257 Traditional Logic** 3  
Study of the art and science of critical thinking; scientific method emphasized.

**304 Humanities Tutorial** R-6  
Development of an individual project based on the theme of the student's program. This project must be submitted and approved during the junior year.

**356 Greek Philosophy** 3  
The philosophies of Plato and Aristotle as perennial philosophies.

**357 Augustine** 3  
Study of Augustine's thought, especially philosophical, in its historical context.

**358 Early Medieval Philosophy** 3  
Examination of the main philosophical world views of the first millennium with an emphasis on Neo-Platonism. Prereq: Junior standing.

**359 Thomas Aquinas** 3  
The philosophy of Thomas Aquinas as a perennial philosophy. Prereq: Junior standing.

**366 Metaphysics** 3  
Historical and systematic philosophical study of fundamental principles of reality, especially as concerns the human person.

**367 Ethics: The Acting Person** 3  
Philosophical study of the foundations of human actions, virtue, and vice.

**371 The Law and the Prophets** 3  
How to interpret the central documents of the faith of Israel for contemporary readers by attending to their distinctive literary structures.

**372 Wisdom and the New Testament** 3  
Study of special themes in Wisdom and Apocrypha. Introduction to principal New Testament authors.

**385 Comparative Arts** 3  
Study of Western arts in light of the aesthetic, social, and philosophical ideas that nurtured them.

**476 Kant and Hegel** 3  
Principles of Kant and Hegel philosophies in the context of eighteenth and nineteenth century thought and society. Prereq: Departmental approval.

**477 20th Century Philosophy** 3  
Emphasis on themes such as existentialism, process, and the "linguistic turn." Prereq: Departmental approval.

**486 Philosophy and Literature** 3  
Philosophical elements of selected works from Western literature, such as those of Dante, More, Milton, and Newman.

**487 Aesthetics** 3  
Principles of aesthetics as revealed by artists, writers, and philosophers.

**702 Introduction to College Teaching in the Humanities and Social Sciences** 3  
Techniques for effective teaching and assessing learning at the college level. Includes special issues and responsibilities related to college-level teaching.

## INDUSTRIAL AND MANUFACTURING ENGINEERING (IME)

Wells, Chair; Bartlett, Bilen-Green, Cho, Cook, Ebeling, Maleki, Marinov

### COURSES

**111 Introduction to Industrial and Manufacturing Engineering** 1  
Introduction to job functions and operating environments for professional careers in industrial engineering and manufacturing engineering. Guest lectures, field trips and student team projects. F

**112 Computer/Software Applications in Engineering** 2  
Development of skills for using modern computer software to solve engineering problems, prepare reports, plan project schedules and budgets, prepare and deliver professional presentations, and manage data. S

**310 Survey of Industrial and Systems Engineering Applications** 3  
Overview of industrial and systems engineering careers activities. Development of industrial literacy. Introduction to fundamental industrial and systems engineering in the context of manufacturing, healthcare, transportation and logistics, information and service industries. Systems considerations include products, processes, facilities and equipment, monetary resources and people. F

**311 Work/Station Design and Measurement** 3  
Analytical methods for measuring human performance in industrial, commercial and manufacturing settings. Development of work procedures and design of work stations. Considerations of ergonomics, safety, performance effectiveness and efficiency, interactions between workstations, information and data requirements, production throughput, training and skill requirements, and resources. Weekly laboratory. S

**320 Aircraft Corrosion Theory and Control** 2  
Examination of fundamental mechanisms of corrosion; procedures for prevention and control. Emphasis on aircraft structures and their manufacture. Weekly laboratory. Prereq: ME 331. S/2 (odd years)

**330 Manufacturing Processes I** 2-3  
Traditional manufacturing processing methods as employed in contemporary practice. Includes properties of materials, machining, casting, forming, and fabrication techniques. Several experiments will be conducted on various manufacturing processes in the laboratory. Prereq: ME 212. F, S

**335 Welding Technology** 2  
Study of arc and gas welding technology together with related metallurgy. Laboratory instruction in welding techniques and skills. 1 recitation, 1 two-hour laboratory. F

**380 CAD/CAM for Manufacturing** 3  
Coverage of CAD, numerical control, and CAM software. Use of manufacturing standards for geometric dimensioning and tolerancing. Prereq: ME 212. F

**411/611 Human Factors Engineering** 2  
Study and application of human factors engineering fundamentals. Emphasis on human-system integration and optimization covering both physical and cognitive ergonomics. Human physical and cognitive characteristics, research methods, interface design, task analysis, usability. Prereq: IME 311, 460. F/2 (even years)

- 420/620 Aircraft Design for Manufacturing Engineers** 3  
Introduction to aircraft structures and their manufacturing processes. Case studies; development of a journal article; literature study leading to a proposal for research to advance the state-of-the-art for DFM applied to aircraft structures. Prereq: IME 330. F/2 (odd years).
- 422 Aircraft Structural Repair and Overhaul** 3  
Applied design and manufacturing engineering methods are used to write Federal Aviation Administration (FAA) approvable airframe/engine repair and overhaul (remanufacturing) procedures. Weekly laboratory. Prereq: IME 330. S/2 (even years)
- 425 Aircraft Component Failure Analysis** 3  
Presentation of metallurgical failure conditions and analysis methods. Study of airframe and engine component failures. Includes weekly laboratory. Prereq: ME 223, IME 320. F/2 (even years)
- 427/627 Electronics Manufacturing** 3  
Process and production engineering for manufacturing of electronic components; specialty materials, process parameters, production system design factors, production performance metrics. Introduction to concurrent engineering applied to development of electronic products. Open to all engineering majors. Prereq: junior or senior standing. F/2 (odd years)
- 430/630 Process Engineering** 3  
Comprehensive analysis of selected manufacturing processes; development of process flow maps and models of process dynamics, evaluation of processing alternatives. Design of effective and efficient processes for selected industrial products. Seminar/Case study format. Prereq: IME 330. F
- 431/631 Production Engineering** 3  
Undergraduate: design of fixtures, dies and tooling for economical production. Graduate: In-depth analysis of production systems for selected manufactured products; development of production system flow maps and linked process dynamic models, evaluation of task time and identification of constraints. Design of alternative solutions for production constraints. Seminar/case study format. Prereq: IME 330; IME 430/630 desirable. S
- 432 Composite Materials Manufacturing** 3  
Processes for manufacturing products from fiber-reinforced composite materials. Analysis of tooling, process variables and quality management during processing. Design of processes for manufacture of selected composite parts. Weekly laboratory. Prereq: IME 330, ME 331. S
- 435/635 Plastics and Injection Molding Manufacturing** 3  
Addresses the material properties, process, and devices for the fabrication of parts from plastics. Contrasts and compares to processes for other materials. Coordinated with ME 463 and 464. Prereq: IME 330. Cross-listed with ME. S/2 (odd years)
- 440/640 Engineering Economy** 2-4  
Capital investment decision foundation within the rules of general and project accounting. Analysis of benefits and returns against cost for engineering installation, operation, life cycle, and buy-rent-lease decisions. Prereq: Junior standing. F, S, SS
- 450/650 Systems Engineering and Management** 3  
Integration of technical disciplines through the stages of systems life cycle: needs and requirements determination, operating and support concepts, design and prototyping, test and evaluation, facilitation, manuals, training, and supportability. Prereq: Junior standing. F
- 451/651 Logistics Engineering and Management** 2  
Extends systems, methods, production, inventory, and facility topics to integrated logistics support. Emphasis on reliability, maintainability, tools, test equipment, spares, operating and maintenance instructions, and training. Pre or Coreq: IME 450. F/2 (odd years)
- 452/652 Integrated Industrial Information Systems** 3  
Integration of technical, business, and operational information for status, progress, and decision-making in product development, manufacturing, and logistical support of product and customers. Prereq: IME 450. S
- 453/653 Hospital Management Engineering** 3  
Survey of management engineering roles in the delivery of health care. Review of functional relationships present in health care delivery systems. Application of industrial engineering tools to solve health care delivery problems focused on cost reduction, process redesign, facility design, quality improvement, and systems integration. Prereq: departmental approval; students should have taken core industrial engineering courses. S/2 (even years)
- 455/655 Management of People Systems** 2  
Study of traditional management functions (planning, organizing, influencing, and controlling) in the context of engineering and management system interactions. Emphasis on communication skills, teaming, job design, leadership, facilitation, and improving employee productivity. Prereq: junior standing. F
- 456/656 Program and Project Management** 3  
IE&M capstone experience. Integration of technical, business, and operational specialties in a project consulting firm. Work with multidisciplinary teams that design, plan, and present for a variety of industrial clients. Prereq: Senior standing. S
- 460/660 Evaluation of Engineering Data** 3  
Design of engineering experiments and evaluations, curve fitting, regression, hypothesis testing, ANOVA, Taguchi methods in engineering design. Pre or Coreq: Math 166. F, S
- 461/661 Quality Assurance and Control** 3-4  
Proactive and reactive quality assurance and control techniques; emphasis on quality planning, statistical process control, acceptance sampling, and total quality management. Issues in reliability and maintainability engineering. Prereq: IME 460. S
- 462/662 Total Quality in Industrial Management** 3  
The meaning and means for achieving "total quality" in all dimensions of industrial activities and organizations. Topics include continuous improvement, statistical process control, leadership, and training. Pre or Coreq: IME 455. F/2 (even years)
- 463/663 Reliability Engineering** 3  
Study and application of statistical models and methods for defining, measuring and evaluating reliability of products, processes and services: life distributions, reliability functions, reliability configurations, reliability estimation, parametric reliability models, accelerated life testing, reliability improvement. Prereq: IME 460/660. S/2 (odd years)
- 470/670 Operations Research I** 3  
Techniques to optimize and analyze industrial operations. Use of linear programming, transportation models, networks, integer programming, goal programming, dynamic programming, and non-linear programming. Prereq: Math 229, 265. S
- 471/671 Operations Research II** 2-3  
Study of probabilistic operations research topics including queuing analysis, decision analysis, and Markov decision processes. Prereq: IME 460, 470. On demand.
- 472/672 Simulation of Business and Industrial Systems** 3  
Development of the fundamentals and techniques of simulating business and industrial systems. Monte-Carlo techniques and computer usage. Prereq: IME 460/660, high level computer language. S
- 480/680 Production and Inventory Control** 3  
Planning and controlling of industrial production and inventory: demand forecasting, master scheduling, materials requirements planning, job scheduling, assembly line balancing, and just-in-time production. Prereq: IME 460/660, 470/670. F
- 482/682 Automated Manufacturing Systems** 3  
Design of integrated production systems including flexible, programmed automatic control for fabrication, assembly, packaging, movement, and storage. Numerical control, flexible manufacturing systems, and computer integrated manufacturing. 2 recitations, 1 three-hour laboratory. Prereq: IME 311, 330, ECE 303. F

**485/685 Industrial and Manufacturing Facility Design 3**

Capstone integration of analysis and design tools to convert product design into production plans and plants. Prereq: Senior standing and adviser approval. S

**489 Manufacturing Engineering Capstone 3**

Capstone experience. Student projects in design, analysis, and experimental investigation related to manufacturing. Prereq: Senior standing and adviser approval. S

**561 Reliability Engineering 3**

Statistical models and methods of reliability engineering; defining, measuring and evaluating reliability of products, processes and services. Life distributions; reliability functions, configurations and estimation; parametric reliability models; accelerated life testing; reliability improvement. Prereq: IME 460.

**699 Supply Chain Management 3**

Concepts and methods in supply chain strategies, planning and operations. Topics include logistics network configuration, inventory management, distribution strategies, strategic alliances, supply chain design, and information technology. Prereq: Math 166 and IME 460/660.

**711 Advanced Human Factors Engineering 3**

Research-based study of current human factors engineering problems. Students will review current human factors topics, design and conduct research studies, and produce technical papers reporting results. Prereq: IME 411/611, 460/660. F/2 (odd years)

**740 Advanced Engineering Economy 3**

Advanced topics in engineering economy including replacement analysis, capital budgeting, income tax effects on equipment selection, probabilistic models, and manufacturing costing. Prereq: IME 440/640. F/2 (odd years)

**761 Quality Engineering 3**

Study and application of advanced statistical tools and techniques for defining, monitoring and improving quality of products, processes and services: statistical control charts, process capability analysis, acceptance sampling of variables and attributes, application of design-of-experiments for product and process optimization, response surface methodology, Taguchi methods. Prereq: IME 461/661. F/2 (odd years)

**765 Data Analysis 3**

Applications oriented. Topics include: statistical estimation, hypothesis testing, non-parametric methods, design of experiments, factorial experiments, response surface methodology, regression analysis, time series analysis and forecasting, multivariate methods, statistical control charts. Prereq: Math 166 and IME 460/660.

**770 Advanced Operations Research Topics 3**

Study of the theory and applications of linear programming, network flows, and nonlinear programming. Prereq: IME 470/670. F/2 (odd years)

**772 Advanced Simulation 3**

In-depth study of special purpose simulation languages to model, analyze, and design industrial and engineering systems. Stochastic and deterministic methods are included. Prereq: IME 472/672. S (even years)

**774 Neural Networks 3**

See CSci 735 for description.

**780 Advanced Production and Inventory Control 3**

Study of the theory and applications of production scheduling, inventory management, production planning, just-in-time production, and materials requirement planning. Prereq: IME 480/680. F (even years)

**782 Robotics/CAD/CAM/Control Systems 3**

Study of automation, integration of fabrication, and assembly systems. Includes automated material handling and intelligent control systems. Prereq: IME 482/682. S/2 (odd years)

**784 Computer Integrated Manufacturing (CIM) 3**

Study of the continuum of integrated manufacturing processes where computer technology is incorporated in the conception, design, planning, and fabrication of a good or service. The study of philosophy and methods of systematically building flexible and efficient production systems. Prereq: IME 482/682. S/2 (even years)

**785 Facilities Location 3**

Theory and methods of locating facilities. Domains include plant and warehouse siting, emergency service sites, vehicle and hazardous material routing, distribution systems design. Topics include planar single and multi-facility models, network location problems, cyclical networks. Prereq: IME 470/670 or Engr 770.

**786 Manufacturing Systems Analysis 3**

Comprehensive analysis of complex issues in the technology and management of modern manufacturing systems and enterprises. Technological issues will impinge on product realization, production of goods, and manufacturing equipment and facilities; management issues addressed will be those drawn from operation of global production enterprises. Seminar format. Prereq: IME 630 or 631. S

**INTERIOR DESIGN**

(See Apparel, Design, Facility, and Hospitality Management.)

**LANDSCAPE ARCHITECTURE (LA)**

Colliton, Director; Kennedy, Krohn, Walter

**COURSES****132 Introduction to Landscape Architecture Studio 2**

Laboratory surveying the profession of landscape architecture and exploring problem solving through the design process. Graphic, oral, and written design presentation skills including the use of computer applications.

**171 Environmental Design I 3**

See Architecture for description.

**172 Environmental Design II 3**

See Architecture for description.

**231 Landscape Architecture Graphics 1**

Two- and three-dimensional computer skills using required software applications. Emphasis on traditional, computer graphic, and written design communication techniques used in problem solving. Prereq: LA major, LA 132, 172; Coreq: LA 271.

**271 Landscape Architecture I 4**

Entry-level design generation methods involving concept formation, site inventory and analysis, programming, and simple site organization and planning. Problem solving through graphic, computer-generated, and model development; oral and written communication skills. Prereq: LA major, LA 131, 172; Coreq: LA 231.

**272 Landscape Architecture II 4**

Continued design development in site organization and planning. Design issues in natural resources, land reclamation, construction technology, and rural development. Intermediate problem solving through two- and three-dimensional graphic techniques; continued oral and written communication skills. Prereq: LA major, LA 231, 271.

**322 History of Landscape Architecture 4**

Global overview of the landscape developments from prehistoric civilizations through the 20th century using styles and trends. Emphasis on analyzing historic places and locations as a problem-solving method.

**331 Introduction to Planting Design 2-3**

Exploration of principles and design methods involved with a wide-range of planting zones and plant habitats throughout North America. 2 credits: Lecture, open to LA majors. 3 credits: Lecture and laboratory; open to LA majors and minors only.

**341 Site Development and Detailing I 3**

Intermediate investigations into site planning and design development with a primary focus on site design integration with the technically-related concepts. Prereq for LA majors: Second-year standing; Prereq for Arch majors: Arch 272.

**342 Site Development and Detailing II** 3  
Intermediate-level focus on fundamental site landscape and engineering issues within the construction process. Emphasis on site grading and stormwater management. Lecture. Prereq: Junior standing for non-majors.

**344 Site Development and Detailing Laboratory** 2  
Applied practical exercises focusing on site layout, site grading and stormwater management, and site materials. Emphasis on construction techniques and the preparation of construction drawings and specifications. Coreq: LA 342.

**371 Landscape Architecture III** 4  
Visual problem solving and large-scale site planning issues. Two-part focus involving the comprehensive visual inventory and analysis along with the immediate application of site planning and design skills. Studio. Prereq: LA major, LA 272.

**372 Landscape Architecture IV** 4  
Cultural and environmental design issues as they relate to large-scale land planning and site design involved with residential communities. Emphasis within the studio involves site engineering and design detailing. Prereq: LA major, LA 371.

**441 Site Development and Detailing III** 3  
Advanced exploration into the use of computers and computer-aided design as part of the landscape architecture construction documentation process. Seminar/laboratory. Prereq: LA 372; Coreq: LA 471.

**471 Advanced Landscape Architecture I6**  
Regional systems inventory, visual survey, analysis techniques, and methodologies for design problem solving through graphic, computer, and modeling development. Focus on urban studies and site planning. Studio. Prereq: LA major, LA 372.

**472 Advanced Landscape Architecture II** 6  
Natural resource and land reclamation management techniques as part of contemporary design in landscape architecture. Emphasis on presentation and communication. Studio. Prereq: LA major, LA 471.

**531 Advanced Landscape Architecture Planting Design** 4  
Exploration into the complexity of planning, design, and management of plant communities with an emphasis on natural systems ecology. Lecture and laboratory. Prereq: LA major, LA 331. F (odd years)

**552 Advanced Landscape Planning** 2  
Theories and practices facing landscape architects and planners in the design of urban, suburban, and rural landscapes. Seminar/field trip. Prereq: Senior standing or departmental approval.

**561 Landscape Architecture Programming** 2  
Discussion and application of a comprehensive design process for production of the capstone design project. Emphasis on preparing a design program. Coreq: LA 571. Cross-listed with Arch.

**571 Advanced Landscape Architecture Design III** 6  
Environmental systems development and implementation of a complex design problem. Emphasis on landscape architecture design development through graphic, computer, and modeling techniques. Studio. Prereq: LA major, LA 472; Coreq: LA 561.

**572 Design Thesis** 8  
Capstone opportunity as a culmination of design education. Student generated design topic is fully developed and realized from master planning through design development, detailing, and documentation. Prereq: LA 561, 571.

## LIBRARY SCIENCE (Lib)

### COURSE

**121 Introduction to Library Research** 1  
Basic information on libraries and their services. Exploration of sources of information in print and computer format; explanation of basic search strategies.

## MANAGEMENT INFORMATION SYSTEMS (MIS)

Harter, Chair; Latimer, Shi

### COURSES

**370 Management Information Systems** 3  
Introduction to basic concepts and developments in information technology. Overview of the opportunities and challenges in the development and management of organizational information systems from a socio-technical perspective. Prereq: CSci 116.

**375 Database Design for Business Application** 3  
Fundamentals of conceptualizing and implementing databases. Emphasis is on using query languages to obtain information for decision-making. Includes managerial topics related to database administration, security, integrity, optimization, and distributed databases. Prereq: MIS 370, CSci 228.

**376 Data and Telecommunications Administration** 3  
Introduction to a wide variety of topics in the voice and data communications field. Prereq: MIS 370, CSci 228.

**470 Information Systems** 3  
Exploration of managerial issues pertaining to administration of the information systems function in organizations. Issues include planning, operations, control, electronic commerce, and other current topics. Prereq: MIS 370.

**770 Information Resources Management** 3  
Examination of the role of information resources in supporting a wide range of organizational functions by providing a managerial perspective on the use, design, and evaluation of information systems. Focus is managerial rather than technical. Prereq: Departmental approval.

## MATHEMATICS (Math)

Shreve, Chair; Brennan, Calvo, Cope, Coykendall, Foguel, Johnson, Juras, Kornfeld, Martin, Olsen, Ungar

### COURSES

**099 Elementary Algebra** 3  
Fundamental operations, factoring, fractions, exponents and radicals, equations. For students with little or no background in algebra. *Does not satisfy any requirements for graduation.* Offered through Continuing Education. Special fee required.

**102 Intermediate Algebra (CCN)** 3  
Properties of the real number system, factoring, linear and quadratic equations, functions, polynomial and rational expressions, inequalities, systems of equations, exponents, and radicals. *Does not satisfy any requirements for graduation.* Offered through Continuing Education. Special fee required. Prereq: Math 099 or placement test.

**103 College Algebra (CCN)** 3  
Relations and functions, equations and inequalities, complex numbers; polynomial, rational, exponential and logarithmic functions; systems of equations, matrices and determinants, sequences and summation. Prereq: Math 102 or placement test. (ND:Math)

**104 Finite Mathematics (CCN)** 3  
Systems of linear equations and inequalities, matrices, linear programming, mathematics of finance, elementary probability and descriptive statistics. Prereq: Math 102 or placement test.

**105 Trigonometry (CCN)** 3  
Angle measure, trigonometric and inverse trigonometric functions, trigonometric identities and equations, polar coordinates and applications. Prereq: Math 103 or placement test.

**146 Applied Calculus I (CCN)** 4  
Limits, derivatives, integrals, exponential and logarithmic functions and applications. Prereq: Math 103 or placement test. (ND:Math)

**147 Applied Calculus II (CCN)** 4  
Definite integrals, double integrals, trigonometry, introduction to differential equations, infinite sequences and series, probability and applications. Prereq: Math 146.

**165 Calculus I (CCN)** 4  
Limits, continuity, differentiation, Mean Value Theorem, integration, Fundamental Theorem of Calculus and applications. Prereq: Math 105 or placement test. (ND:Math)

**166 Calculus II (CCN)** 4  
Applications and techniques of integration; polar equations; parametric equation; sequences and series, power series. Prereq: Math 165.

**228 Introduction to Linear Algebra** 1  
Systems of linear equations, row operations, echelon form, matrix operations, inverses, and determinants. Prereq: Math 105 or equivalent. *Credit awarded only for Math 228 or 229, not both.*

- 229 Basic Linear Algebra** 2  
Includes content of Math 228 with the addition of vectors in  $n$ -space, subspaces, homogeneous systems, linear independence, rank, and dimension. Prereq: Math 105 or equivalent. *Credit awarded only for Math 228 or 229, not both.*
- 259 University Calculus III** 3  
Functions of several variable, vectors in two and three variables, partial derivatives, surfaces and gradients, tangent planes, differentials, chain rule, optimization, space curves, and multiple integrals. Prereq: Math 166. *Credit awarded only for Math 259 or 265, not both.*
- 265 Calculus III (CCN)** 4  
Multivariate and vector calculus including partial derivatives, multiple integration, applications, line and surface integrals, Green's Theorem, Stoke's Theorem, and Divergence Theorem. Prereq: Math 166. *Credit awarded only for Math 259 or 265, not both.*
- 266 Introduction to Differential Equations (CCN)** 3  
Solution of elementary differential equations by elementary techniques. Laplace transforms, systems of equations, matrix methods, numerical techniques, and applications. Prereq: Math 259 or 265; Coreq: Math 228 or 329.
- 270 Introduction to Abstract Mathematics** 3  
Sets, symbolic logic, propositions, quantifiers, methods of proof, relations and functions, equivalence relations, math induction and its equivalents, infinite sets, cardinal numbers, number systems. Prereq: Math 166.
- 327 Applied Linear Algebra (CCN)** 3  
Systems of linear equations, matrices, and linear programming, numerical applications. Prereq: Math 103 and 146 or 165.
- 329 Linear Algebra** 3  
Vector spaces, linear transformations eigenvalues and eigenvectors, canonical forms, inner product spaces, and selected applications. Prereq: Math 270.
- 340 Axiomatic Geometry** 3  
Hilbert's axioms for Euclidean geometry, projective geometry, history of parallel axiom, hyperbolic geometry, elliptic geometry. Prereq: Math 270.
- 374 Special Problems in Mathematics** 1  
Diverse and challenging mathematical problems are considered with the intent of preparing the student for the Putnam Mathematics competition. May be repeated. Pass/Fail only. Prereq: Math 270.
- 376 Actuarial Exam Study** 1  
Selected material from calculus, linear algebra, numerical analysis, and other areas that appear on national actuarial exams. May be repeated. Pass/Fail only. Prereq: Math 266, 329.
- 378 History of Mathematics** 3  
Historical consideration emphasizing the source of mathematical ideas, growth of mathematical knowledge, and contributions of some outstanding mathematicians. Prereq: Math 270.
- 420/620 Abstract Algebra I** 3  
Groups, permutations, quotient groups, homomorphisms, rings, ideals, integers. Prereq: Math 270.
- 421/621 Abstract Algebra II** 3  
Division rings, integral domains, fields, field extensions, Galois Theory. Prereq: Math 420.
- 430/630 Graph Theory** 3  
Graphs and directed graphs, graph models, subgraphs, isomorphisms, paths, connectivity, trees, networks, cycles, circuits, planarity, Euler's formula, matchings, bipartite graphs, colorings, and selected advanced topics. Prereq: Math 270.
- 436/636 Combinatorics** 3  
Recurrence relations, formal power series, generating functions, exponential generating functions, enumeration, binomial coefficients and identities, hypergeometric functions, floor and ceiling functions, Sterling and Eulerian numbers. Prereq: Math 270.
- 440 Differential Geometry** 3  
Basic properties of curves and surfaces, Frenet equations, the Gauss Map, intrinsic geometry of surfaces, geodesics, Gauss-Bonnet Theorem, and applications. Prereq: Math 270.
- 446 Introduction to Topology** 3  
Topology of Euclidean space, metric spaces, topological spaces, bases and neighborhoods, Hausdorff property, continuity, homeomorphisms and embeddings, connectivity, and compactness. Prereq: Math 270.
- 450/650 Real Analysis I** 3  
Sequences and convergence in  $\mathbb{R}$ , continuity, uniform convergence, spaces of continuous functions, compactness, fixed point theorems, differentiability, inverse and implicit function theorems, applications. Prereq: Math 266, 270.
- 451/651 Real Analysis II** 3  
Riemann and Riemann-Stieltjes integration, convergence theorems, multiple integration and Fubini's Theorem, elements of Fourier analysis, applications. Prereq: Math 450.
- 452/652 Complex Analysis** 3  
Complex number systems, analytic and harmonic functions, elementary conformal mapping, integral theorems, power series, Laurent series, residue theorem, and contour integral. Prereq: Math 265.
- 460/660 Intensive Mathematics** 1  
Through overview of the general purpose mathematical software MATHEMATICA: numerical and symbolic calculations for algebra and linear algebra, single and multivariable calculus, ordinary and partial differential equations, 2D- and 3D-graphics, animation, word processing. Prereq: Math 259.
- 472/672 Number Theory** 3  
Properties of integers, number theoretic functions, quadratic residues, continued fractions, prime numbers and their distribution, primitive roots. Prereq: Math 270.
- 480/680 Applied Differential Equations** 3  
Power series expansions and the method of Frobenius, special functions and their use (Bessel functions, Legendre polynomials); phase plane analysis. Prereq: Math 266.
- 481/681 Fourier Analysis** 3  
Discrete and continuous Fourier transforms, Fourier series, convergence and inversion theorems, mean square approximation and completeness, Poisson summation, Fast-Fourier transform. Prereq: Math 265.
- 482/682 Survey of Mathematical Models** 3  
Lagrangian and Hamiltonian dynamics, potential theory, diffusion, hydrodynamics, elasticity; dimensional analysis, tensors; emphasis on how physical concepts are formulated mathematically rather than solution methods. Prereq: Math 266.
- 483/683 Partial Differential Equations** 3  
Solution methods for potential, diffusion and wave equations; treatments of homogeneous and nonhomogeneous equations; boundary conditions; separation of variables, Greens' functions, transform techniques. Prereq: Math 480.
- 488/688 Numerical Analysis I** 3  
Numerical solution of nonlinear equations, interpolation, numerical integration and differentiation, numerical solution of initial value problems for ordinary differential equations. Prereq: Math 266.
- 489/689 Numerical Analysis II** 3  
Numerical solutions of linear and nonlinear systems, eigenvalue problems for matrices, boundary value problems for ordinary differential equations, selected topics. Prereq: Math 329, 488.
- 720, 721 Algebra I, II** 3 each  
Graduate level survey of algebra: groups, rings, fields, Galois theory, and selected advanced topics. Prereq: Math 421/621 or departmental approval.
- 724 Theory of Rings I** 3  
The ideal theory of commutative rings, structure of (non-commutative) rings, and selected advanced topics. Prereq: Math 721.
- 726 Homological Algebra** 3  
An overview of the techniques of homological algebra. Topics covered will include categories and functors, exact sequences, (co)chain complexes, Mayer-Vietoris sequences, TOR and EXT. Applications to other fields will be stressed. Prereq: Math 620/621.
- 728, 729 Linear Algebra I, II** 3 each  
Theory of linear transformations and matrices, canonical forms, inner product spaces, unitary spaces, symmetric forms, generalized inverses, and selected advanced topics. Prereq: Math 329.
- 730, 731 Graph Theory I, II** 3 each  
Graduate-level survey of graph theory: paths, connectivity, trees, cycles, planarity, genus, Eulerian graphs, Hamiltonian graphs, factorizations, tournaments, embedding, isomorphism, subgraphs, colorings, Ramsey theory, girth. Prereq: Math 430/630.

- 735 Introduction to Bioinformatics** 3  
An introduction to the principles of bioinformatics including information relating to the determination of DNA sequencing. Prereq: Stat 661.
- 736, 737 Discrete Mathematics I, II** 3 each  
Combinatorial reasoning, generating functions, inversion formulae. Topics may include design theory, finite geometry, Ramsey theory, and coding theory. Advanced topics may include cryptography, combinatorial group theory, combinatorial number theory, algebraic combinatorics, (0,1)-matrices, and finite geometry. Prereq: Math 430/630.
- 746, 747 Topology I, II** 3 each  
Topological spaces, convergence and continuity, separation axioms, compactness, connectedness, metricizability, complete metric spaces, homotopy, uniform spaces, and selected advanced topics. Prereq: Math 451.
- 750, 751 Analysis I, II** 3 each  
Lebesgue and general measure and integration theory, differentiation, product spaces, metric spaces, elements of classical Banach spaces, Hilbert spaces, and selected advanced topics. Prereq: Math 451.
- 752, 753 Complex Analysis I, II** 3 each  
Analytic and harmonic functions, power series, conformal mapping, contour integration and the calculus of residues, analytic continuation, meromorphic and entire functions, and selected topics. Prereq: Math 451.
- 754, 755 Functional Analysis I, II** 3 each  
Normed spaces, linear maps, Hahn-Banach Theorem and other fundamental theorems, conjugate spaces and weak topology, adjoint operators, Hilbert spaces, spectral theory, and selected topics. Prereq: Math 751.
- 756 Dynamic Systems** 3  
A study of basic notions of topological and symbolic dynamics. Introduction to measurable dynamics and ergodic theory. Ergodicity, mixing and entropy of dynamical systems. Prereq: Math 750.
- 760, 761 Ordinary Differential Equations I, II** 3 each  
Existence, uniqueness, and extendibility of solutions to initial value problems, linear systems, stability, oscillation, boundary value problems, difference equations, and selected advanced topics. Prereq: Math 751.
- 762 Integral Equations** 3  
Existence and uniqueness of solutions of Fredholm and Volterra integral equations, Fredholm Theory, singular integral equations, and selected advanced topics. Prereq: Math 751.
- 772, 773 Number Theory I, II** 3 each  
Number theoretic functions, algebraic number fields, prime numbers and their distribution, the Prime Number Theorem and related results, Fermat's Theorem. Prereq: Math 472/672.
- 778 Modern Probability Theory** 3  
See Statistics for description.
- 782, 783 Mathematical Methods in Physics I, II** 3 each  
Tensor analysis, matrices and group theory, special relativity, integral equations and transforms, and selected advanced topics. Prereq: Math 329, 452. Cross-listed with Phys 752, 753.
- 784 Partial Differential Equations** 3  
Classification in elliptic, parabolic, hyperbolic type; existence and uniqueness for second order equations; Green's functions, and integral representations; characteristics, nonlinear phenomena. Prereq: Math 751.
- 786, 787 Mixed Boundary Value Problems I, II** 3 each  
Methods for transient and steady-state solutions of diffusion problems with mixed boundary conditions; integral transforms; Green's function and integral equations formulations, asymptotics. Prereq: Math 452 or 752.
- 788, 789 Numerical Analysis I, II** 3 each  
Numerical solutions to partial differential and integral equations, error analysis, stability, acceleration of convergence, numerical approximation, and selected advanced topics. Prereq: Math 489.
- ## MECHANICAL ENGINEERING (ME)
- Pieri, Chair; Alimi, Danescu, Goplen, Gronhovd, N. Jazar, Kallmeyer, Mahinfalah, Mehta, Nazari, Song, Stewart, Stone, Ziejewski
- ### COURSES
- 189 Skills for Academic Success** 1  
See University Interdisciplinary Studies for description. F
- 212 Fundamentals of Visual Communications for Engineers** 3  
Visual communications for design and manufacturing, computer-aided drawing and design, three-dimensional modeling and orthographic projections, geometric dimensioning and tolerancing, ASME Y14.5 1994 standard, sketching, parametric modeling, drawings and assemblies. F, S
- 213 Modeling of Engineering Systems** 3  
Introduction to numerical methods used in the solution of engineering problems; computer methods, programming, and graphics; engineering system modeling and simulation; case studies. Prereq: Math 166, 229, ME 222. F, S
- 221 Engineering Mechanics I** 3  
Scalar and vector approaches to trusses, frames and machines, internal forces, friction forces, center of gravity, centroid, and moment inertia. Prereq: Math 165. F, S, SS
- 222 Engineering Mechanics II** 3  
Dynamics of particles and rigid bodies, work-energy, impulse-momentum, principles of conservation of energy and momentum. Prereq: ME 221, Math 166. F, S, SS
- 223 Mechanics of Materials** 3  
Introduction to stress, strain, and their relationships; torsion of circular shafts, bending stresses, deflection of beams, stress transformations, buckling. Prereq: ME 221. F, S, SS
- 226 Statics for Technologists** 3  
Equilibrium of rigid-body and coplanar force systems, trusses, three-dimensional force systems, friction, centroids, and centers of gravity. Prereq: Math 105.
- 227 Dynamics for Technologists** 3  
Study of kinematics and kinetics of particle motion, rigid body dynamics, work-energy, and impulse-momentum principles. Prereq: ME 226.
- 228 Strength of Materials for Technologists** 3  
Introduction to the concepts of stress, strain, torsion, horizontal shear stress, flexural stress, beam deflections, and Mohr's Circle. Prereq: ME 226.
- 311 Introduction to Aviation** 3  
General introduction to aviation and preparation for FAA examination for Private Pilot License, study of FAA regulations, weather conditions, visual and radio navigation. F, S
- 312 Introduction to Flight** 2  
Instruction in flight procedures, operation of aircraft, and introduction to solo flight. Completion of 15 hours of dual flight instruction required. Coreq: ME 311. F, S
- 313 Commercial Instrument Ground School** 3  
Preparation of student for FAA written examination for Commercial Certificate and Instrument Rating License; study of commercial flight maneuvers and instrument flying and procedures. Prereq: ME 311 or holder of Private Pilot License. On demand.
- 331 Engineering Materials I** 4  
Characterization of microscopic structures and associated macroscopic properties and performance of mechanical engineering design materials (metals, ceramics, plastics) and processing effects. Includes laboratory. Prereq: Chem 122, ME 223. F, S
- 332 Engineering Materials II** 3  
Characterization of properties and processes in metals; diffusion, phase diagrams, phase transformation, creep, wear, corrosion, fracture, and fatigue. Prereq: ME 331. F, S, SS

- 341 Mechanics of Machinery** 3  
Application of solid mechanics principles and computer methods in designing mechanisms for function and performance. Prereq: ME 213, 222. F, S
- 350 Thermodynamics and Heat Transfer** 3  
Basic concepts, first and second laws of thermodynamics. Introduction to heat transfer principles. Prereq: ME 222. F, S, SS
- 351 Thermodynamics I** 3  
Basic concepts, properties of pure substances and ideal gases. First and second law, entropy, and availability. Prereq: ME 222, Math 259. F, S
- 352 Fluid Dynamics** 3  
Foundations of the science of fluid dynamics. Basic concepts including thermodynamic principles applied to fluids. Development of conservation principles and applications. Prereq: ME 351. F, S
- 353 Thermodynamics II** 3  
Continuation of thermodynamics. Cycle analysis, thermodynamic relations, mixtures, chemical reactions, and related topics. Prereq: ME 351. F, S
- 411/611 Introduction to Nuclear Engineering\*** 3  
Study of the basic principles of nuclear engineering and reactors. Special topics on modern power plants utilizing nuclear energy. Prereq: Phys 252. S
- 412/612 Engineering Measurements\*** 3  
Principles and characteristics of instruments used for engineering measurements, statistical analysis of data, signal conditioning, data acquisition systems. Includes laboratory. Prereq: ECE 303, ME 223. F, S
- 421/621 Theory of Vibrations\*** 3  
Fundamentals of vibrations; free, forced, and damped vibration of single and multiple degrees-of-freedom systems. Prereq: ME 213, 222, Math 266. F, S, SS
- 423 Intermediate Mechanics of Materials** 3  
Study of failure theories, energy methods, inelastic bending, and elastic stability. Analysis of axisymmetric members, curved beams, and torsion of noncircular bars. Prereq: ME 223. F, S
- 435/635 Plastics and Injection Molding Manufacturing** 3  
See Industrial and Manufacturing Engineering for description.
- 442/642 Machine Design I\*** 3  
Application of engineering mechanics, material properties, and failure theories to the design of reliable machine components. Prereq: ME 213, 331, and 423. F, S
- 454/654 Heat and Mass Transfer\*** 3  
Principles of heat transfer by conduction, convection, and radiation. Introduction to mass transfer principles. Prereq: ME 213, 352, Math 266. F, S  
*\*Courses ME 611, 612, 621, 642, 643, and 654 are not acceptable for credit in graduate programs in Mechanical Engineering (M.S. or Ph.D.).*
- 455 Mechanical Systems Laboratory I** 1  
Investigation of behavior of fluid flows as well as devices for generating, controlling, and measuring fluid flow. Prereq: ME 352. F, S
- 456 Mechanical Systems Laboratory II** 1  
Investigations, tests, and reports based upon ME 353, 454. Prereq: ME 353, 454, 455. F, S
- 461, 462 Design Project I, II** 3 each  
Capstone student project in design, analysis, and experimental investigation in mechanical engineering. Coreq for 461: ME 442, 454 and Senior standing in ME curriculum. Prereq for 462: ME 461. Courses must be taken in consecutive semesters. Summer classes are based on minimum enrollment. 461-F, S, 462 - S, SS.
- 463, 464 Plastics Design Project I, II** 3 each  
Capstone student project in analysis, design, and experimental investigation in the Polymers and Coatings option of ME. Coreq for 463: ME 442, 473, 474, and Senior standing in ME curriculum. Prereq for 464: ME 463. Courses must be taken in consecutive semesters, 463-F, 464-S.
- 465, 466 Power Plant Design I, II** 3 each  
Capstone design philosophy, criteria, and procedures; emphasis on coal-fired electric generating units with system simulation and optimization; case studies of recent engineering designs. Prereq for 465: ME 353; Coreq: ME 442, 454, Senior standing in ME curriculum. Prereq for 466: ME 465. Courses must be taken in consecutive semesters, 465-F, 466-S.
- 471/671 Stress Analysis** 3  
Coordination of mathematical and modern experimental analysis as applied to engineering materials. Includes laboratory. Prereq: ME 223. S
- 473/673 Engineering Plastics for Design** 3  
Mechanical and thermal properties of plastics materials as needed to design and manufacture plastics components to support constant and time-varying loads. Prereq: ME 331. F
- 474/674 Mechanics of Composite Materials** 3  
Materials, properties, stress, and strength analyses; engineering design and manufacturing aspects of short and continuous fiber-reinforced materials. Prereq: ME 442/642. S
- 475/675 Automatic Controls** 3  
Introduction to industrial automatic controls. Theory and applications of pneumatic control, continuous process control, and programmable logic control. Demonstrations and discussion of the current industrial practice. Prereq: Math 266. S
- 477/677 ME Finite Element Analysis** 3  
Introduction to the finite element method and its application to problems in mechanical engineering, including stress analysis. Prereq: ME 213 or ABEn 255. F, S
- 479/679 Fluid Power Systems Design** 3  
Fluid dynamics principles and fluid properties are applied to the study of function, performance, and design of system components and systems for power transmission and control purposes. Prereq: ME 222, 352. F
- 481/681 Fundamentals of Energy Conversion** 3  
Introduction to electric power generating systems and their major components such as turbines, boilers, condensers, and cooling towers. Prereq: ME 353. F
- 484/684 Gas Turbines** 2  
Theory and design of gas turbines and components. Prereq: ME 353, 454/654.
- 485/685 Heating, Ventilation, and Air Conditioning** 3  
Application of the basic fundamentals of thermodynamics, heat transfer, and fluid flow to heating, ventilating, and air conditioning. Prereq: ME 353, 454/654, senior standing. S
- 487/687 Internal Combustion Engines** 3  
Theory and practice of power and propulsion engines utilizing gas as a working substance. Study of gas turbines, spark, and compression ignition engines. Prereq: ME 353. F
- 489/689 Vehicle Dynamics** 3  
Fundamental science and engineering underlying the design and operation of vehicles. Use of previous knowledge of statics, kinematics, dynamics, and machine design. Prereq: ME 341. S
- 711 Advanced Engineering Analysis** 3  
Mathematical analysis and numerical treatment of engineering problems, eigenvalue problems in lumped and distributed parameter systems, advanced mathematics applied to engineering design. Prereq: ME 465 or departmental approval. F
- 712 Advanced Finite Element Analysis** 3  
Application of finite element methods to problems of plasticity, viscoplasticity, fracture, vibrations, fluids, material and geometric nonlinearity, and heat transfer. Prereq: ME 477/677.

- 717 PC Based Measurements and Controls** 3  
Introduction to digital electronics. Discussion of sensors, personal computers, signal conditioning, analog to digital converters, and digital to analog converters; selection of commercial hardware and software. Prereq: ME 412/612.
- 720 Continuum Mechanics** 3  
See Civil Engineering for description.
- 721 Advanced Dynamics and Vibrations** 3  
Kinematics and dynamics of a particle, a system of particles and a rigid body, orbital motion. Lagrange's equations, vibration theory. Prereq: ME 421/621.
- 722 Mechanics of Deformable Solids** 3  
Special problems in theories of failure, contact stresses, thick-walled cylinders, thin tubes, curved beams, energy methods. Prereq: ME 223.
- 723 Experimental Stress Analysis** 3  
Measurement of deformations that are of significance in the engineering design of load resisting members. Use of optical, electrical, and mechanical instrumentation; brittle coating and photoelastic techniques. Includes laboratory. Prereq: ME 471/671.
- 751 Advanced Thermodynamics** 3  
Rigorous treatment of thermodynamic principles. Emphasis on the concept of availability methods as applied to various engineering systems. Prereq: ME 353.
- 752 Statistical Thermodynamics** 3  
Microscopic treatment of thermodynamics. Introduction to quantum mechanics, kinetic theory; applications to gases, liquids, and solids; transport phenomena; introduction to irreversible process. Prereq: ME 353.
- 753 Gas Dynamics** 3  
Fundamental concepts of fluid dynamics and thermodynamics are used in the treatment of compressible flow, frictional flows, and flows with heat transfer or energy release. Prereq: ME 352.
- 754 Boundary Layer Theory** 3  
Fundamental laws of motion of a viscous fluid are derived and used in the consideration of laminar boundary layers, transition phenomena, and turbulent boundary layer flows. Prereq: ME 352.
- 761 Heat Transmission I** 3  
Advanced study of heat conduction in solids. Analytical, graphical, and numerical evaluations of the temperature field. Use of advanced mathematical methods in the solution of boundary value problems. Prereq: ME 454/654.
- 779 Selected Topics in Mechanical Engineering** 3  
Topics or studies require departmental approval.
- MICROBIOLOGY (MICR)**  
Freeman, Chair; Berry, Dyer, Ebert, Gustad, Haggart, Logue, Nolan, Robinson, Rust
- COURSES**
- Biol 202, 202L**  
**Introductory Microbiology, Lab (CCN)** 2  
Study of the characteristics and importance of microorganisms with emphasis on their identification, control, and relationships to health and disease. (ND:LabSc) Not for microbiology majors.
- 350, 350L General Microbiology, Lab (CCN)** 3  
Principles of microbiology for students requiring a rigorous professionally oriented course.
- 352 General Microbiology II** 3  
Further exploration of microbiological concepts introduced in Micr 350. Topics include molecular structure, physiology, metabolism, growth and microbial genetics. Prereq: Micr 350.
- 352L General Microbiology Lab II** 1  
Application of principles of microbiology introduced in General Microbiology II using advanced microbiology techniques and tools. Prereq: Micr 350L. Pre or Coreq: Micr 352.
- 363 Clinical Parasitology** 2  
Protozoan, helminthic, and arthropodal parasites of humans. Emphasis on clinical identification, life histories, and control. Prereq: Biol 150, 150L.
- 445/645 Animal Cell Culture Techniques** 2  
Methods of animal cell culture propagation and uses for cell culture systems.
- 452/652 Microbial Ecology** 3  
Influence of natural environments on microbial growth. Environmental selection and microbial succession of different species, population interactions, and environmental modification via microbial metabolism. Prereq: Micr 350, 350L.
- 453/653 Food Microbiology** 3  
Microbiology of preservation, manufacture, and spoilage of food and dairy products from commercial and domestic viewpoints. Prereq: Biol 202L or Micr 350L. Cross-listed with CFS and F&N.
- 460/660 Etiology of Foodborne Illness (CCN)** 3  
See Food Safety for course description.
- 460L/660L Pathogenic Microbiology Laboratory (CCN)** 2  
Isolation and identification of pathogenic microorganisms. Prereq: Micr 350L.
- 465/665 Fundamentals of Animal Disease** 3  
Basic principles of disease processes and prevention with emphasis on zoonotic and domestic animal diseases of infectious, parasitic, metabolic, toxicologic, and neoplastic origin. Prereq: VetS 135.
- 470/670 Basic Immunology** 3  
Principles of immunology, antigen-antibody reactions, and immune response in host. Prereq: Micr 350.
- 471/671 Immunology and Serology Laboratory** 2  
Basic immunological and serological procedures. Prereq: Micr 350.
- 475/675 Animal Virology** 3  
Basic presentation in laboratory culture and fundamentals of animal virology. Prereq: Biol 202L or Micr 350L.
- 480/680 Food Safety Practicum** 3  
See Food Safety for course description.
- 482/682 Bacterial Genetics and Phage** 3  
Principles of bacterial genetics and phage-host relationships. Prereq: Micr 350, Bioc 460.
- 486 Capstone Experience in Microbiology** 3  
Capstone experience to integrate the principles of microbiology with the development of skills in experimental design and scientific discourse. Prereq: Senior standing.
- 561 Microbiology Laboratory for Pharmacy** 1  
Students are exposed to laboratory procedures currently used in clinical microbiology laboratories.
- 572 Clinical Immunology** 1  
Basic concepts in immunology including special attention to clinical conditions that may appear as a result of immune system activity. Prereq: Biol 202 or Micr 350.
- 752 Advanced Food Microbiology** 3  
See SAFE 752 for course description.
- 762 Advanced Pathogenic Bacteriology** 3  
Biophysical and biochemical mechanisms by which microorganisms cause infectious disease and host reactions to the disease. Prereq: Micr 460, 460L. Cross-listed with Food Safety.
- 770 Immunology of Chronic Infections** 3  
A study of chronic infections, including pathogens involved, mechanisms of host immunity, and economic and social importance of these organisms. Prereq: Micr 470/670.
- 781 Advanced Bacterial Physiology** 3  
In-depth consideration of various topics in bacterial physiology such as autotrophy, bacterial growth and growth yields, energy-yielding metabolism, and regulation of catabolic pathways. Prereq: Micro 480/680.

**782 Molecular Microbiology Techniques 3**

Familiarize students with current molecular and immunologic strategies and techniques commonly used to study infectious disease processes. Prereq: BioC 460, 461, 474, Micr 471.

**783 Advanced Bacterial Genetics and Phage 3**

Mechanisms of genetic rearrangement and regulation in bacteria and phage. Recombinant DNA. Prereq: Micr 482/682.

**785 Pathobiology 3**

A study of organ systems pathology with attention to pathogenesis of disease and lesion development. Infectious, neoplastic, degenerative and heritable diseases will be discussed. Emphasis is placed on animal disease. Prereq: Micr 460/660.

**MILITARY SCIENCE (MS)**

Remus, Chair; Blotsky, Joyce, Sanders

**COURSES****110 Army ROTC Physical Fitness 2**

Instruction in planning and leading physical fitness programs. Development of physical fitness required of an Army officer. Emphasis on development of an individual fitness program and the role of exercise and fitness in one's life. F, S

**111 Introduction to ROTC 1**

Increase self-confidence through team study and activities in basic drill, physical fitness, leadership reaction course, first aid, and making presentations. Fundamental concepts of leadership in classroom and outdoor laboratory environments. Weekly lab required. Coreq: MS 310. F

**112 Introduction to Leadership 1**

Principles of effective leading; reinforce self-confidence; develop communication skills to improve performance and group interaction; relate organizational ethical values to leadership effectiveness. Weekly lab required. Coreq: MS 320. S

**114 Basic Pistol Marksmanship 1**

Fundamentals of military pistol marksmanship techniques, firearms safety, range safety, marksmanship programs, and methods of instruction.

**115 Basic Rifle Marksmanship 1**

Fundamentals of military rifle marksmanship techniques, firearms safety, range safety, marksmanship programs, and methods of instruction.

**211 Self/Team Development 2**

Apply ethics-based leadership skills; develop skills in oral presentations, writing concisely, planning events, coordinating group efforts, advanced first aid, land navigation, and basic military tactics. Includes ROTC Leadership Assessment Program. Weekly lab required. Coreq: MS 310. F

**212 Individual/Team Military Tactics 2**

Introduction to individual and team military tactics in small unit operations: use of radio communications, making safety assessments, movement techniques, planning team safety/security, and pre-execution check methods. Includes practical exercises. Weekly lab required. Coreq: MS 320. S

**213 Basic Camp: Camp Challenge 3**

A paid six-week summer camp at an Army post. Travel, lodging, and most meal expenses are defrayed by the Army. Rigorous environment similar to Army Basic Training. No military obligation incurred. Application required.

**214 United States Military History 2**

Overview of all United States military operations with emphasis on technology, leadership, strategy, tactics, and logistics of several selected campaigns.

**310 Leadership Laboratory 1**

Individual and collective drill, small unit leadership experience, and tactical training. To lead small groups, receive personal assessments and encouragement, and defensive tactics. Develop skills in planning and leading by conducting training for lower-division students. Weekly lab, physical fitness program, and field exercises required. Coreq: MS 310. F

**312 Leading Small Organizations II 3**

Analyze tasks, prepare written/oral guidance for team members, delegate tasks, and supervise. Plan for and adapt to the unexpected under stress. Examine leadership case studies and value of ethical decision making. Weekly lab, physical fitness program, and field exercises required. Coreq: MS 320. S

**313 Advanced Camp 3**

A paid five-week summer camp at an Army post. Highly structured, demanding environment. Emphasis on individual leadership and basic skills performance under challenging conditions. Performance contributes to level of commission upon graduation. Prereq: MS 311 or 312.

**320 Leadership Laboratory 1**

Small unit drill, as well as tactical application of leadership fundamentals at the squad/patrol leader level. S

**410 Leadership Laboratory 1**

Assumption of command and staff positions within the cadet battalion. F

**411 Leadership Challenges and Goal Setting 3**

Plan, conduct, and evaluate activities of the ROTC cadet organization. Articulate goals, put plans into action. Assess organizational cohesion and develop improvement strategies. Lead people and manage resources. Apply Army policies. Weekly lab, physical fitness program, and field exercises required. Coreq: MS 410. F

**412 Transition to Lieutenant 3**

Identify and resolve ethical dilemmas. Refine counseling and motivating techniques. Examine tradition and law related to an Army officer. Prepare for Army lieutenant. Weekly lab, physical fitness programs, and field exercises required. Coreq: MS 420. S

**420 Leadership Laboratory 1**

Assumption of command and staff positions within the cadet battalion. S

**MUSIC (MUSC)**

Eyler, Froelich, Groves, Jones, Mack, J. Miller, Mueller, Olfert, Patnode, Queen

**COURSES****101 Fundamentals of Music (CCN) 3**

Introduction to fundamental elements of music through the study of scales, chords, basic harmonic progressions, rhythms, and terminology.

**103 Introduction to Music History (CCN) 3**

Introduction to the major works of music in the western tradition which define the stylistic elements of musical periods in history.

**104 Introduction to Music Literature to 1825 (CCN) 3**

Understanding and appreciating musical styles and composers up to circa 1825 with some emphasis on the relationship of music to concurrent social and artistic trends. Designed for non-music majors. (ND:Hum)

**105 Introduction to Music Literature: 1825 to the Present (CCN) 3**

Understanding and appreciating musical styles and composers from circa 1825 to the present with some emphasis on the relationship of music to concurrent social and artistic trends. Designed for non-music majors. (ND:Hum)

**108 Roots of American Popular Music (CCN) 3**

Survey of American popular music and musicians from Civil War times through the present with an emphasis on historical and sociological influences. Designed for non-music majors. (ND:Hum)

**130, 131 Elementary Harmony I, II 3 each**

Introduction to the compositional practices of the 18th and 19th centuries. Prereq for 131: Musc 130; Coreq: Musc 132, 133 respectively.

**132, 133 Elementary Ear Training I, II 1 each**

Development of sight singing and ear training skills. Laboratory band and chorus required. Coreq: Musc 130, 131 respectively.

**141 Symphonic Literature 2**

Survey of the history of symphonic literature with emphasis on selected works. Prereq: Musc 140, ability to read music.

- 142 Operatic Literature** 2  
Survey of the history of opera with emphasis on selected works. Prereq: Musc 140, ability to read music.
- Applied Music**  
Private lessons. Prereq: Qualifying examination in performance.
- Applied Piano** 1  
165, 265, 365, 465. May be repeated twice.
- Applied Organ** 1  
166, 266, 366, 466. May be repeated twice. Tri-College course.
- Applied Voice** 1  
167, 267, 367, 467. May be repeated twice.
- Applied Wind Instruments** 1  
168, 268, 368, 468. May be repeated twice.
- Applied Percussion Instruments** 1  
169, 269, 369, 469. May be repeated twice.
- Elementary Applied Voice, Wind Instruments, Percussion** 1 each  
170, 171, 172. May be repeated.
- 143 Keyboard Literature** 2  
Survey of keyboard styles, instrumental development, and literature (excluding organ) from the early 14th century through the 20th century, with special emphasis on works from 1775 to 1925. Prereq: Music major or minor.
- 150 Vocal Methods and Pedagogy I** 2  
Basic instruction in vocal pedagogy, methods, and literature for music majors.
- 160, 161 Piano Class I, II** 1 each  
Group instruction in the basic fundamentals of playing the piano. Designed primarily to meet the basic piano proficiency requirements for music education majors.
- 162, 163 Voice Class I, II** 1 each  
Group instruction in the fundamentals of singing. For music students who do not major in voice.
- 173, 273 Supplementary Applied Study** 1-2  
For Music Performance majors. 173 and 273 registrations should be for one credit; add one credit for supplementary pedagogy study. Registration by permission of instructor only.
- 174 Pronunciation for Singers I** 1  
Instruction in the proper pronunciation of English, Italian, German, Latin, and Spanish for song, oratorio, and opera.
- 175 Pronunciation for Singers II** 1  
Instruction in the proper pronunciation of French for song, oratorio, and opera. Prereq: Musc 174.
- 180 Performance Attendance** 0  
Attendance at regional performances, including NDSU events. Minimum of five registrations necessary for graduation for music majors, two registrations for music minors. P/F only.
- 201 World Music (CCN)** 3  
Survey of the music cultures of major non-Western and non-Anglo North American ethnic groups of the world.
- 230, 231 Advanced Harmony I, II** 3 each  
Advanced harmonic materials of the common practice period and analysis of small and large forms. Prereq for 230: Musc 130; Prereq for 231: Musc 230; Coreq: Musc 232, 233 respectively.
- 232, 233 Advanced Ear Training I, II** 1 each  
Advanced work with ear training and sight singing materials. Laboratory band and chorus required. Coreq: Musc 230, 233 respectively.
- 250 Basic Conducting** 2  
Study and development of basic ensemble conducting skills.
- 260, 261 Piano Class III, IV** 1 each  
Intermediate instruction in class piano. Prereq: Musc 161.
- 331 Instrumental Arranging** 2  
Arranging materials for bands. Prereq: Musc 231.
- 332 Choral Arranging** 2  
Arranging materials for choral ensembles. Prereq: Musc 231.
- 340 Music History I** 3  
Study of the history of music from the Greek period through the Baroque. Prereq: Musc 103.
- 341 Music History II** 3  
Study of the history of music from the Classical period through the 20th century. Prereq: Musc 340.
- 344 Wind Band Literature** 2  
Description to come.
- 350 Vocal Methods and Pedagogy II** 2  
Advanced instruction in vocal pedagogy and methods for music education majors. Prereq: Musc 150.
- 351 Instrumental Conducting and Literature** 2  
Fundamentals and techniques of conducting instrumental ensembles with practical application through the study of instrumental literature.
- 352 Choral Conducting and Literature** 2  
Fundamentals and techniques of conducting choral ensembles with practical application through the study of choral literature.
- 353 Woodwind Methods I** 2  
Class instruction in woodwind instruments for vocal and instrumental music education majors. Emphasis on pedagogical principles, applied competency of fundamentals, and literature.
- 354 Woodwind Methods II** 2  
Class instruction in woodwind instruments for instrumental music education majors. Emphasis on advanced pedagogical principles, applied competency of fundamentals and in-depth coverage of literature.
- 355 Brass Methods** 2  
Class instruction in brass instruments for vocal and instrumental music education majors. Emphasis on pedagogical principles, applied competency of fundamentals, and literature.
- 357 Marching Band Methods and Techniques** 2  
Methods and materials for directing, charting, and fielding a high school marching band.
- 358 Jazz Methods** 2  
History, methods, and materials for teaching jazz styles and improvisation.
- 359 Percussion Methods** 2  
Class instruction in percussion instruments for music education majors. Emphasis on pedagogical principles, applied competency, and literature.
- 364 Jazz Improvization** 2  
Basic concepts necessary to play and teach the fundamentals of jazz improvization.
- 373 Supplementary Applied Study** 2-3  
For Music Performance majors. Typical registration should be for two credits; add one credit for supplementary pedagogy study. Registration by permission of instructor only.
- 380 Recital** 1  
Preparation and presentation of a half recital in instrumental, keyboard, or vocal performance.
- 411/611 Form and Analysis** 2  
Study of the types of tonal relationships which create musical works of art. Examination of small forms such as motive and phrase, and progressing to large forms such as fugue, variation, and sonata.
- 430/630 Counterpoint** 3  
Study of contrapuntal techniques of the Renaissance and Baroque periods through analysis and composition exercises. Prereq: Musc 231.
- 431/631 Contemporary Harmonic Techniques** 3  
Study of harmonic and contrapuntal techniques of contemporary composers, with exercises in writing in the various styles. Prereq: Musc 231.
- 473 Supplementary Applied Study** 3-4  
For Music Performance majors. Typical registration should be for three credits; add one credit for supplementary pedagogy study. Registration by permission of instructor only.
- 480 Recital** 1  
Capstone for performance majors.
- 701 Psychology of Music** 2  
Study of acoustics, the anatomy and physiology of hearing, and how music and sound are perceived by the listener.
- 721 Advanced Vocal Pedagogy and Repertoire** 2  
In-depth study of the physical and physiological considerations of vocal technique with application to specific voices and suitable repertoire.

- 722 Advanced Instrumental Music Pedagogy and Literature** 2  
Advanced study in the pedagogy and literature of wind instruments. Emphasis on techniques of teaching winds in grades 5 through 12. Section 1: Brass pedagogy. Section 2: Woodwind pedagogy.
- 731 Applied Study** 1-4  
Private applied music study (instrumental, keyboard, vocal, conducting). Course credit determined by program and recommendation of instructor.
- 734 Analytical Techniques** 3  
Analysis of music of all periods, using a variety of techniques. Music to be analyzed will vary with each offering; may be repeated with permission of instructor.
- 740 Medieval and Renaissance Music History** 3  
In-depth historical study of Medieval and Renaissance musical styles and genres through critical listening, discussions, and student and instructor presentations.
- 741 Baroque Music History** 3  
In-depth historical study of Baroque musical styles and genres through critical listening, discussions, and student and instructor presentations.
- 742 Classical Music History** 3  
In-depth historical study of Classical musical styles and genres through critical listening, discussions, and student and instructor presentations.
- 743 Romantic Music History** 3  
In-depth historical study of Romantic musical styles and genres through critical listening, discussions, and student and instructor presentations.
- 744 20th Century Music History** 3  
In-depth study of the 20th-century musical language and compositional values and goals through critical listening, score analysis, discussions, and student and instructor presentations.
- 748 Music Bibliography and Research Methods** 2  
Introduction to music reference works, general music bibliography, and research methods.
- 760 Choral Literature 1450-1700** 3  
A study of the choral literature of the Renaissance and early Baroque periods, including major composers, genres, forms, and compositional styles.
- 761 Choral Literature 1700-1820** 3  
A study of the choral literature of the mid-Baroque through the Classical period including major composers, genres, forms, and compositional styles.
- 762 Choral Literature 1820-Present** 3  
A study of the choral literature of the Romantic period through the present including major composers, genres, forms, and compositional styles.
- 765 Band Literature: History and Development** 3  
Historical survey of instrumental literature for wind band, covering repertoire from the Renaissance to the present.
- 766 Band Literature: Chamber Music, Other Genres** 3  
Survey of instrumental literature for wind band, covering music for young bands, wind band and voice, wind band and solo instruments, chamber music, and other genres.
- 780 Recital** 4  
Preparation and presentation of a professional full-length recital in instrument, keyboard, vocal, or conducting performance, with accompanying document.
- 790 Graduate Ensemble** 1  
Ensemble registration for graduate students. Study and performance of major works of each ensemble.
- Organizations**  
Membership in all organizations is subject to approval of the director. May be repeated.
- 111 Marching Band** 1  
**112 Varsity Band (ND:FA)** 1  
**114 University Summer Band** 1  
**115 University Chorus (ND:FA)** 1  
**303 Concert Band (ND:FA)** 1  
**306 Concert Choir (ND:FA)** 1  
**310 Brass Ensemble** 1  
**311 Jazz Ensemble** 1  
**312 Percussion Ensemble** 1  
**313 Trombone Ensemble** 1  
**314 Brass Chamber Ensemble** 1  
**315 Woodwind Chamber Ensemble** 1  
**316 String Chamber Ensemble** 1  
**317 Madrigal Singers** 1  
**318 Dakota Jazz (Vocal)** 1  
**319 Opera Workshop** 1  
**320 Vocal Chamber Ensemble** 1  
**321 Piano Chamber Music** 1  
**322 Jazz Combo** 1
- NATURAL RESOURCES MANAGEMENT (NRM)**  
Grygiel, Chair; Ashworth, Barker, Berryhill, Biondini, Bleier, Clambey, Kirby, J. Leitch, Lin, Nuechterlein, Padmanabhan, J. Richardson, Shultz, Steele, Stegman, Walter
- COURSES**  
**150 [190] Natural Resources Management Orientation** 1  
Introduction to natural resources management issues, concepts, and careers.
- 225 Natural Resource and Agro-ecosystems** 3  
See Animal and Range Sciences for description.
- 264 Natural Resource Management Systems** 3  
See Agricultural Systems Management for description.
- 491 Seminar** 1  
Capstone experience employing problem based learning on topics relating to natural resources management. Prereq: Senior standing.
- 690 Graduate Seminar** 3  
Capstone experience employing problem based learning on topics relating to natural resources management. Prereq: Graduate standing.
- 701 Terrestrial Resources Management** 3  
Management and ecology of heterogeneous landscapes where ecosystem processes and human activities interact as dynamic components. Prereq: Bot 660 and 754.
- 702 Natural Resources Management Planning** 2  
Presentation of the principles, practices and key policy issues of natural resources management and planning. Prereq: NRM 701.
- 720 Natural Resources Administration and Policy** 2  
A comprehensive analysis of the theory of externalities and their application to the design of natural resources policy. Prereq: Econ 681, NRM 702.
- 730 Environmental Law** 1  
Overview of the subject of environmental law.
- 731 NEPA and Environmental Impact Assessment** 2  
The interaction and effects of NEPA with national environmental policy; implementation of NEPA; public opinion on the state of the environment.
- 732 Environmental Impact Statement** 2  
An in-depth review of EISs including instruction and practice in the preparation of an EIS.
- NURSING (Nurs)**  
Nelson, Chair; Gilles, Gross, Kiser-Larson, McCullagh, Torgerson, Waldhaus
- COURSES**  
**341 Client Concepts** 4  
Emphasizes the physiologic, psychologic, and pathophysiologic concepts which provide the foundation for professional nursing care.
- 342 Adult Health Nursing I** 4  
Focuses on the etiology, pathophysiologic mechanisms, and nursing care of adult clients experiencing common disorders of body system function.

- 351 Nursing Concepts** 4  
Introduction to the major, encompassing concepts integral to the nursing process including communication, legal issues, values and ethics, spirituality, pain management, and immobility issues.
- 352 Family Nursing I** 4  
Focuses on nursing care and promotion for the childbearing family and includes identification and care of high risk clients.
- 360 Health Assessment (CCN)** 4  
Focuses on health assessment and health promotion of individual clients through utilization of the nursing process and basic nursing concepts.
- 362 Family Nursing II** 4  
Focuses on nursing care of the child and family as client. Includes infancy through adolescence, hospitalized and within the community, acutely ill and chronically ill; common stressors throughout the growing years; strategies for health promotion.
- 401 Community Health Nursing** 4  
Synthesis and application of nursing and public health concepts to promote the wellness of communities, families, and individuals.
- 402 Mental Health Nursing** 4  
Synthesis and application of nursing and psychiatric-mental health concepts to promote the wellness of individuals and groups.
- 403 Adult Health II** 4  
The etiology, pathophysiologic mechanisms, and nursing care of critically ill adult clients.
- 404 Adult Health III** 4  
The etiology, pathophysiologic mechanisms, and organization of nursing care of adult clients experiencing selected complex stressors.
- 411, 412 Role Development I, II** 2 each  
Capstone integration of nursing concepts into the complex professional practice role. Nursing program themes are applied and reinforced. Critical thinking and decision-making skills are emphasized in analysis of patients' health status.
- 420 Nursing Research** 2  
Introduction to the research process and its application to nursing practice.
- 430 Nursing Management** 2  
Study of concepts and issues related to management and leadership in professional nursing.
- 601 Theoretical Perspectives of the Discipline** 2  
The course is designed to help the student analyze, critique and apply a variety of nursing theories, models and conceptual frameworks in advanced nursing practice. Prereq: Graduate status.
- 602 Ethics of Health Care and Nursing** 2  
The course provides the graduate nursing student with opportunities to analyze interactions among common clinical, organizational, societal, and policy decisions from ethical and legal perspectives. Prereq: Graduate status.
- 604 Advanced Nursing Research** 3  
Research in nursing includes an exploration of the research process and the methodologies appropriate to nursing. Prereq: Graduate status.
- 606 Health Care Delivery Systems Policy and Financing** 2  
Focus on health care delivery systems configuration, policy development and how health care system are financed. Prereq: Graduate status.
- 608 Transcultural and Social Perspectives** 3  
Develop understanding of diversities in races, cultures, individuals, families, communities, populations, lifestyles, gender, and age groups. Changing demographics will be analyzed, major health needs identified, and health promotion and disease prevention plans formulated. Prereq: Graduate status.
- 612 Advanced Health Assessment** 3  
Performance of health histories, complete physical/psychosocial assessments, and developmental assessments of clients from across the lifespan. A laboratory component is included. Prereq: Graduate status.
- 612P Practicum I: Advanced Health Assessment** 3  
Clinical opportunities for application of recently learned skills and extended clinical experiences in advanced health assessment. Clinicals are supervised by a health care provider who has documented expertise in the area of specialization. Prereq: Nurs 612
- 614 Advanced Pathophysiology I** 2  
General pathophysiological responses to selected body systems to disease processes are presented from both biological and behavioral perspectives. Emphasis on normal cellular function, developmental changes and common physiological symptoms. Prereq: Graduate status.
- 616 Advanced Pathophysiology II** 2  
Builds on the context from Nurs 614 with emphasis on normal cellular function, developmental changes and common physiological symptoms. Synergistic clinical manifestations and total body-mind responses to system alterations. Prereq: Nurs 614.
- 618 Family Nursing Theory and Health Promotion** 4  
Theoretical foundations and research based interventions related to psychosocial effects of illness, health behaviors, health promotion and disease prevention. Critically examines patterns of health behaviors, influence of psychosocial issues, risk assessment, lifestyles, and developmental stages. Prereq: Graduate status.
- 620 Advanced Practice Roles** 2  
Focus on the advanced practice nurse's role expectations. Includes an understanding of the profession, regulations and rules of advanced practice, scope of practice, legal ramifications of scope of practice, interdisciplinary, collaborative practice. Prereq: Nurs 634P and 641P.
- 620P Practicum IV: FNP Role Integration** 4  
Clinical focus on the advanced practice nurse's role expectations in the primary care setting. Includes an understanding of the profession, regulations and rules of advanced practice, scope of practice, legal ramifications of scope of practice, and interdisciplinary, collaborative practice. Prereq: Nurs 634P and 641P.
- 621 Integrative Health Practices** 3  
Integrative therapies with a focus on selected systems of health and specific modalities widely used by health care consumers. Emphasis on assessing patients for use and developing a list of educational and provider resources. Prereq: Graduate status.
- 623 The Nurse as Educator** 4  
Major study in selected area with an emphasis in research. Prereq: Nurs 632 and 622P.
- 624 Advanced Transcultural Nursing** 3  
Program planning to promote the health of diverse populations will be based on epidemiological data, theory and research. Students will select a specific age group or health problem within a population/cultural group to study in depth. Prereq: Nurs 608.
- 625 Advanced Parish Nursing** 3  
Emphasis is placed on the mind-body-soul connection with health and healing. Strategies for designing, implementing and evaluating a parish nurse program, along with administrative implications are explored. Prereq: Nurs 616 and 618.
- 626 Ethical Considerations of Parish Nursing** 3  
Ethical and legal considerations unique to an advanced parish nursing practice are evaluated and protocols recommended. Theoretical applications, research findings, and policy and legal principles are utilized. Parameters of advanced nursing practice in parish settings will be delineated. Prereq: Nurs 602.
- 630 Advanced Community Assessment** 3  
Epidemiologic techniques, reporting, and research will be presented. Emphasis is placed on disease prevention and control. Health problems of national and international significance will be examined and strategies for solutions and/or management will be proposed. Prereq: Stat 330.
- 631 Advanced Pharmacology I** 2  
Information relative to therapeutic management guidelines for treatment of selected disease processes. Drug information by classification and basic principles of pharmacodynamic and pharmacokinetics, clinical uses, mechanisms of action, contraindications, adverse reactions, and client education implications.

- 632 Advanced Pharmacology II** 2  
Continuation of information relative to therapeutic management guidelines for treatment of selected disease processes. Drug information by classification and basic principles of pharmacodynamic and pharmacokinetics, clinical uses, mechanisms of action, contraindications, adverse reactions, and client education implications. Prereq: Nurs 631.
- 633 Family Primary Care I: Assessment & Management** 3  
Clinical decision making skills are fostered in the diagnosis, management, monitoring and evaluation of common acute, emergent, and chronic health conditions. Selected case studies of clients will be examined in relation to problems, diagnoses, plans, and evaluations. Prereq: Nurs 612, 612P, and 616.
- 633P Practicum II: Family Primary Care I** 4  
Clinical opportunities for application of recently learned skills and extended clinical experiences in advanced health assessment. Theory, research and didactic learning experiences are incorporated and supervised by a health care provider with expertise in the area of specialization. Prereq: Nurs 631 and 633.
- 634 Family Primary Care II: Assessment and Management** 3  
Clinical decision making skills are fostered in the diagnosis, management, monitoring and evaluation of common acute, emergent, and chronic health conditions. Selected case studies of clients will be examined in relation to problems, diagnoses, plans, and evaluations. Prereq: Nurs 633.
- 634P Practicum III: Family Primary Care II** 4  
Clinical opportunities for application of clinical experiences in advanced health assessment. Theory, research and didactic learning experiences are incorporated in the student practice and supervised by a health care provider with expertise in the area of specialization. Prereq: Nurs 632 and 634.
- 640 Adult Nursing I** 3  
Evaluation and synthesis of advanced pathophysiology concepts applied to nursing and health related theories, and research related to client outcomes. Health and illness phenomena, symptom management, and nursing interventions will be reviewed. Prereq: Nurs 612 and 616.
- 640P Advanced Nursing Practicum I** 3-6  
Clinical opportunities for application of clinical experiences in a primary care setting. Theory, research and didactic learning experiences are incorporated in the students practice and supervised by a health care provider with expertise in the area of specialization. Prereq: Nurs 640.
- 641 Adult Nursing II** 3  
Continuation of Adult Nursing I. Emphasis on clinical decision making, teaching/learning theory and formulation of researchable questions for advanced nursing practice as an adult CNS. Prerequisite: Nurs 640.
- 641P Advanced Nursing Practicum II** 3-6  
An extended practicum time allowing the student a chance to more fully integrate skills and knowledge learned through the graduate program. Emphasis will continue on consultation, program planning, education, health promotion, and prevention of disease/illness. Prereq: Nurs 641.
- 695 Out of Area Preceptorship/Master's Project** 4  
A capstone practicum experience arranged out of the local area with a cultural group that the student has studied over the previous semesters. Arrangements may be made for an international project. This project may be used/designed to meet Plan B requirements. Prereq: Nurs 620 and 624P.
- 696 Special Topics** 1-5  
Special topics related to specific areas of study. May be interdisciplinary in nature, and may be repeated under various topics. Prereq: Graduate status.
- 793 Independent Study** 1-4
- 797 Master's Project** 4-6  
A project is selected which will contribute to the student's preparation for advanced practice in nursing. A committee comprised of three faculty members is chosen; two from nursing (one who serves as adviser) and one faculty member from a related field. A final examination is required. Prereq: Nurs 601, 602, 604; approval of advisory committee.
- 798 Thesis in Nursing** 6-10  
Major study in selected area with an emphasis in research. The thesis research is carried out under the supervision of a nursing faculty adviser. Three other faculty members serve as committee members, one from nursing and one from outside of the department in a related field. The final examination is an oral defense of the thesis. Prereq: Nurs 601, 602, and 604.
- NUTRITION (Nutr)**
- 240 Principles of Nutrition (CCN)** 3  
Current nutrition facts and philosophy as a basis for meeting nutritional needs in a changing society. 3 lectures.
- PHARMACEUTICAL SCIENCES (PSci)**  
Balaz, Gardner, Hinderliter, Lee, O'Rourke, Schnell, Sehgal, Sharma, Singh, Wagner
- COURSES**
- 340 Pathophysiology I** 4  
Comprehensive study of the normal and abnormal physiological processes and the mechanisms important to the understanding of pharmacology and drug therapy. Prereq: Zoo 120, 120L, departmental approval.
- 341 Pathophysiology II** 4  
Normal and abnormal physiological processes and the mechanisms important to the understanding of pharmacology and drug therapy. Prereq: PSci 340.
- 368, 369 Pharmaceutics I, II** 4,3  
Quantitative and theoretical principles of science applied to the design, preparation, evaluation, use, and therapeutic limitations of various pharmaceutical dosage forms. Biological and physiochemical principles that govern the absorption, distribution, metabolism, and excretion of drug dosage forms in humans. Prereq: Admission to the professional program.
- 370 Laboratory Techniques in Pharmaceutical Sciences** 1  
Scientific principles applied to preparation of dosage forms. Includes mathematical procedures for preparation, physical principles for stability and appropriate physical characteristics, and chemical principles governing the stability, formulation, and proper biopharmaceutical aspects of dosage form.
- 409/609 Isotope Tracer Techniques** 3  
Theory and techniques for the use of radioactive and stable isotopes in research.
- 411/611 Pharmacodynamics and Applied Therapeutics I** 3  
Basic chemical and pharmacological principles applied to the study of therapeutic agents; pharmacologic and therapeutic properties of drugs that affect the autonomic nervous system. Prereq: Bioc 460, 461, PSci 341.
- 412/612 Pharmacodynamics and Applied Therapeutics II** 3  
Pharmacologic and therapeutic properties of chemotherapeutic agents, anti-infectives, and drugs that affect the endocrine system. Prereq: PSci 341, Bioc 461.
- 413/613 Pharmacodynamics and Applied Therapeutics III** 3  
See Department for course description.
- 414/614 Pharmacodynamics and Applied Therapeutics IV** 3  
Pharmacologic and therapeutic properties of drugs that affect the cardiovascular, respiratory, and renal systems. Prereq: PSci 401.
- 415/615 Pharmacodynamics and Applied Therapeutics V** 3  
Pharmacologic and therapeutic properties of drugs that affect the gastrointestinal and genitourinary tracts, integumentary/connective tissues, and the central nervous system. Prereq: PSci 401.
- 416/616 Pharmacodynamics and Applied Therapeutics VI** 3  
See Department for course description.
- 443/643 Toxicology** 2  
Poisons, their mode of action, detoxification, and treatment. Prereq: PSci 411, 412.
- 470/670 Pharmaceutics III: Pharmacokinetics** 3  
Concepts and mathematical techniques for describing the time course of drugs in biological systems.

- 545 Clinical Toxicology** 2  
Toxic potential of various poisonous substances including mechanism of toxicity, toxic doses, clinical presentation, clinical and laboratory monitoring and their specific treatment.
- 701 Quantitative Drug Design** 2  
Modeling of drug disposition and receptor binding with focus on rational development of new drugs and elucidation of action mechanisms.
- 703 Drug Metabolism** 2  
Drug biotransformations and their effects on drug properties such as duration of action, potency, toxicity, and specificity. Prereq: Bioc 701, 702.
- 718 Techniques in Pharmaceutical Research** 3  
Application of modern instrumental techniques in the pharmaceutical sciences; qualitative and quantitative determination of physiologically and pharmacologically important substance.
- 741 Techniques of Pharmacological Research** 3  
Techniques of long-term pharmacological investigation and experimentation.
- 746 Neuropharmacology** 3  
Study of action mechanisms of drugs affecting the central and peripheral nervous systems.
- 747 Cardiovascular Pharmacology** 3  
Study of action mechanisms of drugs affecting the circulatory systems, including their pathology.
- 762 Advanced Biopharmaceutics** 2  
Stability and kinetic factors involved in absorption, distribution, metabolism, and excretion of drug products. Prereq: PSci 470.
- PHARMACY PRACTICE (Phm)**  
Miller, Chair; Biberdorf, Christensen, R. Clarens, Drummond, Harrington, Kelsch, Kuzel, Low, Naughton, Omvig, Patterson, Strandberg, Strommen, Sylvester, Welch
- COURSES**
- 170 Common Medicines and Diseases** 2  
Consumer-oriented introduction to drugs, common dosage forms, usage of common classes of prescription, and over-the-counter drug products. *Does not count toward a pharmacy major.*
- 300 Principles of Clinical Pharmacology** 3  
Principles of pharmacology and therapeutics for nursing and other non-pharmacy health professions. *Does not count toward a pharmacy major.*
- 351 Pharmaceutical Care I** 2  
Then first in a six course series, this course is designed to introduce pharmaceutical care and teach pharmacy students about health care systems, drug literature sources and a medical record. The Concept Pharmacy Lab experience is incorporated in this course.
- 352 Pharmaceutical Care II** 2  
Continuation of the Pharmaceutical care series, students will learn to develop a pharmaceutical care plan, interpretation of lab values, values, health care systems
- 401 Consultation and Pharmaceutical Care** 2  
Effective strategies and techniques in clinical consultation with physicians and patients, including patient medication counseling.
- 436/636 Drugs of Abuse Potential** 2  
Psychosocial, financial, and physical consequences of drug abuse including alcohol, narcotics, psychotropics, stimulants, and depressants. *Does not count toward a pharmacy major.*
- 458 Introduction to Clinical Practice** 2  
Study and application of techniques necessary to monitor patient care. Distinction between normal and abnormal findings associated with common disease processes is analyzed. Prereq: PSci 340, 341.
- 460 Hospital Pharmacy Services** 2  
Management procedures of hospital pharmacies.
- 471 Clinical Pharmacokinetics** 2  
Discussion of multiple dosing, determination of dosage regimens, and factors influencing these; drug monitoring, clinical pharmacokinetics of various drug groups. Prereq: PSci 470.
- 472 Pharmacy Law/Ethics** 4  
Pharmaceutical jurisprudence. State and federal laws and regulations concerned with the practice of pharmacy. Ethical issues in pharmacy.
- 480 Drug Literature Evaluation** 2  
Survey of clinical drug literature sources and evaluation of the original literature.
- 520 PTDI: Pediatrics-Geriatrics** 2  
Focused on providing pharmaceutical care for patients from prenatal period to geriatric years. Specific therapy common to the very young or very old.
- 532 PTDI: Infectious Disease** 3  
Clinical, patient-oriented approach to infectious disease. Review of antimicrobial agents combined with specific infectious disease processes and therapies to help the student make sound judgments on infectious disease problems.
- 534 PTDI: Rheumatology, Endocrine, and Reproduction** 2  
Pathophysiology, diagnostic evaluation, and therapeutic approach to major rheumatology disorders (bones, joints, and musculoskeletal disorders); endocrine disorders (diabetes, mellitus, thyroid, adrenal, and endocrine-based gynecological disorders) and contraceptive pharmacotherapy.
- 535 PTDII: Hematology and Neoplastic Diseases** 3  
In-depth study of the pathophysiology, pharmacotherapy, diagnostic evaluation, and therapeutic approach to major hematologic disorders and neoplastic diseases. Prereq: PSci 402, Phrm 471.
- 536 PTDII: Neurology and Psychiatry** 3  
Pathophysiology and pharmacotherapy of the major neurologic and psychiatric disorders. Prereq: PSci 403.
- 537 PTDI: Renal/Fluid and Electrolyte** 2  
Pathophysiology and pharmacotherapy of the major renal diseases and fluid and electrolyte disorders.
- 538 PTDI: Cardiovascular and Pulmonary Diseases** 4  
Pharmacotherapy of cardiovascular and pulmonary diseases. Study of the pathophysiology, clinical presentation, and treatment of various cardiovascular and pulmonary diseases. Prereq: PSci 414.
- 558 PTDI: Gastrointestinal and Nutrition** 3  
Learn to provide pharmaceutical care for people with gastrointestinal disease and/or requiring specialized nutritional support.
- 575 Pharmacy Management** 3  
Case studies of retail and hospital pharmacy management concerns, as well as the unique consideration of retail pharmacy and institutional factors of hospital pharmacy management.
- 578 Non-Prescription Medications** 2  
Introduction to over-the-counter medications including indications, contraindications, dosage forms, interactions, side effects, warnings, and precautions.
- 579 Prescription Practice** 2  
Dispensing of prescription and non-prescription medication via a computerized model-pharmacy and the pharmacist's professional, ethical, and legal responsibility. Prereq: Phrm 472.
- 581, 582, 583 Clinical Clerkship I, II, III** 6-18 each  
Experiential clinical training for pharmacy practice. Prereq: Successful completion of third professional year.
- PHILOSOPHY (Phil)**  
Cater (Emeritus)
- COURSES**
- 101 Introduction to Philosophy (CCN)** 3  
Basic problems, concepts, and methods of philosophy.
- 321 Greco-Roman Philosophy** 3  
Greco-Roman philosophy from pre-Socratics to the Stoics and Epicureans.
- 322 Medieval Philosophy** 3  
Western philosophy from St. Augustine to Ockham and Marsilius of Padua.

- 323 Modern Philosophy** 4  
Western philosophy from Descartes to Kant.
- 481/681 Philosophy of Science** 3  
Philosophical aspects of science.

**PHYSICAL EDUCATION**

(See Health, Nutrition and Exercise Science)

**PHYSICS (Phys)**

Hammond, Chair; Denton, Kelly, Rottman, Sawicki, Swenson

**COURSES**

- 110, 110L Introductory Astronomy, Lab (CCN)** 3,1  
Qualitative survey of the current understanding of the universe including planetary explorations, solar phenomena, stars, black holes, nebulae, galaxies. (ND:Sci)
- 120, 120L Fundamentals of Physics, Lab (CCN)** 3,1  
Application of physics concepts and principles to the real world. Topics selected from mechanics, heat, optics, electricity, and magnetism. (ND:Sci)
- 180 Contemporary Concepts in Physics** 1  
An introduction to concepts of modern physics including relativity and quantum mechanics with applications to atomic and nuclear systems.
- 211, 211L College Physics I, Lab (CCN)** 3,1  
Beginning course for students without a calculus background. Includes basic principles of bodies at rest and in motion, fluids, vibrations, waves, and sound. Prereq: Math 105. (ND:LabSc)
- 212, 212L College Physics II, Lab (CCN)** 3,1  
Second course for students without a calculus background. Includes optics, electricity, magnetism, and thermodynamics. Prereq: Phys 211, 211L.
- 215 Research for Undergraduates** 1-3  
Special research studies in physics under the supervision of an instructor.
- 251, 251L University Physics I, Lab (CCN)** 5,1  
Newtonian mechanics of translational and rotational motion, work, energy, power, momentum, conservation of energy and momentum, periodic motion, waves, sound, heat, and thermodynamics. Prereq or coreq: Math 165.
- 252, 252L University Physics II, Lab (CCN)** 4,1  
Electric charge, field, potential, and current; magnetic field; capacitance; resistance; inductance; RC, RL, LC and RLC circuits; EM waves; optics. Prereq: Phys 251, 251L; Coreq: Math 166.

- 328 Basic Physics for Teachers** 2-3  
Investigation of basic principles of geometric optics, static and current electricity, and heat and temperature. Includes laboratory work. Prereq: Departmental approval.

- 350 Modern Physics** 3  
Breakdown of classical physics, special relativity, Bohr model, Schrodinger mechanics of simple systems, atomic structure, selected topics from nuclear and solid state physics. Prereq: Phys 252, Math 266.

- 351, 352 Mechanics I, II** 3 each  
Rigid bodies and systems of particles analyzed with Lagrangians, Hamiltonians, and methods from vector calculus; gravitation; central field problems; wave motion; fluid dynamics. Prereq for 351: Phys 252, Math 266; Prereq for 352: Phys 351.

- 361 Electromagnetic Theory** 4  
Electrostatics, magnetostatics, dielectrics, electric circuits, time varying electric and magnetic fields, electromagnetic induction, physical content, and application of Maxwell's equations. Prereq: Phys 252, Math 266.

- 363 Optics** 3  
Introductory modern optics at an intermediate level. Geometrical optics and matrix methods applicable to computer ray-tracing techniques. Light as electromagnetic waves: interference, coherence, and diffraction. Characteristics of laser beams. Prereq: Phys 252.

- 371 Intermediate Laboratory** 1  
Classical physics, electrical measurements, electronics, and optics with emphasis on error analysis and experimental techniques.

- 401 Engineering Physics I: Fundamental Properties of Solids** 3  
Schrodinger's equation and quantum mechanics of simple systems. Properties of solids including band theory of metals and semiconductors, Fermi-Dirac statistics, properties of p-n junction, light emitting diodes and laser diodes. Prereq: Phys 252.

- 402/602 Engineering Physics II: Optical Electronics** 3  
Classical and linear optics, physical origin of optical nonlinearities, optical second harmonic and parametric generation, phase matching, electro-optic effect and laser modulation, optical phase conjugation and four wave mixing theory Prereq: Phys 252.

- 411/611 Optics for Scientists and Engineers** 3  
Lecture and laboratory introduction to modern optics. Geometric optics, electromagnetic nature of light, polarization, interference, diffraction, fiber optics. Major related optics project. Prereq: Phys 252.

- 429 Advanced Physics for Teachers** 3  
Departmental approval required.

- 462/662 Heat and Thermodynamics** 3  
Classical principles and laws of thermodynamics. Cyclic processes and entropy functions. Legendre differential transformations. Clausius equations, and principles of Maxwell's equations. Prereq: Phys 252.

- 463/663 Statistical Mechanics** 2  
The Maxwell-Boltzmann distribution function and its applications to thermodynamic problems. Introduction to Bose-Einstein and Fermi-Dirac statistics. Prereq: Phys 462.

- 471/671 Advanced Laboratory** 2  
Advanced laboratory in modern physics: experiments such as electron diffraction, nuclear spectroscopy, magnetic domains, and bubbles. Data analysis and fitting and solutions of differential equations using Mathcad software package.

- 485/685 Quantum Mechanics I** 3  
Operators, one-dimensional wells and barriers, Schrodinger equation, uncertainty, duality, Born interpretation, unstable states, bosons and fermions, central force problems, angular momentum, spin. Prereq: Phys 252, Math 266.

- 486/686 Quantum Mechanics II** 3  
Continuation of Physics 485/685. Perturbation theory, angular momentum addition, variational schemes, WKB method, scattering theory, time-dependent problems. Prereq: Phys 485/685.

- 489 Physics Projects** 1-4  
Capstone experience in physics.

- 752, 753 Mathematical Methods in Physics I, II** 3 each  
See Mathematics 782, 783 for description. Prereq for 753: Phys 752.

- 755 Classical Mechanics** 3  
Variational principles, Lagrange's equations, two body central force problem, rigid body motion, Hamilton's equations, canonical transformation, Hamilton-Jacobi theory. Prereq: Phys 352.

- 758 Statistical Physics** 3  
Review of thermodynamics and statistical mechanics; Monte Carlo and molecular dynamics simulation; applications to phase transitions. Prereq: Phys 463.

- 761 Electromagnetism** 3  
Review of Maxwell's Equations, radiation, collisions between charged particles, dynamics of relativistic particles and fields. Prereq: Phys 361.

- 771, 772 Quantum Physics I, II** 3 each  
Schrodinger equation, wave packets, uncertainty, angular momentum, spin, second quantization, harmonic oscillator. Prereq for 771: Phys 486; Prereq for 772: Phys 771.

**775 Nuclear Physics** 3  
Nuclear properties, nuclear force, nuclear models, nuclear decay, nuclear reactions, nuclear collisions, radioactivity, fission, fusion. Prereq: Phys 486.

**781, 782 Solid State Physics I, II** 3 each  
Crystal structure and binding, reciprocal lattices and x-ray diffraction, lattice vibrations, thermal properties, free electron model, band theory, magnetism, superconductivity. Prereq for 781: Phys 486; Prereq for 782: Phys 781.

## PLANT PATHOLOGY (PPth)

Statler, Chair; Biller, delRio, Francl, Freeman, Gudmestad, Neate, Nelson, Rasmussen, Secor, Stack

### COURSES

**324 Introductory Plant Pathology** 3  
Etiology, symptomatology and control of representative plant diseases and demonstrations. 2 lectures, 1 laboratory. F

**452/652 Plant Structure** 3  
Study of the development and structure of cells, tissues, and organs of vascular plants. 2 lectures, 1 laboratory. Cross-listed with Bot. F (even years)

**453/653 Microscopy** 3  
Principles, advantages, and limitations of light and electron microscopic techniques, including sample preparation, data acquisition, interpretation, and photographic techniques. 2 lectures, 1 laboratory. S (odd years)

**454/654 Diseases of Field and Forage Crops** 3  
Etiology, symptomatology, control, and importance of field and forage crop diseases. 2 lectures, 1 laboratory. Prereq: PPth 324. S (even years)

**455/655 Plant Disease Management** 3  
Diagnosis and control of horticultural crop diseases. 2 lectures, 1 laboratory. Prereq: PPth 324. S (odd years)

**456/656 Forest and Shade Tree Pathology (CCN)** 3  
Biotic and abiotic sources of tree decline are included, as are some pathogens of forest products. Recognition and treatment techniques will be covered. Emphasis of field diagnostic skills. Prereq: PPth 324. S/2 (odd years)

**460/660 Fungal Biology** 3  
Fungal ecology, morphology, genetics, physiology, taxonomy, and relevance to humans. 2 lectures, 1 laboratory. Prereq: Biol 150, PPth 324. F (even years)

**750 Plant Virology** 2  
Lecture: structure, function, and control of plant viruses and disease. Laboratory: Morphology, purification, and characterization of viruses. 2 lectures, 1 laboratory. First half semester. Prereq: PPth 324. S (even years)

**751 Physiology of Plant Disease** 3  
Infection, penetration, recognition, nutrient transfer, toxins, photosynthesis, and physiological

resistance mechanisms. 2 lectures, 1 laboratory. Prereq: PPth 324. S (odd years)

**752 Plant Nematology** 2  
Isolation, identification, biology, and controls of plant parasitic nematodes and techniques used in nematology. 3 lectures, 1 laboratory. Last half semester. Prereq: PPth 324. F (odd years)

**753 Bacterial Diseases of Plants** 2  
Identification, epidemiology, symptomatology, control, and techniques for studying plant diseases caused by bacteria. 3 lectures, 1 laboratory. First half semester. Prereq: PPth 324. F (odd years)

**754 Plant Disease Epidemiology** 3  
Temporal and spatial dynamics of diseases and causative pathogens in plant populations. 2 lectures, 1 laboratory. Prereq: PPth 324. F (even years)

**756 Techniques in Electron Microscopy** 3  
Operation of transmission and scanning electron microscopes and ancillary equipment. Techniques include fixation, dehydration, critical point drying, embedding, ultrathin sectioning, and metallic sample coating. 1 lecture, 2 laboratories. Prereq: Bot 456/656, departmental approval. F (odd years)

**759 Host-Parasite Genetics** 3  
Host-parasite genetics including genetics of plant and pathogens and gene-for-gene relationships. 3 lectures. Prereq: PlSc 311. S (even years)

**760 Advanced Mycology** 4  
Biology and classification of fungi. Emphasis on identification, growth and development, physiology, and etiology of fungi. 2 lectures, 2 laboratories. Prereq: PPth 460. F (odd years)

**761 Advanced Plant Pathology** 2  
Analysis of advanced and integrated concepts in host-parasite relationships, disease control, mechanisms of resistance, biotechnology, and professionalism. 3 lectures. Prereq: PPth 324. S (even years)

## PLANT SCIENCES (PISc)

Schneiter, Chair; Berglund, Berzonsky, Cai, Carena, Christoffers, Deckard, Dexter, Elias, Franckowiak, Grafton, Hammond, Hatterman-Valenti, Helms, Herman, Horsley, Howatt, Johnson, Kegode, Kianian, Laschkewitsch, Lee, Lym, McClean, McMullen, Mergoum, Messersmith, Meyer, Smith, Thompson, Williams, Zollinger

### COURSES

**110 World Food Crops (CCN)** 3  
Scientific principles of crop growth, worldwide production, management alternatives, and processing for domestic and international consumption. 2 lectures, 1 discussion, 1 tutorial laboratory. F, S

**111 Genetics and You** 2  
Basic concepts in genetics with emphasis on current human genetics. 2 lectures. S

**177 Floral Design (CCN)** 2  
History of floral design, care, handling, and identification of fresh cut flowers and dried

materials. Use of tools, equipment, and supplies used in the industry and application of basic design styles, holiday designs, and displays. 1 lecture, 1 two-hour laboratory. S

**210 Horticulture Science (CCN)** 3  
Principles of plant classification, structure, function, growth, propagation, culture, and use of horticultural crops. Covers vegetable and fruit production in the home garden, growing flowers and planting flower beds, and landscaping principles and materials. 3 lectures. F

**211 Horticulture Science Laboratory** 1  
Exercises in plant identification, propagation, nutrition, gardening, greenhouses, lawn care, landscape design, interior plants, pruning, and culture of horticulture. 1 two-hour laboratory. F

**215 Weed Identification** 1  
Identification of weed seeds and plants from seedling to mature stages. Emphasis on life cycles, common distribution, and family groupings. One 1 1/2-hour lab plus time by arrangement. F

**219 Introduction to Prairie and Community Forestry (CCN)** 2  
Urban and traditional forestry as applied to the Great Plains region, as well as global forests. History, opportunities, and basic interactions of forestry with wildlife, parks and recreation, horticulture, and the ecology of the planet. 2 lectures. F (odd years)

**225 Principles of Crop Production (CCN)** 3  
Principles of field crop production with emphasis on relationships of crops to their climate and production considerations as a means of managing resources and environmental factors. 2 lectures, 1 two-hour laboratory. Prereq: PlSc 110. S

**315, 315L Genetics, Lab** 3,1  
Study of the basis of heredity with emphasis on structure and function of DNA and Mendelian genetics. 3 lectures. Cross-listed with Biol (CCN), Bot, and Zoo. F, S

**320 Principles of Forage Production (CCN)** 3  
Introduction to several forage crops and their management, forage quality characteristics, use of legumes in rotations, and preservation of forages. 3 lectures, 1-hour recitation. Prereq: PlSc 110 or departmental approval. F

**321 Human Karyotyping** 1  
Culture of white blood cells to stain and characterize chromosomes. Laboratory by arrangement. Prereq: PlSc/Biol/Bot/Zoo 315. Cross-listed with Biol and Zoo. F, S

**323 Principles of Weed Science (CCN)** 3  
Introduction to biological, chemical, cultural, and mechanical weed control; characteristics of weeds and their identification; pesticides application and dissipation. 2 lectures, 1 discussion, 1 tutorial laboratory. S

- 335 Seed Technology and Production** 2  
Techniques involved in production, harvest, and processing of seed. Special attention to maintenance of genetic and mechanical quality during growth, harvesting, and processing. 3 lectures, 2 two-hour laboratories. Prereq: PISc 110. S; last half semester.
- 340 Grain Grading** 2  
Description and interpretation of the Grain Standards Act and instruction in grading of grain. 3 lectures, 3 two-hour laboratories. Prereq: PISc 225 or departmental approval. S; first half semester.
- 341 Landscape Bidding and Contracting** 1  
Introduction to the business structures of landscape contracting. Emphasis on understanding the rationale behind pricing, bidding, and completing landscape projects with a net profit. 1 lecture. F (odd years)
- 350 Sugarbeet Production** 2  
History, growth, and development; soil and fertility management; weeds, insect, and disease control; cultivars; harvesting, storage, and processing of sugarbeets. Prereq: PISc 110 or 210. F
- 355 Woody Landscape Plants** 3  
Nomenclature, identification, and landscape characteristics of native and introduced deciduous and evergreen woody plants commonly used in the Northern Plains. Field trips. 1 lecture, 2 two-hour laboratories. Pre or coreq: Biol 150, PISc 210. F
- 360 Horticultural Food Crops** 4  
History, classification, culture, physiological principles, postharvest handling, and marketing of major fruit and vegetable crops. 4 lectures. Pre or coreq: Biol 150, PISc 210. S (odd years)
- 362 Potato Science** 2  
History, botany, cultural practices, harvesting, breeding, physiology, storage, and processing of the potato. 2 lectures. Pre or coreq: Biol 150, PISc 110 or 210. F (odd years)
- 365 Herbaceous Landscape Plants (CCN)** 2  
Production, identification, and uses of annual, perennial, and bulbous ornamentals in home and public landscapes with consideration to insect and disease problems. 2 two-hour lecture/laboratories. Pre or coreq: Biol 150, PISc 210. F (odd years)
- 368 Plant Propagation (CCN)** 3  
Principles and practices of seed propagation and of asexual propagation: cuttings, layering division, specialized structures, grafting, budding, and micropropagation. 2 lectures, 1 two-hour laboratory. Pre or coreq: Biol 150, PISc 210. S
- 375 Turfgrass Management** 3  
Species characteristics of cool and warm season turfgrasses, including cultural requirements for home lawns, parks, and sports turf. 2 lectures, 1 two-hour laboratory. Pre or coreq: Biol 150 and PISc 110 or 210. F (even years)
- 412 Nursery Production and Management** 3  
Industry overview, production-management practices, facilities, equipment, nursery stock standards, storage, and overwintering. Field trips, 3 lectures. Pre or coreq: PISc 368. S (odd years)
- 422 Greenhouse Production and Management** 3  
Study of identification and production of greenhouse crops, including pot, cut flower, bedding, and foliage plants. Field trips. 2 lectures, 1 two-hour laboratory. Pre or coreq: PISc 368. S (even years)
- 431/631 Intermediate Genetics** 3  
Expansion of classical and molecular concepts of genetics; basic concepts of Mendelian, quantitative, population, molecular, and evolutionary genetics. 2 lectures. Prereq: PISc 315. Cross-listed with Bot and Zoo. F
- 446/646 Genetics and Plant Improvement** 3  
Genetic principles and their application to plant improvement. Crop evolution, chromosome structure, and population dynamics related to crop improvement methodology. Genetically modified plants, their impact on breeding technique, and the release of improved varieties. 3 one-hour lectures. Prereq: PISc 315. F
- 453/653 Advanced Weed Science** 2  
Integrated weed control programs for crops, pastures, non-cropland, and aquatic environments. Herbicide formulation and mixtures. Herbicide absorption, translocation, and action. 2 lectures. Prereq: PISc 323. F
- 455/655 Cropping Systems: An Integrated Approach** 3  
Integrative capstone focus on the scientific professional and ethical issues associated with crop production and management practices using decision case studies. 3 lectures. Prereq: Junior standing. S
- 465/665 Advanced Landscape Plants** 2  
Nomenclature, identification, and landscape characteristics of native and introduced deciduous and evergreen woody plants grown in Upper Midwest. Emphasis on cultivar introduction, trademarks/patents, adaptation, and diversity within species. Field trips required. 2 two-hour laboratories. Prereq: PISc 355. F (even years)
- 484/684 Plant Tissue Culture and Micropropagation** 2  
Principles, techniques, and applications of plant tissue, organ, cell, protoplast, and embryo culture. Emphasis on micropropagation. 1 lecture, 1 two-hour laboratory. Prereq: PISc 315. F
- 485/685 Arboriculture Science** 3  
Tree, shrub, and vine care based on the physiology of the plant and the limitations of the environment. Includes pruning, fertilizing, bracing, planting, removal and selection of plant materials, and related subjects. 3 lectures. Prereq: PISc 355. S (even years)
- 486/686 Eco-Physiology of Horticultural Crops** 2  
Influence of environmental factors, stress and hardiness on plant growth and development, and their relationship to production practices. 2 lectures. Prereq: PISc 210 or 225. F (even years)
- 710 Professional Development I** 1  
(non-didactic) Introduce students to professional society structure and function, manuscript review, resume preparation, lecture organization, grant writing, and research proposal preparation. F
- 711 Professional Development II** 1  
(non-didactic) Manuscript preparation, manuscript review and grantsmanship. S
- 724 Field Design I** 3  
Application of various field designs, factorial and split-plot arrangements, orthogonal and non-orthogonal comparisons, models, components of variance, correlation, and regression to biological problems. 3 lectures. Prereq: Stat 330 or 725. F
- 727 Crop Breeding Techniques** 1  
Hybridization of North Dakota crops. Laboratory by arrangement. Prereq: PISc 446/646. Su (odd years)
- 731 Plant Molecular Genetics** 3  
Molecular aspects of plant genome organization and expression; basic and applied usages of molecular markers and gene transfer techniques. 3 lectures. Prereq: PISc 431/631. S (even years)
- 734 Field Design II** 2  
Application of incomplete block designs, confounding and covariance analyses to biological problems. 2 lectures. Prereq: PISc 724. S (odd years)
- 741 Cytogenetics** 4  
Chromosome behavior during mitosis and meiosis; chromosome structure, function, and recombination; inheritance in aneuploids and polyploids; haploid formation and utilization. 3 lectures, 1 three-hour laboratory. Prereq: PISc 315. F (even years)
- 751 Advanced Genetics** 3  
Classical and modern genetic concepts, nature and induction of mutations linkage, and application of chi-square. 3 lectures. Prereq: PISc 315, 431/631. S (odd years)
- 753 Action and Fate of Herbicides** 2  
Herbicide mode of action and fate of herbicides in plants and soil, physiology of herbicide resistance, and herbicide antidotes. 2 lectures. Prereq: PISc 453/653, Bioc 460. S (even years)

**755 Advanced Crop Management Decision Making** 3  
 Problem-based learning approach focusing on the scientific, professional, personal, and ethical issues associated with advanced crop management decision-making. Prereq: PISc 455/655. F/2 (even years)

**759 Biotechnology Applications to Plant Breeding** 2  
 Current and potential application of plant cell culture and genetic transformation technologies for the improvement of agronomic and horticultural crops. Emphasis on current literature. 2 lectures. Prereq: PISc 446/646. S (even years)

**763 Laboratory Methods—Weed Science** 2  
 Chemical, analytical, and physiological methods for determining pesticide residues in soil and ground water; and herbicide absorption, translocation, and metabolism in plants. 2 two-hour laboratories. Prereq: PISc 453/653, Bioc 460. S (odd years)

**776 Advanced Plant Breeding** 4  
 Application of genetic principles to improvement of self- and cross-pollinated crops. 4 lectures. Prereq: PISc 724, 446/646. S (odd years)

**781 Quantitative Genetics** 4  
 Concepts of inheritance in random and non-random mating populations and applications to plant breeding. 4 lectures. Prereq: PISc 724, 446/646. S (even years)

## POLITICAL SCIENCE (PoIS)

Nelson, Chair; Ambrosio, Amlund, Monzingo, O'Regan, Stambough, Wood

### COURSES

**110 Introduction to Political Science (CCN)** 3  
 Problems of political science as a discipline, political systems, and political behavior. Includes causes and consequences of individual and group political behavior. (ND:SS)

**115 American Government (CCN)** 3  
 Principles of American government, political behavior, and institutions. (ND:SS)

**120 Terrorism (CCN)** 3  
 Examination of problems of terrorism. Includes its historical perspectives; terrorist motivations, organizations, tactics, strategies; role of media; government responses; future trends, prospects.

**210 Current Politics (CCN)** 3  
 Study of current national and state political issues.

**215 Problems and Policies in American Government (CCN)** 3  
 Study of the functioning of American government focusing on the policy process.

**216 Campaigns and Elections** 3  
 Examination of political campaigns and elections with special emphasis for voting behavior, history and theory of political advertising, and effectiveness/ethics of negative advertising. Prereq: PISc 115.

**220 International Politics (CCN)** 3  
 Concepts, theories, and issues in international relations. (ND:SS)

**225 Comparative Politics** 3  
 Comparative analysis of contemporary political systems, practices, institutions, and actors.

**230 Judicial Process (CCN)** 3  
 Role of lawyers, judges, and courts in the political system. Special emphasis on judicial decision-making and the ideas behind law.

**240 Political Ideologies (CCN)** 3  
 Study of ideas, belief systems, and basic principles of ideologies.

**325 Introduction to Political Inquiry** 3  
 Problems of theory-building, research design, case selection, and measurement are covered in the context of quantitative and qualitative political research. Prereq: PISc 110 and 115.

**350 Gender Issues and the Law** 3  
 This course examines gender differentiations reflected in the U.S. law from both the historical and contemporary perspectives and the impact of that differentiation, particularly on women, in the areas of employment, education and family law.

**351 Women and Politics** 3  
 Study of women leaders; their roles and perspectives within a national and international framework.

**360 Principles of Public Administration** 3  
 Empirical study of public administrators in their diverse roles and functions.

**420/620 Political Behavior—Executive-Legislative Process** 3  
 Behavioral study of executives and legislators with emphasis on examination of empirical data.

**421/621 Political Behavior—Political Parties** 3  
 Behavioral study of political leaders with emphasis on examination of empirical data.

**422/622 State and Local Politics** 3  
 This course is designed to guide students through a discovery of American politics at the sub-national level. From a comparative perspective, students examine differences between states in terms of their political structures, behavior, and environments. Prereq: Junior or senior standing.

**430/630 Constitutional Law—Civil Liberties** 3  
 Examination of First Amendment rights including freedom of speech, press, religion, association, and

assembly. Due process and equal protection concerns are also addressed.

**431/631 Constitutional Law—Criminal Justice** 3  
 Study of Fourth, Fifth, and Sixth Amendment rights. Emphasis on the law of arrest, search and seizure, self-incrimination, and right to counsel.

**442/642 Global Policy Issues** 3  
 Analysis of the impact of planetary limits to growth, increasing globalization of the world economy, and changing control over resource systems on global politics.

**443/643 Politics of Development** 3  
 Introduction to topics of development and underdevelopment and to special circumstances facing the political systems of Third World countries.

**444/644 International Law** 3  
 Examines the history and foundation of the international legal system, including custom, treaties, jurisdiction, and the relationship between international and municipal law. Prereq: PISc 220.

**445/645 Ethnic Conflicts** 3  
 Explores numerous topics and cases related to ethnic conflicts, including the nature of ethnic identity, the causes of ethnic conflicts, and ethnic conflict prevention/resolution.

**450/650 Politics of the Developing Countries** 3  
 Comparative examination of the government and politics of developing countries. Attention is given to special economic and cultural circumstances facing the political systems of these countries.

**451/651 Politics of the Industrialized Countries** 3  
 Comparative study of government and politics in the industrialized countries including the analysis of legislative and executive branches, parties, bureaucracies, constitutions, policies, and voting behavior.

**452/652 Comparative Political Economy** 3  
 Comparative study of the relationship between politics and the economy in industrialized and developing countries. Topics include elections, trade, development, investment, redistribution, and the political business cycle.

**489 [499] Senior Seminar** 3  
 Capstone experience. Emphasis on integrative skills needed to interrelate the concepts of the discipline.

**720 Theoretical Perspectives to the Study of Political Science** 3  
 Designed to guide beginning graduate students through the dominant paradigms and emerging subject areas of political science scholarship.

## POLYMERS AND COATINGS (P&C)

Bierwagen, Chair; Croll, Glass, Huo, Webster;  
Adjunct Faculty: Donley, Hill, Provder

### COURSES

#### 472/672 Environment and Chemical Industries 2

Environmental issues as they pertain to chemical industries, including regulations, bioremediation, safety, disposal of materials, and design of environmentally compliant chemicals and chemical processes. Prereq: Chem 341.

#### 473/673 Polymers Synthesis 3

Catalysts and mechanisms in the chain-growth and step-growth synthesis of macromolecules from polyesters of the 30s to current engineering polymers. Prereq: Chem 342.

#### 474/674 Coatings I 3

Principles of film formation, synthesis, structure-property relationships, coating solvents; pigments and their dispersion. Prereq: Chem 342.

#### 475/675 Coatings II 3

Physical properties of coatings and their components; formulation, design, testing, and applications; color, adhesion, and rheology. Prereq: P&C 474/674.

#### 478/678 Carbohydrate Polymers 1

Variation in carbohydrate polymers, derivation of most abundant carbohydrate polymers for industrial uses, and utilization of polymers in petroleum recovery.

#### 484/684 Coatings I Laboratory 2

Polymer synthesis, coating characterization, and properties. Laboratory counterpart to P&C 474. Coreq: P&C 474/674.

#### 485/685 Coatings II Laboratory 2

Coating formulation; testing, color measurements, synthesis, application methods. Laboratory counterpart to P&C 475. 1 six-hour laboratory. Hours flexible. Prereq: 484/684; Coreq: P&C 475/675.

#### 486/686 Corrosion and Its Control by Coatings 2

Corrosion science: electrochemistry of corrosion, corrosion effects, measurement of corrosion, corrosion control by coatings, characterization of coating protection, accelerated testing. Pre or coreq: Chem 430; Coreq: P&C 474/674, 475/675. Cross-listed with Chem.

#### 771 Modern Methods of Polymer Characterization 3

Modern spectroscopic (FT-IR, solid state NMR, light scattering, and others) and physical (dynamic mechanical analysis, chromatographic and thermal analysis) methods for characterization of polymers

and coatings. Prereq: Chem 365 or departmental approval.

#### 773 Organic Chemistry of Coatings 3

Organic reactions involved in film formation and degradation. Prereq: Chem 741 or departmental approval.

#### 775 Color and Appearance 3

Topics in color and appearance in coatings and weathering of coatings, including photochemical principles. Prereq: P&C 675.

#### 777 Water-Soluble Polymers 2

Structure of water and its influence on aqueous solution behavior of polymers. Synthetic, carbohydrate, protein, and other bioengineered water-soluble polymers. Prereq: P&C 473/673.

#### 778 Physical Chemistry of Polymers 4

Introduction to rheological concepts and the flow behavior of macromolecules. Transitions in polymers, molecular weight characterization, blend compatibility, composite behavior, and other topics, e.g., drug release and liquid crystals. Prereq: P&C 673.

#### 782 Physical Chemistry of Coatings 3

Surface chemistry diffusion in coatings, colloid stability, advanced CPVC concepts, film formation, particle size effects, and theories of coating application methods. Prereq: Chem 365; Coreq: P&C 474/674.

## PSYCHOLOGY (Psyc)

Council, Chair; Hinsz, McCaul, McCourt, Miltenberger, Nawrot, O'Neill, Robinson, Rokke, Wittrock

### COURSES

#### 111 [110] Introduction to Psychology (CCN) 3

Survey of the scientific study of behavior and mental processes. (ND:SS)

#### 210 Human Sexuality 3

Survey of biological, developmental, and psychological aspects of human sexuality. Prereq: Psyc 111.

#### 211 Introduction to Behavior Modification 3

Basic principles and procedures governing acquisition, maintenance, and change of behavior, emphasizing human applications. Laboratory involves designing, implementing, and reporting an individual project. Prereq: Psyc 111.

#### 212 Psychological Aspects of Drug Use and Abuse 3

Examination of legal and illegal psychoactive drugs. Emphasis on psychological, physiological, and behavioral effects of these drugs and problems of drug abuse. Prereq: Psyc 111.

#### 214 Social Interaction 3

See Sociology for description.

#### 221 Psychology in Business and Industry 3

Applications of psychology to work/business. Topics include personnel selection/placement, job satisfaction and morale, motivation, leadership, group performance, and organizational theory/development. Prereq: Psyc 111.

#### 250 [213] Developmental Psychology (CCN) 3

Survey of the psychology of human life span development. Coverage also includes heredity and prenatal development. Prereq: Psyc 111.

#### 270 [231] Abnormal Psychology (CCN) 3

Survey of the classification, symptoms, and etiology of psychological disorders. Attention given to diagnosis, etiology, and treatment according to prominent theoretical perspectives. Focus on empirical basis for understanding these problems. Prereq: Psyc 111.

#### 322 Thinking and Making Decisions 3

Covers the functional uses of critical thinking. Focuses on uses in problem solving and decision making. Applications are directed at both personal and professional concerns. Prereq: Psyc 111.

#### 350 Research Methods I 3

Introduction to scientific method, ethics, principles of observation, measurement, survey research, and correlation. Laboratory training on conducting research, analyzing data, and preparing research reports. Prereq: Psyc 111, Math 103, CSci 147; Coreq: Stat 330.

#### 351 Research Methods II 3

Experimental and quasi-experimental designs in psychological research. Laboratory includes performance of experiments, data analysis, and preparation of research reports. Prereq: Psyc 350.

#### 360 Animal Behavior 3

See Zoology for description.

#### 370 Forensic Psychology 3

Broad overview of the interactions of Psychology and the Law, including current areas of practice, assessment, and forensic techniques. Special focus upon psychology as applied to and affected by Family, Civil, and Criminal Law. Prereq: Psyc 270.

#### 380 Clinical Psychology 3

Introduction to the science and practice of clinical psychology. Includes a survey of the assumptions on which clinical methods are based and an overview of clinical assessment and treatment techniques. Prereq: Psyc 270.

- 440/640 Experimental Methods** 3  
Intermediate experimental design and data analysis with emphasis on the analysis of variance. Laboratory includes data analysis on the computer. Prereq: Psyc 351, Stat 331.
- 453/653 Organizational Psychology** 3  
Survey of topics related to application of psychology to organizational settings. Emphasis on theoretical bases of the individual (motivation, satisfaction) and social (leadership, work group) factors involved in work behavior. Prereq or coreq: Psyc 351.
- 460/660 Sensation and Perception** 3  
Explores physical, anatomical, and physiological bases of sensation and perception and their psychophysical measurement. Laboratory experiments complement lectures and demonstrate various experimental techniques and sensory phenomena. 2 lectures and equivalent of 2-hour laboratory. Prereq: Psyc 351.
- 461/661 Memory and Knowledge** 3  
Examination of current behavioral and neuropsychological research and theory in the area of memory and knowledge representation. Various cognitive phenomena are demonstrated and relevant design issues are highlighted via laboratory experiments. Prereq: Psyc 351.
- 463/663 Experimental Development Psychology** 3  
Examination of historical and contemporary theory and research in social and cognitive development. Topics include attachment, adolescent risk-taking, theories of intelligence, and meta-cognition. Laboratory experiences illustrate methods of investigating psychological development. Prereq: 351.
- 464/664 Attention and Thinking** 3  
Examines current behavioral and neuropsychological research and theory in the area of attention and thought processes. Laboratory experiments will demonstrate various attentional phenomena and highlight relevant design issues.
- 465/665 Psychobiology** 3  
Fundamental anatomy (structure) and physiology (function) of the nervous system. Physiological bases of behavior. 2 lectures, equivalent of 2-hour laboratory. Prereq: Psyc 351.
- 468/668 Personality** 3  
Study of complex human behavior with attention to historically significant theories and current empirical issues. Laboratory experiences illustrate methods of investigating individual differences. Prereq: Psyc 351.
- 470/670 Experimental Social Psychology** 3  
Examination of historical and contemporary theory and research in social psychology. Study of the relationship between the individual and social context. 2 lectures and equivalent of 2-hour laboratory. Prereq: Psyc 351.
- 471/671 The Psychology of Aging** 3  
Survey of cognitive and psychosocial development in adulthood and old age, including psychopathologies of old age. Contemporary research findings are emphasized. Prereq: Psyc 111, Junior standing.
- 472/672 Advanced Psychopathology** 3  
In-depth coverage of recent research on diagnosis, etiology, and maintenance of behavior disorders emphasizing the interaction of biological, behavioral, and social factors. Prereq: Psyc 270, Junior standing.
- 473/673 Child Psychopathology and Therapy** 3  
Overview of the etiology and treatment of behavior disorders in children and adolescents. Emphasis on recent research findings and behavioral intervention strategies. Prereq: Psyc 270 or 351.
- 474/674 Behavior Analysis in Developmental Disabilities** 3  
Overview of developmental disabilities with emphasis on mental retardation. Application of behavior analysis procedures for skills training, functional assessment and treatment of problem behaviors and staff management. Students participate in assessment and treatment projects. Prereq: Psyc 211.
- 480/680 History and Systems** 3  
Historical development of scientific psychology. Emphasis on the development of various systems of psychology in America. Capstone experience. Prereq: Psyc 351 or Senior standing.
- 481/681 Health Psychology** 3  
Application of behavioral procedures to the prevention, treatment, and rehabilitation of medical disorders. Emphasis on contemporary research findings. Prereq: Psyc 350.
- 486/686 Neuropsychology** 3  
Introduction to human neuropsychology with emphasis on the neural basis of motor, perceptual, cognitive, emotive, and language behavior. Topics include normal and pathological conditions from clinical and experimental perspectives. Prereq: Psyc 351.
- 488/688 Human/Computer Interaction** 3  
See Computer Science for description.
- 489 [499] Honor Thesis** 2-6  
Capstone experience option.
- 718 Visual and Cognitive Neuroscience** 3  
Fundamentals of current visual and cognitive neuroscience research including detailed survey of ideas, methods, and models used to understand function of the human nervous system.
- 727 Advanced Topics in Visual Perception** 3  
Integrated overview of the field of vision research. Addresses recent developments in the study of the phenomenology, psychophysics, and neural substrates of human visual sensation and perception. Prereq: Psyc 460 or equivalent.
- 731 Fundamental Processes in Cognition** 3  
Explores the underlying architecture of the human cognitive system—how it takes in, processes, stores, and retrieves information.
- 732 Applied Cognitive Processes** 3  
Explores the ways cognitive principles operate in ecologically valid (real-world) situations.
- 733 Judgment and Decision Making** 3  
Explores issues and topics related to judgment and decision making.
- 735 Neural Networks** 3  
See Computer Science for description.
- 750 Introduction to Clinical Issues and Practices** 1  
Instruction and practice in clinical interview techniques and discussion of clinical issues including ethics, laws, and crisis intervention.
- 755 Behavior Therapy and Assessment I** 4  
Introduction to the nature and characteristics of behavioral assessment and behavior therapy. Laboratory includes behavioral interviewing and training in assessment and treatment procedures.
- 756 Behavior Therapy and Assessment II** 4  
In-depth coverage of behavioral assessment and treatment approaches, emphasis on their empirical status. Laboratory includes instruction with practice in implementation of these procedures. Prereq: Psyc 755.
- 761 Applied Research Methods** 3  
Experimental methodology and design skills useful in clinical research including N=1 designs, experimental, and quasi-experimental designs. Laboratory includes reports on recent research articles, presentations on specific content areas, and development of a detailed research proposal.
- 762 Advanced Research Methods and Analysis** 3  
Advanced experimental design and data analysis. Emphasis on regression models as applied to psychological data and designs. Includes analysis on the computer. Lecture and laboratory. Prereq: Psyc 640.

**770 Advanced Psychological Assessment** 3  
Comprehensive approach to assessment in clinical psychology. Includes administration, interpretation, and report writing. Primary focus on Wechsler intelligence scales and personality testing by objective and projective methods.

**771 Social/Health Psychology Research** 3  
Covers research designs frequently utilized in conducting social psychology related research with particular emphasis on health psychology.

**782 Emotions** 3  
Focused on basic questions about defining emotions, differences in experiencing or expressing emotions, and relatedness to cognition. Includes emotions and psychotherapy, emotions in a social context, and the impact of emotional expressions versus repression on health. Prereq: Departmental approval.

**787 Advanced Social Psychology and Health** 3  
Covers theory and research from social psychology that has implications for health behavior. Emphasizes theories of attitudes and behavior applied to such topics as regimen adherence, self-protective health behavior, and disease prevention. Prereq: Psyc 670 and 681 or departmental approval.

## RADIOLOGIC SCIENCES (RS)

P. Olson

### COURSE

**111 Introduction to Radiological Sciences** 1  
Lectures, discussions, and field trips focus on professional traits, ethical behavior of the health care provider, major curriculum requirements, and scope of practice.

## RELIGIOUS STUDIES (ReIS)

Helgeland

### COURSES

**100 [150] Introduction to Religion (CCN)** 3  
Introduction to the ways religious concerns are expressed, to religious values as a basis for human action, and to a spectrum of ethical styles. (ND:Hum)

**220 Old Testament (CCN)** 2  
Study of the religious, political, and social history of ancient Israel as reflected in the Hebrew Bible.

**230 New Testament (CCN)** 3  
Overview of the developments in the primitive Christian community as reflected in the New Testament.

**243 Religion and Self (CCN)** 3  
Psychological and ethical issues involved in growth to religious maturity. Attention to basic human activities such as love, faith, marriage, sexuality, death, and grief.

**260 Introduction to Ethics** 3  
Overview of different types of approaches to ethical dilemmas such as theistic ethics, naturalistic ethics, and situational ethics. Covers the ethical issues confronted in personal, public, and professional life.

**270 [250] American Religious History (CCN)** 3  
Introduction to the basic issues in American history including the study of Puritans, immigration, church and state, revivalism, civil and military religion, apocalypticism, and new age religion. Cross-listed with Hist.

**315 Contemporary Religion** 3  
Study of how contemporary cultural developments require the rethinking of historic religious perspectives in such topics as natural science, political thought, psychology, history, and gender.

**320 History of Christianity** 3  
Major developments in the Christian religion including scriptures, persecution, monasticism, papacy, Reformation, science and religion, and the ecumenical movement. Cross-listed with Hist.

**401 Sociology of Religion** 3  
See Sociology for description.

**453 Magic and Religion** 3  
See Anthropology for course description.

## RESPIRATORY CARE (RC)

P. Olson

### COURSE

**111 Introduction to Respiratory Care** 1  
Introduction to the profession of respiratory care. Lectures, discussions, and field trips focus on professional traits and communication, ethical behavior of the health care provider, major curriculum requirements, and scope of practice.

## ROTC

(See Aerospace Studies and Military Science.)

## SOCIOLOGY (Soc)

Goreham, Chair; Burkland, Corwin, Klenow, Lindgren, McDonald, Rathge, Slobin, Thompson, Youngs

### COURSES

**110 [112] Introduction to Sociology (CCN)** 3  
Introductory analysis of the nature of society, the interrelationship of its component groups, and the process whereby society persists and changes. (ND:SS)

**115 [201] Social Problems (CCN)** 3  
Sociological analysis of major social problems.

**202 Minorities and Race Relations** 3  
Analysis of lifestyles and characteristics of racial, cultural, and ethnic groups in society. Review of processes of discrimination, prejudice, and related dehumanizing biases toward minority groups including women. Prereq: Soc 110.

**214 Social Interaction** 3  
Examination of issues relevant to the study of individual behavior (e.g., self-concept, attitudes, social perception) in a social context. Cross-listed with Psyc.

**233 Social Organization** 3  
Examination of major institutional characteristics of modern societies. Emphasis on social issues as they relate to the organization of societies.

**340 [301] Social Research Methods** 3  
Overview of the scientific method, the philosophy of science, and the goals of science. Detailed study of qualitative and quantitative methodologies. Cross-listed with Comm.

**341 Social Research Methods Laboratory** 1  
Laboratory to accompany Soc 340. Provides application of conceptualization, operationalization, sampling methods, qualitative and quantitative research methods, and computer statistical analysis. Cross-listed with Comm.

**350 Social Work I** 3  
Orientation to social work and the study of common human needs.

**351 Social Work II** 3  
Advanced discussion of social work and human service administration. Prereq: Soc 350.

**401/601 Sociology of Religion** 3  
Study of religion viewed as a social institution with a characteristic history, ecology, structure, behavior, and purpose. Cross-listed with ReIS.

**403/603 Sociology of the Great Plains** 3  
Social and cultural patterns, trends, and problems peculiar to life in the semi-arid Great Plains.

**405/605 Community Development** 3  
Study of communities viewed as social systems. Includes political, economic, social, and economic factors affecting community growth and decline. Community development methods are addressed.

**406/606 Crime and Delinquency** 3  
Study of the nature and extent of juvenile delinquency and adult crime. Analysis of causes of juvenile and adult offending and an exploration of policies to combat crime and delinquency. Prereq: Soc 110.

**407/607 Deviant Behavior** 3  
Analysis of the sociological aspects of the antecedents, the social/human relations processes, and the consequences of deviance in Western society. Prereq: Soc 110.

- 408/608 Criminology** 3  
Consideration of social and human relations regarding the causation, societal reaction, and prevention of adult crime. Prereq: Soc 110.
- 409/609 Social Policy** 3  
Investigation of the socio-cultural conditions that affect social policy formation in the areas of medicine-mental health, criminal justice, social welfare, and community and social change.
- 410/610 Social Inequality** 3  
Analysis of social and economic inequities and investigation of the relationship between inequity and life chances.
- 412/612 Sociology of Sex Roles** 3  
The socialization of men and women; an analysis of institutional norms, values, and attitudes and their effects on gender role development. Prereq: Soc 110.
- 413/613 Sociology of Work** 3  
Analysis of contemporary work-related issues concerning changing organizational structures and cultural expectations. Prereq: Soc 110.
- 416/616 Sociology Through Literature** 3  
Study of basic concepts of sociology as illustrated in selected literature from 19th- and 20th-century English, American, French, and Russian novels. Prereq: Soc 110.
- 417/617 Sociology of the Family** 3  
Comparative family types, member relationships, family dynamics in relation to personality, social change, and social values.
- 418/618 Social Psychology** 3  
Examination of both historical and contemporary research and theory in social psychology—the study of the relationship between the individual and the social context. Prereq: Soc 110.
- 420/620 Sociology of Disaster** 3  
Examination of natural and human-made disasters, stages of a disaster, social impacts of a disaster, and community, organizational, and governmental responses to disaster. Explores U.S. and cross-cultural disaster research.
- 422/622 Development of Social Theory** 3  
Sociological theories and systems from Comte, Marx, Durkheim, and Weber through the 20th century. Prereq: Soc 110.
- 424/624 Feminist Theory and Discourse** 3  
Historical overview of feminist ideas and major writings from the 18th century to the present, which includes issues related to women's personal, social, and public lives.
- 426/626 Sociology of Medicine** 3  
Analysis of the social aspects of health and illness, the health care professions, organization of health care, and related issues.
- 427/627 Sociology of Mental Health** 3  
Social factors affecting the nature and incidence of mental disorders, the meaning of social disorders as social phenomena, methodological problems, and the social context of psychiatry. Prereq: Soc 110.
- 439/639 Social Change** 3  
Analysis of the complex nature of social change. Prereq: Soc 110.
- 440/640 Sociology of Aging** 3  
Examination of sociological perspectives on aging. Topics include social theories of aging, retirement, long-term care, chronic illness, and death.
- 441/641 Sociology of Death** 3  
Examination of research on social psychological and social organizational dimensions of death and dying. Additional topics include hospice movement, grief and bereavement, and communicating death news.
- 442/642 Current Issues in Medicine** 3  
Overview of current sociology of medicine issues such as chronic illness, bioethics, medical technology, changes in health care organizations, and women's health issues.
- 443/643 International Disasters** 3  
Impacts of natural and human-made disasters on industrialized and developing societies; relief and reconstruction post-disaster programs.
- 445/645 Special Populations in Disasters** 3  
Identification of special populations and their needs that arise in emergency or disaster situations both in industrialized and developing countries.
- 460/660 Criminalization** 3  
Analysis of historical and contemporary developments in the functions of police and courts. Focuses on societal, inter- and intra-organization contexts.
- 461/661 Corrections** 3  
Analysis of institutional- and community-centered corrections. Emphasis on historical, contemporary, and developing trends regarding structures, program content, and problems.
- 462/662 Cases in Criminal Justice** 2  
Case study approach to principles of criminal justice policies and operations. Analysis of contemporary functions in police, courts, and corrections via the case study method.
- 465/665 Applied Demographics** 3  
Overview of demographic concepts and principles and their application to business and planning decisions. Emphasis on using data bases and information sources available on the Internet.
- 489 Senior Capstone in Sociology** 1  
Synthesis of social research methods, sociological theory, and subdiscipline content material. Emphasis on integrative skills needed to interrelate the basic concepts of the discipline. Prereq: Soc 340 or Senior standing.
- 700 Qualitative Methods** 3  
Advanced analysis of the methods used in qualitative research projects such as intensive interviewing, focus groups, and participant observation. Prereq: Soc 340. Cross-listed with PolS.
- 701 Quantitative Methods** 3  
Advanced analysis of the methods used in quantitative research projects, such as survey design, experimental design, and evaluation research. Prereq: Stat 330 or 725, Soc 340. Cross-listed with PolS.
- 702 Program Evaluation** 3  
Methods and techniques of conducting applied research associated with the evaluation of criminal justice programs.
- 707 Juvenile Corrections** 3  
Historical and contemporary examination of the role of juvenile facilities in punishment, treatment, and reform.
- 709 Criminal Justice Policy** 3  
Examination of the role of criminal justice agencies in developing and implementing policy. Focus on the interplay between criminal justice theory and practice.
- 721 Individual Theories of Crime** 3  
Review of historical and contemporary individual theories of crime. Discussion of the assumptions, causes, and policy implications of criminological theories.
- 722 Structural Theories of Crime** 3  
Review of historical and contemporary structural theories of crime. Assumptions, causes, and policy implications of criminological theories.
- 723 Social Theory** 3  
Examination of contemporary social theories and theory construction. Prereq: Soc 422/622.
- 750 Violence** 3  
The course will examine violence in various social settings (e.g., community, domestic, and school) with attention to the causes, consequences, and moderating factors associated with violent criminal behavior.
- 752 Criminogenic Commodities** 3  
Examination of the role of drugs and firearms in contributing to crime. Analysis on the laws pertaining to drugs and guns and their impact on criminality.
- 754 Criminal Investigations** 3  
Researches the process of gathering information and evidence in the administration of justice. Focus on the role of evidence gathering and its importance to disseminating justice.
- 755 Administrative Policing** 3  
Organizational theory, leadership, communication, labor relations, and crisis management in police administration.
- 757 Community Policing** 3  
Examines the history, philosophy, theory, and implementation of community policing, compares community policing with other policing styles, and describes community-police collaborations to apprehend criminals, prevent crime, maintain order, and enhance community quality-of-life.

- 759 Security Management** 3  
Examination of public and private security concerns and methods for addressing them. Analysis of protection of money, materials, information, and secrets.
- 762 Community Corrections** 3  
Evaluation of practices, issues, and trends in community corrections. Focus on probation, parole, halfway houses, and other community alternatives to incarceration.
- 764 Parole and Probation** 3  
Develops a substantive understanding of the conceptual, resource, and managerial issues in probation and parole.
- 768 Gender and Justice** 3  
Critical analysis of the role of gender in the justice system. Focuses particularly on the role of women in justice circles, as employees, offenders, and victims.
- SOIL SCIENCE (Soil)**  
Richardson, Chair; Casey, Cihacek, Deibert, Enz, Franzen, Giles, Goos, Hopkins, Khan, Moraghan, Prunty, Todd
- COURSES**
- 210 Introduction to Soil Science (CCN)** 4  
Physical, chemical, and biological properties of soils, as related to use, conservation, and plant growth. 3 lectures, 1 laboratory, including 3 field trips on soil development and variability. F
- 217 Introduction to Meteorology and Climatology** 3  
Basic meteorology-climatology concepts and their application; includes energy balance, greenhouse effect, temperature, pressure systems, lows, highs, fronts, winds, clouds, storms, humidity, precipitation, and measurements. Lectures, discussions, demonstrations. S
- 321 Soil Management and Conservation (CCN)** 3  
Principles and practices of soil management and conservation planning in relation to government programs, the environment, erosion, tillage systems, crop production, and sustainability of soil, water, and air resources. 3 lectures. Prereq: Soil 210 recommended. F
- 322 Soil Fertility and Fertilizers (CCN)** 3  
Principles of plant nutrition and soil nutrient availability; soil testing and fertilizer recommendations and management. Macronutrient emphasis. 2 lectures, 1 two-hour laboratory. Prereq: Soil 210, Chem 121, 121L. S
- 333 Managing Soil Physical Properties** 2  
Study of principles and measurement of soil physical properties: density, texture, structure, aggregation, compaction, porosity, water content, water characteristic, hydraulic conductivity. 2 lectures. Prereq: Soil 210. F
- 339 Managing Soil Physical Properties Laboratory** 1  
Sampling and measurement procedures for determination of various soil physical properties. 1 two-hour laboratory, plus arrangement. Prereq: Soil 210; Coreq: Soil 333. F
- 410/610 Soil and the Environment** 2  
Soil as part of the ecosystem, soil classification, land use, waste disposal, environmental quality. *Not acceptable for graduate credit for Soil Science majors*. 2 lectures. Prereq: Junior standing, 6 credits of physical or biological sciences. S
- 444/644 Soil Genesis and Survey** 4  
Introduction to soil genesis, morphology, geography, techniques of soil survey; field studies and description of soils. 3 lectures, 1 three-hour laboratory. One or more Saturday field trips. Prereq: Soil 210. F
- 447/647 Microclimatology** 3  
Characteristics and causes of the climate near the ground and its interaction with living organisms. Energy and mass transfer concepts. Lectures, discussions, demonstrations. Prereq: Phys 211. S (even years)
- 455/655 Soil Chemistry** 3  
Chemical reactions and equilibria, solubility relationships, mineral weathering, cation and anion adsorption, redox reactions, metal chelation, and fixation of nutrients in the soil. 3 lectures. Prereq: Soil 332, Chem 122, 122L. F
- 465/665 Soil and Plant Analysis** 3  
Laboratory analysis of soil and plant material for constituent elements. 2 lectures, 1 laboratory. Prereq: Soil 210, Chem 330, 331. S (odd years)
- 480/680 Soil and Waste Disposal** 2  
Role of soil as a reactor and roles of chemical, physical, hydrological and biological soil properties that influence waste transformation in soil. 2 lectures. Prereq: 16 credits of physical sciences including one year of chemistry, Senior or graduate standing or departmental approval. S (even years)
- 733 Environmental Modeling** 2  
Mathematical simulation and computer model development for analysis of current environmental problems. Emphasis on mechanics of model construction, calibration, and validation. 2 lectures. Prereq: Computer programming. F (odd years)
- 763 Soil Physics** 3  
Composition of soil in terms of solid, liquid, and gaseous phases. Theory of water, heat, and solute transport processes. Water availability for plant growth. 2 lectures, 1 laboratory. Prereq: Soil 333, 339, Phys 211, Math 146 or 165. S (even years)
- 782 Advanced Soil Fertility** 2  
Advanced study of soil-plant-nutrient relationships with emphasis on concepts of soil fertility, ion absorption, nutrient transformation, and interpretation of experimental data. 2 lectures. Prereq: 455/655. F (even years)
- 783 Advanced Soil Physics** 3  
Mathematics of saturated and unsaturated soil water flow, including use of computer models. 3 lectures. Prereq: Soil 763, Math 147 or 166. S (odd years)
- 784 Advanced Soil Genesis, Morphology and Classification** 2  
Advanced study of processes of soil development, soil morphology, and principles of soil classification. 2 lectures. Prereq: Soil 444/644. F (even years)
- 785 Advanced Soil Chemistry** 2  
Advanced study of chemical properties of soil. 2 lectures. Prereq: Soil 455/655. S (even years)
- SPANISH (Span)**  
Hawley, Pearson, Soria-Dufner, Sparks
- COURSES**
- 101, 102 [111, 112] First-Year Spanish I, II (CCN)** 4 each  
Basic structures and vocabulary of Spanish. Practice in the fundamentals of listening, speaking, reading, and writing. No previous knowledge of Spanish required. 101:(ND:Hum)
- 201, 202 [211, 212] Second-Year Spanish I, II (CCN)** 3 each  
Emphasis on developing proficiency in the four language skills. Review of grammar, practice in composition, and cultural and literary readings. Prereq: Span 102 or equivalent.
- 311, 312 Spanish Conversation and Composition I, II** 3 each  
Advanced practice to develop greater proficiency in oral and written skills through the study of cultural and literary readings. Prereq: Span 202 or equivalent.
- 315 Introduction to Spanish/Latin American Civilization** 3  
Introduction to the political, social, and cultural history of Spanish-speaking lands. Includes important schools of art, music, and architecture. Taught in Spanish. Prereq: Span 312.
- 401 Advanced Spanish Grammar and Writing** 3  
Writing practice with primary focus on form, syntax, and style. Taught in Spanish. Prereq: Span 312.
- 410 Introduction to Spanish Literature** 3  
Representative works of the literature of Spain from its epic beginnings to the contemporary period. Overview of literary movements, genres, and cultural background. Taught in Spanish. Prereq: Span 312.

**411 Introduction to Spanish American Literature** 3

Representative works from the pre-conquest era to the 20th century. Overview of literary movements, genres, and cultural background. Taught in Spanish. Prereq: Span 312.

**412 Contemporary Spanish American Literature** 3

Developments and techniques in major 20th-century texts through representative works. Overview of cultural, historical, and socio-political aspects, as well as literary background. Taught in Spanish. Prereq: Span 312.

**489 [499] Senior Thesis** 1-6

Capstone experience option. Research and original investigation under the guidance of a faculty member. Student work to be written in Spanish.

**STATISTICS (Stat)**

R. Magel, Chair; Bhandary, Degges, Huang, Rao, Terpstra

**COURSES****330 Introductory Statistics** 3

Frequency tables, histograms, probability, well-known probability distributions, one and two sample tests of hypotheses, confidence intervals, and contingency tables. Prereq: Math 103 or 104. (ND:Math)

**331 Regression Analysis** 2

Simple and multiple regression techniques and correlation coefficients. Extensive use of SAS. Emphasis on applications. Prereq: Stat 330. (ND:Sci)

**367 Probability** 3

Probability, probability distributions for discrete random variables, probability density functions, marginal joint probability density functions, expected value and variance, and transformations. Prereq: Math 166.

**368 Statistics** 3

Moments, moment generating functions, central limit theorem, one and two sample tests of hypotheses, estimation, and simple linear regression and correlation. Prereq: Stat 367.

**450/650 Stochastic Processes** 3

Discrete time Markov chains, Poisson processes, continuous time Markov chains, birth and death processes, renewal processes, branching processes, queuing systems, and applications. Prereq: Stat 368.

**451/651 Bayesian Statistical Decision Theory** 3

Bayesian approach to statistics including utility and loss, prior and posterior densities, and Bayesian inference. Comparisons with classical statistical methods. Prereq: Stat 368 or 468.

**460/660 Applied Survey Sampling** 3

Simple random, stratified, systematic and cluster sampling; two-stage sampling. Estimation of population means and variances. Ratio and regression estimators. Prereq: Stat 330 or 368.

**461/661 Applied Regression Models** 3

Simple linear regression, matrix approach to multiple regression, and introduction to various tests and confidence intervals. Includes discussion of multicollinearity and transformations. Prereq: Stat 330 or 368.

**462/662 Introduction to Experimental Design** 3

Fundamental principles of designing an experiment, randomized block, Latin square, and factorial. Also covers analysis of covariance and response surface methodology. Prereq: Stat 330 or 368.

**463/663 Nonparametric Statistics** 3

Various tests and confidence intervals that may be used when the underlying probability distributions are unknown. Includes the Wilcoxon, Kruskal-Wallis, and Friedman. Prereq: Stat 330 or 368.

**464/664 Discrete Data Analysis** 3

Application of binomial, hypergeometric, Poisson, mixed Poisson, and multinomial distributions in discrete data analysis. Log-linear models and contingency tables. Logistic regression. Discrete discriminant analysis. Prereq: Stat 367.

**465/665 Meta-Analysis Methods** 3

Statistical methods for meta-analysis with applications. Various parametric effect size from a series of experiments: fixed effect, random effect linear models; combining estimates of correlation coefficients; meta-analysis in the physical and biological sciences. Prereq: Stat 330 and 331 or 461/661 or 725.

**467 Probability and Mathematical Statistics I** 3

Random variables, discrete probability distributions, density functions, joint and marginal density functions, transformations, limiting distributions, central limit theorem. Prereq: Math 265 or Stat 368.

**468 Probability and Mathematical Statistics II** 3

Properties of estimators, confidence intervals, hypotheses testing, Neyman-Pearson lemma, likelihood ratio tests, complete and sufficient statistics. Prereq: Stat 467.

**470/670 Statistical SAS Programming** 3

Focuses on statistical problem solving and writing SAS computer code. Data types, data management, data input/output, SAS as a programming language, data analysis, report writing, and graphing. Prereq: 461/661 or 462/662.

**476 Actuary Exam Study II** 1

Selected material from probability and mathematical statistics in preparation for the national actuarial exam. Prereq: Stat 368 or 468.

**520 Statistical Methods for Pharmacy** 3

Descriptive statistics, life tables, probability, binomial and normal distributions, estimation, hypothesis testing, introduction to regression and ANOVA. Examples from the medical/pharmaceutical area. Prereq: Math 103.

**725 Applied Statistics** 3

Data description, probability, inference on means, proportions, difference of means and proportions, categorical data, regression, analysis of variance, and multiple comparisons. Prereq: Knowledge of algebra. *Note: This course is not intended for statistics or mathematics majors.*

**730 Biostatistics** 3

Direct assays, parallel line assays, slope ratio assays, multiple assays, and quantal assays. Model, estimation, and testing. Probit and logit analysis. Prereq: Stat 461, 520 or 725.

**735 Introduction to Bioinformatics** 3

See Mathematics for course description

**750 Time Series** 3

Estimation of trend in time series data. Seasonal models. Stationary models. Moving average, autoregressive, and ARMA models. Model identification. Forecasting. Intervention analysis. Prereq: Stat 367 or 467 and 461/661.

**761 Advanced Regression** 3

Multiple regression, analysis of residuals, model building, regression diagnostics, multicollinearity, robust regression, and nonlinear regression. Prereq: Stat 367 or 467 and 461/661.

**762 Messy Data Analysis** 3

One-way classification models with heterogeneous errors. Two-way classification analysis in the unbalanced case. Analysis of mixed models. Split-plot, nested, and crossover designs. Prereq: Stat 462/662.

**764 Multivariate Methods** 3

Sample geometry; correlation; multiple, partial, canonical correlation test of hypothesis on means; multivariate analysis of variance; principal components; factor analysis; and discriminant analysis. Prereq: Stat 461 or 462.

**767 Probability and Mathematical Statistics I** 3

Random variables, discrete probability distributions, density functions, joint and marginal density functions, transformations, limiting distributions, central limit theorem. Additional project required. Prereq: Math 265 or Stat 368.

- 768 Probability and Mathematical Statistics II** 3  
Properties of estimators, confidence intervals, hypotheses testing, Neyman-Pearson lemma, likelihood ratio tests, complete and sufficient statistics. Additional projects required. Prereq: Stat 767.
- 770 Survival Analysis** 3  
Basic methodology in the analysis of Censored Data, two basic types of censoring, parametric estimation, nonparametric estimation, and life table methods. Prereq: Stat 768.
- 774 Linear Models I** 3  
General linear models. Full rank models. Estimation, confidence ellipsoids, and tests of hypotheses. Not full rank models. Applications to regression and design of experiments. Prereq: Stat 768.
- 775 Linear Models II** 3  
Repeated measurements models. Variance components models. Response surfaces. Growth curve models, unbalanced designs. Prereq: Stat 774.
- 777 Multivariate Theory** 3  
Wishart distribution, distribution of Hotelling's T-square and Lambda statistics, cluster analysis, correspondence analysis, principal components, factor analysis, discriminant analysis, multidimensional scaling. Prereq: Stat 764.
- 778 Modern Probability Theory** 3  
Probability theory presented from the measure theoretic perspective. Emphasis on various types of convergence and limit theorems. Discussion of random walks, conditional expectations, and martingales. Prereq: Stat 768 or Math 750. Cross-listed with Math.
- 780 Asymptotics, Bootstrap, and Other Resampling Plans** 3  
Development of large sample and small sample properties of a variety of estimators. Prereq: Stat 768.
- 786 Advanced Inference** 3  
Further discussion of properties of estimators, theory of estimation, and hypotheses testing. Prereq: Stat 768.
- THEATRE ARTS (Thea)**  
Anderson, Erickson, Fike, Horvik, Larew, Lifton
- COURSES**
- 110 Introduction to Theatre Arts (CCN)** 3  
Basic orientation and historical perspective to the art of theatre. Includes the spectrum of dramatic literature, theatrical production, and performance.
- 115 World Film** 3  
Study of the development and practice of the art of film and its relationship to the theater emphasizing performance and production angles.
- 160 Introduction to Acting** 3  
Introduction to the experience and craft of acting; designed for the general student. Emphasis on enhancing spontaneity, imagination, and awareness. For non-majors only.
- 161 Acting I (CCN)** 3  
Beginning actors are introduced to basic mental and physical performance skills, stage conventions, and scene work. Emphasis on enhancing the student's spontaneity, imagination, and awareness. (ND:FA)
- 180 Dramatic Literature and Style** 3  
Survey of dramatic literature from the 18th century to the present with emphasis on historical and cultural context, production style, and problems inherent in contemporary production.
- 201 [150] Theatre Practicum (CCN)** 1  
Participation in various activities of theatrical production. May be repeated.
- 261 [260] Acting II (CCN)** 3  
Practical application of fundamental skills to textual work. Prereq: Thea 160.
- 266 Voice and Movement for the Actor** 2  
Vocal and articulatory techniques and character development are explored through a study of speech production and the use of physical exercises and performance. Offered alternate years. Prereq: Thea 261.
- 270 Stagecraft (CCN)** 3  
Introduction to the crafts and technologies of theatre production. Includes fundamentals of scenery construction, tool usage, safety, and basic rigging. 2 lectures, 1 two-hour laboratory.
- 271 Costume Construction** 3  
Introduction to costuming. Construction, alteration, and acquisition of costumes and costume accessories. 3 lectures, 1 two-hour laboratory.
- 275 Makeup Design I** 3  
Fundamentals of stage makeup. Facial analysis and introduction to materials and techniques. Elementary character interpretation through two-dimensional application.
- 276 Makeup Design II** 3  
Advanced study in makeup techniques and application, including prosthetics. More advance character interpretation through three-dimensional application. Concludes with major makeup projects. Prereq: Thea 275.
- 280 World Theatre** 3  
Survey of dramatic literature from the Greeks to the 18th century with emphasis on historical and cultural context, production style, and problems inherent in contemporary production.
- 350 Studio Theatre** 1-2  
Workshops in specialized techniques or a showcase for individual creativity. Includes projects in acting, directing, design, movement, and play writing. May be repeated.
- 361 Movement for the Actor** 2  
Introduction to basic stage movement techniques. Emphasis on bodily awareness and control, responsiveness, freedom from personal mannerism, and physical characterization. Offered alternate years. Prereq: Thea 261.
- 365 Directing I** 3  
Introduction to the creative process of directing. Focus on script analysis, basic directing tools, and scene work. Prereq: Thea 261.
- 370 Technical Theatre Production** 3  
Advanced study in technical theatre production. Emphasis on planning processes and individual duties/responsibilities for technicians at all levels of theatrical production. 2 lectures, 1 three-hour laboratory. Prereq: Thea 270, 271.
- 372 Stage Management** 3  
Fundamentals of production stage management. Emphasis on the role, duties, and relationships of the stage manager as a member of the production team.
- 375 Introduction to Stage Design** 3  
See Department for course description.
- 377 Lighting for the Stage** 3  
Advanced study in stage lighting. Emphasis on design, planning processes, and implementation of lighting into theatrical productions. Two lectures, one three-hour lab. Prereq: Thea 270.
- 440 Advanced Projects in Production** 3  
Advanced projects in acting, directing, and technical theatre. May be repeated. Prereq: Thea 370 or departmental approval.
- 450 Capstone Experience** 3  
Demonstration of mastery in selected area of theatre through an advanced project in acting, directing, design/technical theatre, or dramaturgy. Departmental capstone experience. Prereq: Senior standing.
- 461 Acting Styles: Verse Drama** 3  
Advanced training in classical acting focusing on effective vocal/rhetorical techniques, and on the use of poetic rhythm and imagery in creating a role. Exploration of Style/Language Analysis, Greek, Commedia, Elizabethan, and Comedy of Manners/Morals. Prereq: Thea 161, 261, 266. Thea 466 and 480 highly recommended. F/2 (even years).
- 462 Acting Styles: Mod/Contemp Nonrealism** 3  
Introduction to various major non-realistic performance styles of the late nineteenth through twentieth centuries. Styles covered include symbolism, expressionism, Brechtian epic theatre, and absurdism, with overview of contemporary non-realistic styles. Prereq: Thea 261.
- 465/665 Directing II** 3  
Problems in directing, formulating production concepts, casting, working with actors, and aiding characterization. Includes preliminary work with thrust and arena staging. Prereq: Thea 365.

**466 Advanced Voice for the Actor** 2  
Intensive examination and development of the vocal mechanism. Continuing focus on consonant/vowel production, diction/articulation, resonance/placement, and breath/posture will be complemented by the introduction of IPA, character voices and dialect work. Prereq: Thea 266.

**467 Advanced Movement for the Actor** 2  
An advanced level movement course introducing styles of theatre movement including unarmed stage combat and various idioms of dance (basics in ballet, modern dance, jazz and/or tap.) Prereq: Thea 266.

**468 [363] The Business of Acting** 3  
Selection, preparation, and performance of songs and classical and contemporary monologues for auditions; preparation of professional resume and cover letter; techniques of cold reading; research of theatre companies, union, agencies, and other job search resources. Prereq: Senior standing.

**475/675 Design for the Stage I** 3  
Basic drafting and design techniques used in theatrical design and technology. Includes script analysis and historical perspective on scenic, costume, lighting, and property design. 2 three-hour laboratories.

**476/676 Design for the Stage II** 3  
Interpretation of the theatrical script, evolving into design concepts for scenery, costumes, lighting, and properties. Continued historical perspective of theatrical design. 2 three-hour laboratories. Prereq: Thea 475.

**480/680 History and Literature of the Theatre I** 3  
Historical study of theatre architecture, staging methods, individual artists, and plays from the Theatre's origins through the 17th century. Offered alternate years. Prereq: Thea 110.

**481/681 History and Literature of the Theatre II** 3  
Historical study of theatre architecture, staging methods, individual artists and plays from the 18th century to the present. Offered alternate years. Prereq: Thea 480/680.

## UNIVERSITY INTERDISCIPLINARY STUDIES (Univ)

### COURSES

**189 [199] Skills for Academic Success** 1  
Development of skills and techniques for academic success. Includes study techniques, time management, test taking, note taking, goal setting, wellness, stress management, and career orientation. Introduction to campus resources and governance. Cross-listed with ABEn, Agri, HD&E, and ME.

**402 Power of Narrative** 3  
Examination of the power of narrative in family stories from the viewpoint of literature, anthropology, and family studies. Exploration of the formation and basis for individual, family, and cultural identity through stories.

**403 Weighing the Evidence** 3  
Examination of evidence from a variety of viewpoints representing different academic disciplines and vocations. Incorporation of a broader perspective in increasingly complex situations.

**404 Spatial Conflicts in Global Society** 3  
Exploration of the utilization of space and spatial harmony and conflict on a personal, local, national, and global basis through readings, up-to-date news coverage, and recent films. Includes a spectrum of critical issues.

**405 Problems of World Hunger: An Integrated Approach** 3  
Exploration of multiple dimensions of hunger from a variety of academic and international perspectives: geographic, political, economic, agricultural, nutritional/health, and social/cultural.

**489 Capstone Experience** 1  
The Capstone Experience for a Bachelor of University Studies degree consists of a reflective paper designed to provide the student with the opportunity to integrate, synthesize and apply the cumulative academic experience. Completion of the course includes a brief oral presentation. Pass/Fail grading only.

## VETERINARY SCIENCE (VetS)

Kirby, Chair; Berryhill, Colville, Stoltzow

### COURSES

**115 Medical Terminology for the Paraprofessional** 1  
Medical terminology explored through a systematic study of word parts and the combinations used to build medical terms.

**125 Animal Restraint** 2  
Study of behavioral characteristics and handling techniques of farm, companion, and laboratory animals.

**135 Anatomy and Physiology of Domestic Animals** 3  
Introduction to the anatomy and physiology of common domestic mammals. Emphasis on how the body's normal structures and functions contribute to health.

**136 Anatomy and Physiology Laboratory** 1  
To accompany VetS 135.

**150 Introduction to the Veterinary Profession** 1  
Exploration of the many educational and career opportunities in veterinary medicine available to both veterinarians and veterinary technicians.

**255 Fundamentals of Veterinary Radiography** 3  
Diagnostic radiograph production including X-ray machine operation, dark room procedures, radiographic positioning, and radiation safety. Veterinary technicians only.

**256 Veterinary Clinical Techniques and Instruments** 3  
Clinical procedures and instrumentation used in the day-to-day operation of a veterinary practice. Veterinary technicians only.

**259 Small Animal Diseases** 2  
Basic principles of common dog and cat diseases with emphasis on client education. Veterinary technicians only.

**357 Veterinary Pharmacology** 3  
Study of drugs used in veterinary medicine with particular emphasis on commonly used drug groups. Veterinary technicians only.

**358 Veterinary Surgical Nursing Techniques** 4  
Preparation for and assistance with veterinary surgical procedures. Provision of proper aftercare for veterinary surgical patients. Veterinary technicians only.

**359 Veterinary Hospital Information and Procedures** 2  
Principles of veterinary hospital management and client relations/education. Veterinary technicians only.

**385 Veterinary Clinical Pathology I** 3  
Study of urine analysis and serum chemistry principles and procedures commonly utilized in veterinary medicine. Veterinary technicians only.

**386 Veterinary Clinical Pathology II** 3  
Study of hematology principles and procedures commonly utilized in veterinary medicine. Veterinary technicians only.

**387 Veterinary Clinical Pathology III** 3  
Study of parasitology principles and procedures commonly utilized in veterinary medicine. Veterinary technicians only.

**485 Veterinary Technology Externship** 6-12  
Capstone experience for veterinary technology students. Continued development of skills through supervised work in a veterinary practice or other appropriate clinical setting. Refer to Animal and Range Sciences for information regarding Veterinary Technology program.

## WOMEN'S STUDIES (WS)

### COURSES

#### 194/494 Issues in Women's Studies 1-3

Student selects a special topic within the interdisciplinary field of women's studies to undertake independent study under the guidance of an instructor with expertise in the selected topic area.

#### 350 Perspectives in Women's Studies 3

Exploration of personal and feminist perspectives on a range of social issues; development of a critical framework for thinking and writing about women and gender. Prereq: Sophomore standing.

#### 491 Women's Week of Awareness 1

Student attends a specified number of NDSU Women's Week events and writes a paper that integrates his/her knowledge and experiences gained on a topic selected by the student under advisement from the instructor.

## ZOOLOGY (Zoo)

Bleier, Chair; Butler, Gerst, Grier, Montplaisir, Nuechterlein, Olson, Sheridan, Stewart, Stockwell

### COURSES

#### 126 Human Biology 3

See Biology for description. *Does not count toward major or minor.* (ND:Sci)

#### 280 Comparative Chordate Morphology 4

Introduction to the systematics, history, and structure of chordates, especially the vertebrates. Prereq: Biol 151, 151L. S

#### 315, 315L Genetics, Lab 3,1

See Plant Sciences for description.

#### 321 Human Karyotyping 1

See Plant Sciences for description. Prereq: Zoo 315L. Does not count toward major or minor.

#### 360 Animal Behavior 3

Description of the principal behavior patterns of animals with consideration of ecological, evolutionary, and internal mechanisms. Prereq: Biol 151, 151L. Cross-listed with Psyc. S (even years)

#### 364 General Ecology 3

See Biology for description.

#### 370 Cell Biology 3

Structure and function of cells, including cell surfaces, membranes, organelles, cytoskeleton, cell division, cell physiology, and methods used in cell studies. Prereq: Biol 150, 150L, Chem 341.

#### 380 Vertebrate Histology 3

Study of the microscopic anatomy of vertebrate tissues and organs, especially mammals. Prereq: Biol 151, 151L. S (odd years)

#### 431/631 Intermediate Genetics 3

See Plant Sciences for description. Prereq: Zoo 315.

#### 440/640 Microbial Ecology 3

Microbial ecology introduces the student to basic, applied, and current concepts in microbiology and the environment. It considers the roles of microorganisms in maintaining environmental quality and the role of environment in determining microbial diversity. Prereq: Zool 364.

#### 450/650 Invertebrate Zoology 4

Survey of the biology, classification, and evolution of invertebrates. Emphasis on major phyla, marine, and parasitic taxa. Prereq: Biol 151, 151L. S.

#### 452/652 Ichthyology 3

Biology and taxonomy of fishes. Prereq: Biol 151, 151L. F (even years)

#### 454/654 Herpetology 3

Primarily a field and laboratory course focusing on amphibians and reptiles. Students must make a commitment to participate in at least one of two 4-day field trips plus an independent review project. Prereq: Biol 151, 151L. F/2 (odd years)

#### 456/656 Ornithology 3

Introduction to the biology, classification, and identification of birds, especially local forms. Early morning field trips required. Prereq: Biol 151, 151L. F

#### 458/658 Mammalogy 3

Biology and taxonomy of mammals. Prereq: Biol 151, 151L. F

#### 460/660 Animal Physiology 4

Development of basic quantitative descriptions of physical and chemical principles governing cell and organ function. Prereq: Biol 151, 151L, Chem 341. F

#### 462/662 Physiological Ecology 3

Comparative physiology of the vertebrates. Study of biochemical, morphological, and behavioral mechanisms involved with compensatory changes in response to changes in ontogeny and/or external environment. Prereq: Biol 151, 151L. S

#### 463/663 Physiology of Reproduction 4

See Animal and Range Sciences for description.

#### 464/664 Endocrinology 3

Physiology and anatomy of endocrine glands; chemistry and interrelations of their secretions. Prereq: Biol 151, 151L. F/2 (odd years)

#### 470/670 Limnology 4

Biological, physical, and chemical features of fresh-water ecosystems. Prereq: Biol 151, 151L, 364; one year chemistry. F/2 (odd years)

#### 472/672 Fisheries Biology 3

Principles of ecology and limnology applied to fish production. Prereq: Biol 364. S/2 (odd years)

#### 474/674 Fisheries Management 3

Techniques used in the study and management of fish. Prereq: Zoo 472. S/2 (even years)

#### 475/675 Conservation Biology 3

Integrative approach to the study and conservation of biodiversity. Application of principles from various sub-disciplines of the biological and social sciences to current conservation problems. Prereq: Zoo 315, 315L. F

#### 476/676 Wildlife Ecology and Management 3

Application of ecological principles to management of game and nongame wildlife populations. Field trips required. Prereq: Biol 364. S

#### 477/677 Wildlife and Fisheries Management Techniques 3

Students will learn traditional and state-of-the-art techniques used in the study and management of fish, wildlife, and other animal populations. Topics will include assessment of population characteristics, habitat, behavioral ecology and genetic structure. Prereq: Zoo 476.

#### 482/682 Developmental Biology 3

Analysis of the processes of development, with an emphasis on animal development. Topics range from classical embryology to the cellular and molecular basis of development. Prereq: Biol 151, 151L. F/2 (even years)

#### 720 Advanced Cell Biology 3

Study of molecular biology of plant and animal cells including molecules, molecular organization, growth and development, nuclear function, cell cycle, and cellular communication. Prereq: Bioc 702.

#### 750 Advanced Conservation Biology 3

This class will cover recent developments in the field of conservation biology, with a specific focus on recent literature. Areas of focus will include Evolutionary Conservation and Conservation Genetics. Prereq: Zool 311, 312, 364, 675.

#### 760 Evolutionary Ecology 3

Lecture-discussion course on recent developments in evolutionary theory and their implications in the study of animal adaptation, ecology, and behavior. Prereq: Biol 364. S/2 (odd years)

#### 764 Neuroendocrine and Endocrine Systems 3

Topics in molecular endocrinology. Emphasis on signal transduction and effects of hormones on gene expression. Prereq: Zoo 464. S/2 (even years)

#### 766 Neurophysiology 3

Function of neurons and simple neural networks. Emphasis on quantitative description of processes and characterization of the neurological basis of simple behaviors. Prereq: Zoo 460 or Psyc 465. S/2 (even years)

#### 770 Aquatic Community Ecology 4

Nature and ecological roles of the freshwater biota. Discussion of contemporary issues in aquatic ecology. Prereq: Zoo 470. F/2 (even years)